Department of Geological Sciences 2010-11 Assessment Report

Compiled by Department of Geological Sciences, Submitted by Thom Wilch, Chair

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ASSESSMENT AREA: Department of Geological Sciences

Majors: Geology, Earth Science, Earth Science (Secondary Education)

Minors: Geology, Environmental Geology, Paleontology, Geographic Information Systems, Earth Science (Secondary Education)

SECTION I. GEOLOGICAL SCIENCES MISSION STATEMENT

The Albion College Department of Geological Sciences provides undergraduate students intellectually engaging and challenging learning opportunities in geology through integrated classroom, laboratory, field, and research experiences. Our students learn to deal with transdisciplinary problems involving complicated systems with complex variables, a wide range of scales of both time and space, and often incomplete or ambiguous data sets. This is excellent preparation for many careers, including geology, law, business, and medicine, as well as for informed citizenship.

Our primary teaching mission is to develop in students critical thinking skills that focus on addressing complex multi-dimensional geological and environmental problems in their natural and social context. Additionally, our goals include: 1) to prepare Geology and Earth Science majors and minors for graduate school and careers in a wide range of areas; 2) to provide superior liberal arts science experiences for non-majors as part of their general education requirement; and 3) to support the Environmental Studies and Environmental Science concentrations and Category. In further support of our students, we foster experiential learning through lab- and field-intensive courses, departmental colloquia, field trips, a summer field course in the Rocky Mountains, and research with faculty.

Our research mission is to plan, conduct, complete, present, and publish scholarly investigations into a wide variety of geological problems. We strive to include students in every phase of the research experience as summer researchers, directed study students, first-year research partners, and honors Thesis advisees. We emphasize the use of fieldwork, literature review, laboratory and computer analyses of data, and written and oral communication in our research projects. We have active research programs in Tibet and India (Carrie Menold), Antarctica (Thom Wilch), Wyoming (Bill Bartels), and South Dakota (Beth and Tim Lincoln), as well as several on-going projects in Michigan.

In support of our research and teaching mission, we maintain superb collections of minerals, rocks, fossils, maps, and digital data. We further support teaching and research by maintaining up-to-date analytical and computing facilities.

SECTION II. LEARNING GOALS & OUTCOMES

INTRODUCTION

The Department of Geological Sciences created a Skills Assessment Matrix for the purpose of assessing skills and knowledge that we expect of our students. The matrix is shown on page two of this document and lists several skill areas that are being assessed in the 2010-11 academic year. Some of the assessment results were written into the January 2011 report and are not included here.

The table below lists the skill/content areas that are assessed in this report.

Goal Areas	Courses in Geology Curriculum (2010-11Version)																											
	101	**103**	104	106	111	115	**201**	202	**203**	**204**	**205**	208	209	210	211	212	216	306	307	309	310	311	312	314			
	Intro	**Earth H**	Resources	Hazards	GIS	Oceans	**Structure**	GdWater	**Min**	**Pet**	**Sed Strat**	Geomorph	Paleo	Regional	Rem Sens	Volc	Env. Eng. Geo	Glaciers	Geochem	Vert Pale	Adv Pet	AdvGIS	Ore Deposits	Field camp	**Colloquium**	Dir. St. Research	**Senior Exam**
1. Communication																											
Writing Skills	I		I	I		I	E		E	E	E	E	E			E	E	**E**		I	E		C	E		C	
Oral Skills	I		I	I		I		I	I	E				E		E	E	E		E	E				C A		
2. Critical Thinking																											
Problem Solving	I	I	I			I	E	C	E	E	C	E	C	E	I	E	I	E	C	C	E	E	E	C		C	A
Critical Reading							E	E				E		C		E		C			E				C A		
Quantitative Reasoning	I						C	E	E	E	I	E	I				E	I	C	I	E	E		E			A*
Application of Scientific Methodology	E**A**	E**A**				I		E		E	C	E	C				I	E	E	C	E		E	C		C	
Independent Research	I							E		I		E	E				E	E	E		C	E	E	C		C	
3. Creativity & Initiative																											
Independence of Thought	I	I	I				I	I		E	E		E	E				E	E	E	C			C	C	CA	
Integrative Thinking	E	I	I	I	I	I	I	E	E	E	E	E	E	E	E	E	E	E	C	E	C	E	C	C	C	CA	
Initiative	I	I	I	I	I		I	I		E	E		E	E			I	E	E	E	E			C	C	CA	
4. Earth Science Methods																											
Field Skills	I				I			CA		E	E	C		CA			I	C						CA		E	
Lab Skills	I	I					E	C	C	C	C	E	E			E	E	E	C	I	C		E	C		E	
Map, Imagery, GIS Skills	I	E		I	C A		E	I		E		CA			C		E	E			E	C		C			A
Info. Technology Skills	I		I		C		I	E	I	E	I	E			C	E	I	E	E	I	C	C	E		C	E	
5. Content Areas																											
Plate Tectonics	EA	E	I	E		E	I			E	E		I			E				E	E			E			A
Earth History	I	E				E					C		C	E		E		C		C				C			A
Solid Earth Composition/Structure	I	I	I	I			C		C	C	I					E					C			C			A
Surface & Atmos. Processes	I	I	I	E	I	E		E		I	E	C	I		I	E	C	C	E	I				E			A

I = topic introduced; E = topic emphasized; C = comprehensively covered

A = 2010-11 assessment; Yellow highlight is Fall 10 assessment, pink highlight indicates Fall 10 and Spring 11 assessment; and blue highlight indicates Spring '10 assessment.

1. Goal Area- Communication Skills

Communication Goals.

Writing Goal: Students are able to effectively articulate their ideas in writing.

Oral Communication Goal: Students are able to effectively articulate their ideas orally. More specifically all graduating majors and minors are able to give "good" oral presentations according to rubric specification described below.

Communication Assessment & Outcomes

Writing Assessment. Departmental Writing Rubric has been developed to be used for writing assignments in designated courses and for written component of Senior Thesis and directed studies (see Appendix A). The rubric has been used in FY seminars and select upper level courses. Assessment results from in these courses have not been compiled.

Oral Communication Assessment/ Departmental Colloquium/ Wilch (author). Oral communication is assessed through the Geology Department colloquia, which are held 2:10-3 p.m. on Friday afternoons during both Fall and Spring semesters. The colloquia feature presentations by Junior and Senior geology and earth science majors and minors, as well as faculty and guest speakers. Presentations can be based on 1) independent faculty-mentored research; 2) off-campus geology experience; or 3) a peer-reviewed journal article. Presentation topic must approved by a faculty member. It is strongly recommended that students consult with faculty members whose teaching/research is most similar to the presentation topic. Participation in and presentations are required for both majors and minors. Majors are required to present once per semester during each of their last four semesters; minors are required to present two times during the last four semesters. Prior to 2008-9, assessment of the required colloquia was informal and qualitative. In past 10 years one student was prohibited from graduating because he did not fulfill this graduation requirement (the student enrolled an extra semester to fulfill this requirement and graduate with a major in Geology). All majors (>125; 100%) fulfilled this requirement in past 15 years.

The student oral presentation rubric (below) was completed after each colloquium presentation by all faculty members attending the presentation (n=4-7). The actual rubric sheets also contain areas for faculty to make constructive comments in each of the areas: organization and format: talk content; visual aids. The scores and comments for each student were aggregated and typed up and a copy of aggregate feedback was given to the students 1-2 weeks after they presented.

Table 1. Geology Oral Presentation Rubric

	Excellent = 4	Good = 3	Fair = 2	Weak = 1
Organization and format	Slides are simple, legible and neat. Clear introduction and summary, with well-articulated "big picture" tie-in. Organized talk with very logical progression of ideas.	Organization and format could be improved in one key area stated in Excellent column.	Organization and format could be improved in two key areas stated in Excellent column.	Organization and format could be improved in three or more key areas stated in Excellent column.
Talk Content	Thorough knowledge of the topic. Correct pronunciation of terminology. Basic scientific questions are clearly stated and addressed. Assertions are well supported with evidence.	Talk content could be improved in one key area stated in Excellent column.	Talk content could be improved in two key areas stated in Excellent column.	Talk content could be improved in three or more key areas stated in Excellent column.
Visual Aids	Figures (photos, graphs, tables) are professional, legible, and neat. Figures are well labeled and include scales. Figures illuminate aspects of the presentation. Text outlines key points appropriately.	Visual aids could be improved in one key area stated in Excellent column.	Visual aids could be improved in two key areas stated in Excellent column.	Visual aids could be improved in three or more key areas stated in Excellent column.
Speaker and delivery	Speaker is professional in manner. Conveys concepts in an effective and engaging manner. Vocal projection is clear and audible. Delivery at an appropriate rate and level for the audience. Welcomed and thoughtfully addressed questions.	Speaker and delivery could be improved in one key area stated in Excellent column.	Speaker and delivery could be improved in two key areas stated in Excellent column.	Speaker and delivery could be improved in three or more key areas stated in Excellent column.

Oral Communication Assessment Outcomes. The aggregate scores from both Fall 2010 and Spring 2011 are presented in the Table 2 below.

Table 2. Compilation of Oral Presentation Assessment Results from 2010-11 Geology Colloquium. The students are assessed on a 1 to 4 scale (Weak, Fair Good, Excellent) as described in the Table 1 above. Fall 2010 n = 17 ; Spring 2011 n = 15.

	Fall 2010 Result Summary			Spring 2011 Result Summary		
Assessment Area	Mean Juniors	Mean Seniors	Mean All	Mean Juniors	Mean Seniors	Mean All
Organization and format	3.09	3.12	3.10	3.33	3.51	3.38
Talk Content	3.24	3.17	3.21	3.23	3.58	3.32
Visual Aids	3.11	3.17	3.13	3.06	3.32	3.13
Speaker and delivery	3.10	3.06	3.09	3.04	2.92	3.01
Total	3.14	3.13	3.13	3.17	3.33	3.21

In Fall 2010, 17 students were assessed using this rubric. One student was evaluated on a completely different trial rubric, which we ultimately decided not to use. In Spring 2010, 15 students were assessed using this rubric. The mean scores for all students were greater than 3.0. In Fall 2010, six students scored below 3.0 and 2 of these were Seniors. In Spring 2011, five students scored below 3.0 and only 1 of these students was a Senior. The Senior who scored below a 3 completed a minor in the department.

This is the second year we have used our Oral Skills Assessment Rubric. The 2010-11 results indicated that Senior geology/earth science majors/minors performed at a similar level in each area and overall compared to Junior majors/minors. Students were given summary feedback sheets with composite numbers in each assessment category and a typed summary of comments.

The results from the Spring 2011 semester show an improvement in both Junior and Senior presentation scores in most areas. The faculty evaluators have noted a significant improvement in the overall presentation quality compared to the pre-assessment colloquium presentations. We believe that sharing assessment information with students helped students improve as pubic speakers. The high scores for some of the students, particularly the Seniors, are also related to the fact that many of the students gave presentations at the Elkin Isaac Research Symposium and were very prepared. We plan to continue using this assessment instrument in 2011-12.

Because majors are assessed in four successive semesters and minors are assessed two times, faculty have the opportunity to work with students who struggle (i.e. get below a 3.0) in this area. We recommend that talk advisors work more intently in successive semesters with students who score low.

3. Critical Thinking Goals/Outcomes

There are five specific skill areas in the critical thinking goals: .

A. Problem Solving*
B. Critical Reading *
C. Quantitative Reasoning*
D. Application of Scientific Methodology*
E. Independent Research

The overarching critical thinking goals are that students are able to generate, manipulate and interpret quantitative data, use geologic concepts to solve problems and understand and apply scientific methodology. Four of the five skill areas (A-D in list above) were assessed in 2010-11.

A. Critical Thinking- Problem Solving Goal. Our goal for this assessment is that all students are able to demonstrate "good" problem-solving skills, and that students planning to continue in graduate school exhibit "very good" or "excellent" skills.

Critical Thinking- Problem Solving Assessment/ Senior Exam, Rubric/ B. Lincoln & T. Wilch (authors). Problem solving was assessed in a new section of our Senior Exam that was administered to majors prior to graduation. Students were given 30 minutes to complete an open-ended question. Here is a copy of the question: "You are given a map and 8 rock samples keyed to that map. Over the next 30 minutes, we would like you to examine these, then write an organized, coherent summary of the geology of this area, integrating material you have learned in several courses. We know that you know much more about these materials than you could possibly write in 30 minutes; please remember we are looking for details that support your conclusions about the geology (including geologic history) of this area. For clarity, make sure you refer to the samples by their numbers as well as by the appropriate rock names."

The written summaries were assessed on a gradational 5-point scale according to the following rubric.

Senior Exam Map Interpretation Assessment Rubric	No. of students
1. Poor interpretation. Missing/incorrect rock names; no specific names for structures; little/no interpretation and history	1
2. Fair interpretation. Between poor and good.	1
3. Good interpretation. Generally correct rock and structure names; correct sequence; interpretation of local events (trangressive sequence, for example)	1
4. Very good interpretation. Between good and excellent.	1
5. Excellent interpretation. Correct rock and structure names and descriptions; correct sequence; interpretation includes broader implications (passive margin setting, for example)	1

Critical Thinking- Problem Solving Assessment Outcomes. Five students completed the exam. The assessment scores for the students covered the full range from 1 to 5. Two of the five students rated below the minimum goal of 3. One of these students (scoring a 2) is also planning to go to graduate school though the student has not yet applied. The student who scored 3 (good) has already started a career unrelated to geology. The two students who scored above good will start graduate school in Fall 2011.

The exam was given in final's week and some students expressed negative comments about doing the exam so late in the semester. This negativity could have affected performances, as the two students who scored less than 3 wrote very little in their answers.

Critical Thinking- Problem Solving Assessment Recommendations. We suggest the following recommendations for using this assessment instrument in the future.

- Give the exam approximately 1 month before the end of school (late March or early April). Include some sort of incentive or reward (for example, dinner) for participating in the assessment activity.
- Provide more open-ended exam questions in upper-level courses. This would do two things: it would provide students more opportunities for developing integrative problem solving skills and the problems could be assessed to evaluate student learning.

B. Goal Area- Critical Thinking: Critical Reading/ Geology Colloquium/ Rubric/ T. Wilch (author)

Critical Thinking: Critical Reading Goal. Students are able to critically read peer-reviewed geology literature. More specifically all graduating majors and minors are to achieve a rating of "good" on interpreting peer-reviewed literature, according to rubric specification described below.

Critical Thinking: Critical Reading Assessment and Outcomes.

We used the same student oral presentation rubric to assess critical reading skills. In this case we only used the Talk Content category to assess the critical reading skills. Presentations were based on 1) independent faculty-mentored research; or 2) a peer-reviewed journal article. The mean results are shown in table below. In Fall 2010, five students scored below a 3.0 and three of these five were Seniors; in Spring 2011, four students scored below a 3.0 and one of these four was a Senior (minoring in geology)

Table 2. Compilation of Critical Reading Assessment Results from 2010-11 Geology Colloquium. The students are assessed on a 1 to 4 scale (Weak, Fair Good, Excellent) as described in the Table 1 above.

	Fall 2010 Result Summary			Spring 2011 Result Summary		
Assessment Area	Mean Juniors	Mean Seniors	Mean All	Mean Juniors	Mean Seniors	Mean All
Talk Content	3.24	3.17	3.21	3.23	3.58	3.32

Results indicate that there was an improvement in mean scores from Fall to Spring semester and a significant improvement in Senior geology majors and minors from Fall to Spring semester. There were similar improvements to those discussed in the previous section on oral presentation. Critical reading skills are practiced in several upper-division geology courses and in all research projects. The results are frequently presented in colloquium presentations. In our new rubric we can provide specific feedback to students on their current level, areas to target for improvement and areas where they are already strong. The fact that three of the Seniors completed Senior theses may also have helped their individual scores.

Because majors are assessed in four successive semesters and minors are assessed two times, faculty have the opportunity to work with students who struggle (i.e. get below a 3.0) in this area. We recommend that talk advisors work more intently in successive semesters with students who score low.

C. Critical Thinking- Quantitative Reasoning Goal. All majors can demonstrate basic quantitative reasoning skills as applied in geology problems.

Critical Thinking- Quantitative Reasoning Assessment. Quantitative reasoning is a required element for problem solving in many areas in geology. Because only a couple of questions on the Senior Exam require quantitative reasoning, we do not have enough data for assessment. Our recommendations for assessing quantitative reason skills are:

- to develop a couple of basic problem sets that students will complete at the beginning of several upper-level lab courses to pre-assess their quantitative reasoning skills. The courses that will use the new problem-set assessment tools include: Structural Geology (Geol 201); Groundwater (Geol 202); Geomorphology (Geol 208); and Environmental and Engineering Geology (Geol 216), and Geochemistry (Geol 307). Geol 201 is required for all majors but most majors take at least one of the other upper level courses as electives.
- Faculty will work with individual students and modify specific lab assignments to address areas of weakness.

D. Critical Thinking- Scientific Methodology/ Geol 103, Rubric/ B. Bartels (author) Performance on quantitative areas of specific advanced geology courses. Specific measures are under discussion.

Critical Thinking- Scientific Methodology Goal : The "Scientific Analysis" mode assessment focuses on the following learning goal: Test hypotheses or other scientific theories.

Critical Thinking- Scientific Methodology Assessment and Outcomes: For Geology 103, we assessed the students' understanding and application of observation, hypothesis development, and hypothesis-testing as it applied to a group of extinct reptiles they had learned about in lecture. The project involved the examination of two skeletons of flying reptiles (pterodactyls) hanging in the Science Complex Atrium, which was part of a larger laboratory examining dinosaurs and other fossils on display in the Science Complex. Students worked as individuals or in groups of 2 or 3.

Scientific methodology and hypothesis testing is described in their textbook and in lecture without specific reference to the problem.

The learning goal is assessed in the ability of the students to develop three hypotheses explaining the differences between the two skeletons and the evidence they would seek in closer examinations of the skeletons, the records of where they were found, or specimens in other museums. We evaluated the 52 students according to the table below.

# Students	Description of Rating
0	Student was unable to formulate a reasonable and testable hypothesis.
52	Student posed at least one reasonable and testable hypothesis
50	Student posed at least two reasonable and testable hypotheses
40	Students posed three reasonable and testable hypothesis
0	Student could construct no adequate tests for any hypothesis
52	Student could construct at least one adequate test for any hypothesis
42	Student could construct at least two adequate tests for any hypotheses
20	Student could construct three adequate tests for all hypotheses

The conclusion from this assessment is that all of the students could formulate a reasonable and testable hypothesis explaining the differences in the skeletons. In addition, 96% (50/52) were able to formulate two hypotheses and 77% (40/52) were able to formulate three. In terms of testing their hypotheses, all of the students could construct at least one adequate test for any of their hypotheses, regardless of how many they may have formulated and 81% (42/52) could construct at least two. However, only 50% (20/40) of the students were able to construct tests for all three of their hypotheses.

The students were not graded on this exercise, although they did not know it at the time they completed it.

The students who were successful at the two hypothesis and test level were able to take information given on related retile groups and apply those methodologies and observations to the pterodactyls. The students who could formulate the third hypothesis were able to take more abstract concepts from the course and apply them here. Their ability to then formulate a test of that third hypothesis was somewhat more limited however, with only half of the students who came up with three hypotheses being able to provide adequate tests for all three.

Knowing that we would be conducting this assessment, we were very careful to avoid direct reference to how to test hypotheses in these situations. Later in the course, we go through a detailed analysis of another group of reptiles to illustrate hypothesis testing, but it comes after they have completed this assessment.

In 2009, we conducted the same assessment with less satisfying results. The percent of students able to formulate at least two hypotheses rose from 90% to 96% and the number who could provide three hypotheses rose from 59% to 77%. In terms of testing, students able to give two adequate tests dropped from 90% to 81%, but the proportion of students who could provide three tests rose from 22% to 50% (of those who provided three hypotheses).

After considering the 2009 results, we introduced multiple hypothesis testing in an earlier classroom exercise using groups of dinosaurs. we believe that this helped students think more critically when faced with a new problem. In addition, in 2009 10% of the students were unable to formulate any tests, and this year all 52 were able to provide at least one.

Given the fact that 77% could come-up with an original third hypothesis but 1/2 of them not an original test, we plan on introducing additional hypothesis testing in a lab exercise earlier in the semester based on trilobites.

4. Creativity & Initiative Goals & Outcomes

There are three specific skill areas in the creativity and initiative goals:

A. Independence of thought
B. Initiative
C. Integrative thinking

Creativity & Initiative Goals. Students demonstrate independence of thought and expression. Student work also demonstrates integrative thinking by addressing problems through multiple approaches. Students demonstrate initiative in pursuit of research and solution to problems. Our goal is that 100% of directed study students perform at a satisfactory level in all three areas and that 50% of directed study students perform at a strong level in all three areas.

Creativity & Initiative Assessment & Outcomes/ Directed Studies, Rubrics/ T. Wilch, C. Menold, and W. Bartels. We assessed these three skill areas (independence of thought, initiative, and integrative thinking) in our directed studies. The rather subjective "skills" of independence of thought, integrative thinking, and initiative were assessed through directed studies. Eight geology majors undertook directed studies supervised by a Geology faculty member. Three of the directed studies were associated with Senior theses.

Late in Spring semester 2010, we developed a rubric for assessing the three skill areas: independence of thought, integrative thinking, and initiative. As a department we have discussed the difficulty of evaluating directed studies because, unlike classes, each one is unique. These results presented here along with last year's results rubrics are the first step in establishing a department standard for performance in directed studies.

Eight students were assessed based on directed studies completed in Fall 2010 and Spring 2011. The eight included two Sophomores, two Juniors, and four Seniors. The two Sophomores were very good at budgeting time and completing tasks but needed help with the big picture and a lot more guidance on next steps. The Juniors performed satisfactorily in terms of independence of thought and integrative thinking and had strong scores in the area of initiative.

The four Seniors included three Senior Thesis students. One Thesis student was almost completely independent and performed at a high (graduate) level in all areas. One Senior Thesis student showed strong initiative and independence and satisfactory integrative thinking. This student completed her thesis after her advisor had left the college mid-year. The third Senior Thesis student demonstrated high-level (graduate) initiative and was rated strong in terms of independence in thought and integrative thinking. The fourth Senior had issues with time management and commitment which affected the quality of the product. All of the Seniors and Juniors presented at the Geological Society of America sectional meeting in Pittsburgh during the Spring 2011 semester.

A. Independence of Thought Assessment and Outcomes

Rating	Description	No.
0 = unacceptable student-level	The student makes no research decisions. The advisor makes all decisions regarding research concept, methods, analysis, conclusions, and significance. If the student does make some research choices, they are poorly reasoned, and must be wholly revised or rejected by the advisor.	0
1 = weak student-level	Student makes few research choices. Most research decisions come with prompting from the advisor. Once given a suggestion or direction, the student infrequently makes wise or informed choices regarding their research direction, significance, or conclusions.	0
2 = satisfactory student-level	Student makes many choices regarding the direction, significance, meaning, and conclusions of their directed study project, but most of those choices come with input, clarification, and/or suggestions from faculty advisor. Most student research decisions require refinement, direction, and/or prompting from the advisor, but student does make some (but not all) research decisions.	5
3 = strong student-level	Student is able to make good decisions on the direction, significance, meaning, and conclusions for some aspects of their directed study project. Student research choices are generally well thought out and self-driven, but may need minor refinements by faculty advisor.	2
4 = very strong graduate-student-level	Graduate student level. Student regularly makes informed and intelligent decisions about the direction, significance, meaning, and conclusions for most aspects of their directed study project. The student is able to make wise research decisions on their own.	1

The independence of thought evaluates students' requirements for supervision in most aspects of their research. Are students able to develop a sound research strategy? Do they need abundant guidance and re-direction?

We met our goal that all students perform at satisfactory level but fell short of our goal that 50% of students should perform at a strong student-level. Student performance ranged from very strong to satisfactory. Satisfactory students had some good ideas that needed refining, and when given direction, could take that direction and apply it. Strong students had many of their own ideas, sometimes needing refinement or minor re-direction. The very strong student's research direction and plans were almost entirely student-derived and well-reasoned, requiring only minor modifications by the advisor. The students completing theses were all satisfactory or better.

B. Integrative Thinking Assessment and Outcomes

Rating	Description	No.
0 = unacceptable student-level	Even with instruction, the student is unable to relate their project to the "big picture" and is not able to apply knowledge, methods, or analyses from more than one discipline or point of view.	0
1 = weak student-level	Student struggles to understand how their research fits into the "big picture," and has difficulty applying a diverse set of tools and analyses to bear on their project without significant instruction.	0
2 = satisfactory student-level	Student relates their research to the "big picture" with some additional research and prompting. The student can apply methods and analyses from various disciplines to their own research with prompting and minor instruction from their advisor.	5
3 = strong student-level	Student understands how their research fits into the "big picture" and applies methods, knowledge, and analyses from multiple disciplines to their project with minimal direction from the advisor.	2
4 = very strong graduate-student-level	Graduate student level. Student regularly makes connections between different aspects of their research, is able to tie their project into the broader scientific community, and can appropriately use methods and analyses from a range of fields and backgrounds.	1

Integrative thinking assesses students' abilities to understand how their project fits in the "big picture," understanding the significance of their research and how it is related to other disciplines within, and outside of geology. This assessment evaluates how well students can incorporate ideas presented in diverse sources, classes, and even disciplines in their project.

We met our goal that all students perform at satisfactory level but fell short of our goal that 50% of students should perform at a strong student-level. Students were generally able to put their project into a broader context. Most of the students completing directed studies performed at a "satisfactory" level. "Satisfactory" students needed some guidance, occasionally had to ask for clarification regarding the significance of their project, but were generally capable of understanding methods and applying concepts from literature and courses to their project. The "strong" and "very strong" students initiated methods or explanations from a variety of sources and disciplines, and understood the importance of their project.

C. Initiative Assessment and Outcomes

Rating	Description	No.
0 = unacceptable student-level	The project did not reach its goals primarily because the student did not take the time or effort to complete the work. In most cases, the work that was completed was finished in the last week or two of the semester due to the student's lack of drive to make regular progress on his or her directed study.	0
1 = weak student-level	The advisor regularly has to remind the student to accomplish tasks. The student frequently puts off work for later, requiring more time to be devoted to the project at the end of the semester. Most of the work in this directed study is accomplished in the last few weeks of the semester due to the student's inability to complete tasks earlier.	1
2 = satisfactory student-level	The project is completed with a time-table mostly established by the advisor, but, once established, the student occasionally needs to be pushed to complete tasks from the advisor. Somewhat more than half of the work is accomplished in the second half of the semester.	1
3 = strong student-level	The student requires minimal or very infrequent pushing from the advisor to accomplish tasks. Research tasks are accomplished rapidly and skillfully. This student's directed study is mostly student driven. The work in this directed study is spread throughout the semester, and does not require an inordinate amount of effort to complete at the end of the semester.	4
4 = very strong graduate-student-level	Student actively pushes the project forward. Little or no pushing is required of the advisor. The student accomplishes tasks accurately and skillfully in a rapid time frame on his or her own initiative. This student's directed study is almost entirely student-driven. The work in this directed study is spread throughout the semester, and does not require an inordinate amount of effort to complete at the end of the semester. It may have been completed ahead of schedule.	2

Initiative assesses students' drive and ability to complete their project. This incorporates students' abilities to make regular progress throughout the semester, their general enthusiasm for their project, and how well they were able to accomplish tasks.

We fell short of our goal that all students perform at satisfactory level and but met our goal that 50% of students should perform at a strong student-level. A majority of students, 6 of the 8, were "Strong" in their initiative, 1 showed "Weak" initiative, and 2 were at "Very Strong Graduate-student-level." The "Strong" students all completed their research by making regular progress throughout the semester. They worked hard and accomplished their tasks. The "Weak" student completed most of the work at the end of the semester and only made adequate progress due to poor time management. The "Graduate-level" students worked very hard to accomplish tasks with no pushing required from their advisors. These students kept up that rigorous level throughout the semester, and were able to accomplish their research and writing ahead of schedule.

Creativity & Initiative Goals: Plans for future assessment. In Fall 2011, we will discuss linking these evaluations to grades. There may be other criteria that are included in student evaluation but independence of thought, integrative thinking, and initiative will likely be included in evaluation criteria for directed studies and independent research experiences. In Fall 2011, students enrolled in directed studies will be given copies of the rubrics to help them better understand some of the overarching goals of independent study experiences and faculty expectations.

5. Earth Science Methods Goals

There are four skill areas in the Earth Science Methods goals:

A. Field Skills
B. Lab Skills
C. Map/Imagery/GIS skills
D. I.T. skills

Field skills (A.) and Map/Imagery interpretation skills (C.) were assessed this spring.

A. Earth Science Methods- Field Skills

Field Skills Goals. With instruction and guidance, all students will be taking notes at a satisfactory level, as defined by our rubric described below. Students who have completed our capstone summer field camp program are expected to perform at a strong to professional level.

Field Skills Assessment & Outcomes/ Geology 210, Rubric/ T. Wilch and C. Menold
An assessment of field note-taking was completed for Regional Field Geology (Geo 210) in Spring 2011. The same basic rubric has been used since Fall 2009 for Regional Field Geology (Geol 210) and Glaciers and Climate Change (Geology 306). Taking thorough and accurate notes in the field is a difficult but critical task in geology. The rubric and summary results from Spring 2011 are shown below.

Rating	Description	# Stu
0 = unac-ceptable student-level notes	Notes are illegible and incomplete. Basic site information (location, date, time, weather, purpose) is very weak or absent. Key observations and sketches are critically flawed. No interpretations/hypotheses or confusion of observations and interpretations. Notes are flawed and would not be useful to other geologists who have not visited the site.	0
1 = weak student-level notes	Notes are mostly legible but lack organization and consistency. Site information (location, date, time, weather, purpose) is weak and lacking important points. Key observations and sketches are lacking important information or clarity. Interpretations/hypotheses are weak and may be confused with observations. Notes are lacking in multiple areas and would be only marginally useful to other geologists who have not visited the site.	3
2 = satisfactory student-level notes	Notes are legible and moderately organized. Site information (location, date, time, weather, purpose) is acceptable but not complete. Key observations are included but detail could be improved. Sketches of site, exposure(s), and features are included but could be improved in clarity, labeling or scale. Interpretations/hypotheses are included but are not well supported by observations. Notes lack detail but would still be useful to other geologists who have not visited the site.	14
3 = strong student-level notes	Notes are legible and reasonably well-organized. Site information is complete (location, date, time, weather, purpose). Observations are appropriate to exposure or site and are mostly thorough. Sketches of site, exposure(s), and features are clear and have appropriate labels, directional indicators and scale. Interpretations/hypotheses are included and supported by observations. Notes would be clear and useful to other geologists who have not visited the site.	3
4 = profess-sional-level notes	Professional level. Notes are legible and well-organized. Site information and observations are detailed and complete. Thoughtful and, in some cases, multiple interpretations/hypotheses are included in notes and clearly separated from factual observations. Notes would be very clear and useful to other geologists who have not visited the site.	0

The five point rating scale is not linked directly to the grading of the field notebooks, although there is a rough correlation. Student note-taking was based on outcrop descriptions and interpretations as well as specific field assignments. The field notebooks tend to be a combination of recording (essentially verbatim) what instructors are saying about the field geology and original observations and interpretations. This semester the course instructors (Wilch and Menold) worked with students during the semester to develop observation skills through a series of guided activities. Students were shown real outcrop pictures (in powerpoint) and were given hand samples of rocks from these outcops. Each student then worked on developing a notebook sketch describing the associated samples. Students were given limited time to make the process more realistic. This process greatly improved basic note-taking skills and the discussions with the class particularly helped the less experienced students. As a result of these in-class activities- the basic expectations of field notes were clearly established prior to the field trip. The focus of note-taking on the field trip was on original observations and interpretations and assessment was conducted exclusively on these notes. Two instructors (Wilch and Menold) taught the course and assessment scores were completed by both instructors. Notebooks with instructor comments and suggestions were returned to the students. This course enrolled 20 students. Field notes are emphasized in several upper level geology courses and are comprehensively covered in our summer field camp course, Geology 314: Geological Field Methods.

As part of the assessment, Wilch and Menold broke down the summary rubric into component skills, using the same 0-4 ranking. The raw results ranked from low to high student mean score are shown below.

Student	Legibility	Completeness	Organization	Location	Observations	Sketches	Interpretations	Student Mean Score	**Rounded Mean Student Score**
1	0	2	2	2	1	0	1	1.1	**1**
2	1	1	1	2	1	1	1	1.1	**1**
3	2	1	1	2	1	1	1	1.3	**1**
4	1	2	1	2	2	2	1	1.6	**2**
5	1	2	2	2	2	1	1	1.6	**2**
6	1	2	2	2	2	1	1	1.6	**2**
7	2	2	2	2	1	2	1	1.7	**2**
8	1	3	1	2	2	2	1	1.7	**2**
9	3	2	2	2	1	2	1	1.9	**2**
10	3	2	2	2	2	1	1	1.9	**2**
11	2	2	3	2	2	2	1	2.0	**2**
12	2	2	2	2	3	1	2	2.0	**2**
13	3	2	3	2	1	2	1	2.0	**2**
14	2	3	3	3	2	2	1	2.3	**2**
15	2	2	3	3	3	2	2	2.4	**2**
16	2	3	2	3	3	2	2	2.4	**2**
17	4	3	2	4	2	1	1	2.4	**2**
18	3	3	2	3	3	2	3	2.7	**3**

19	3	3	3	3	3	3	2	2.9	**3**
20	4	3	4	4	3	2	3	3.3	**3**
Skill Mean	**2.1**	**2.3**	**2.2**	**2.5**	**2.0**	**1.6**	**1.4**	**2.0**	**2**

A summary of the raw scores is shown in table below.

Assessment Score	Legiblility stu.)	Completeness (# stu.)	Organization (# stu.)	Location (# stu.)	Observations (# stu.)	Sketches (# stu.)	Interpretations (# stu.)
0	1	0	0	0	0	1	0
1	5	2	4	0	6	7	14
2	7	11	10	13	8	11	4
3	5	6	6	5	6	1	2
4	2	1	0	2	0	0	0
Mean Score	2.1	2.3	2.2	2.5	2	1.6	1.4

Total no. of students assessed was 20

Students performed best on basic recording skills (legibility, completeness, organization, location description). Students did a "satisfactory" job on making original observations. Student scores were weakest in the areas of sketches and especially interpretations.

This was the third time that this version of the rubric has been used to evaluate student's ability to take field notes. Students were instructed in note-taking at the beginning of the course and at several points throughout the course. The trip was geologically coherent, being organized on two E-W /W-E transects from the coastal area of Washington through the accreted and volcanic Cascades into eastern Columbia River basin. There were approximately 60 outcrop stops conducted during the fourteen-day field trip. Students were instructed on general note-taking skills and note-taking was discussed throughout the trip. The amount of instructor influence on notes varied from site-to-site. Much of the geology was being viewed for the first time by both students and instructors.

The notebooks were graded only at the conclusion of the trip. This is not an advanced course in geology, but rather a 0.5 unit course open to students who have completed anything ranging from a single geology lab course (Geology 101 or 103) to students having completed a G-Track (grad school prep) Geology Major. The students included Sophomores to Seniors, mostly geology majors, but also a non-major and 2-3 earth science education students.

A comparison of the 2010 and 2011 Regional Field Geology scores is shown below.

Rating	2010 Geol 210	2011 Geol 210
0 = unacceptable student-level notes	1	0
1 = weak student-level notes	0	3
2 = satisfactory student-level notes	9	14
3 = strong student-level notes	8	3
4 = professional-level notes	0	0

The scores appear to be slightly lower this year (2011) compared with 2010, particularly with respect to the number of "strong student-level" notes. This may reflect different students, evaluators and/or emphases placed by evaluators. The mode (14/20) evaluation score for 2010 was a 2, which indicates satisfactory student-level notes.

To look at that the issue of student background, we qualitatively classified the 2011 students by experience level.

Experience Ranking	# Stu.	mean	st dev
1. only 1-2 introductory level courses in geology	4	1.6	0.23
2. more geology courses (up to 6), no regional or field camp	9	2.6	0.56
3. previous regional plus other geology courses	5	2.6	0.48
4. field camp	2	2.2	0.71

As evidenced by the positive evaluations of students with experience level 2, field note-taking is a skill that is readily acquired by some students, but more difficult for others. There were only two students who have completed field camp. These most experienced students are both Seniors and had divergent scores (indicated by high standard deviation). The divergence is attributed to individual abilities, as well as different career plans: the lower scoring student has no plans to work as a geologist, whereas the higher scoring student is planning on attending graduate school in geology.

In the 2010 assessment, two suggestions to improve the assessment were made: 1) to systematically assess the field notes on two or more occasions during the students' careers; and 2) to include an analysis of how many field-note intensive classes each student has taken prior the current course. We are continuing to assess field note-taking skills in other courses, and three courses will be assessed in Fall 2011: Geol 202 (Groundwater), Geol 205 (Sedimentation and Stratigraphy) and Geol 306 (Glaciers and Climate Change). We did address the second suggestion as is shown in the table above. In 2010, there were only two "independent" exercises, and these were not assessed separately. In 2011, the majority of exercises (outcrop descriptions and interpretations) were treated as independent exercises. We suggest that in the future that assessment concentrate on these type of "independent" exercises.

This year's assessment followed up on a more intentional teaching of note-taking skills during the semester. It is anticipated that use of this or similar rubrics in other field intensive courses will result in more intentional teaching of note-taking skills and an overall improvement in note-taking quality. We found it instructive to break down the rubric into its component skills. Students perform well on basic note-taking skills Students performed best on basic recording skills (legibility, completeness, organization, location description). These skills should be attainable by all college students, regardless of experience. Students did a "satisfactory" job on making original observations. For undergraduates, we view this as the most important skill in note-taking. The goal for field notes is that the basic observations can stand on their own and are accurate and thus useful for other geologists. Student scores were weaker in the area of sketches and weakest in the area of interpretations. We suggest that more effort be concentrated in future semesters on developing sketching skills. The practicing technique that we used of sketching slides of outcrops seemed very effective. Interpretations require the most sophisticated knowledge of the geology. The student who scored best in this area was a Sophomore who had completed one Geology 210 course and six other geology courses. He was able to

offer multiple hypotheses to explain many outcrops and clearly separated his observations and interpretations from those of peers and instructors.

In summary, we suggest that in future semesters:

- Faculty use this same rubric but also evaluate individual skills (as was done this year)
- Include experience levels of students in future assessment
- Intentional teaching of skills is done in the classroom as well as in the field
- Assessment focus on notes taken during independent exercises, rather than during faculty field lectures
- During field-intensive semester-long courses, student note-taking skills will be assessed and graded multiple times to offer them guidance on ways to improve.

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C1. Earth Science Methods: Map & Imagery Interpretation Skills/ Geomorphology (Geol 208) Lab Exam Questions/Wilch

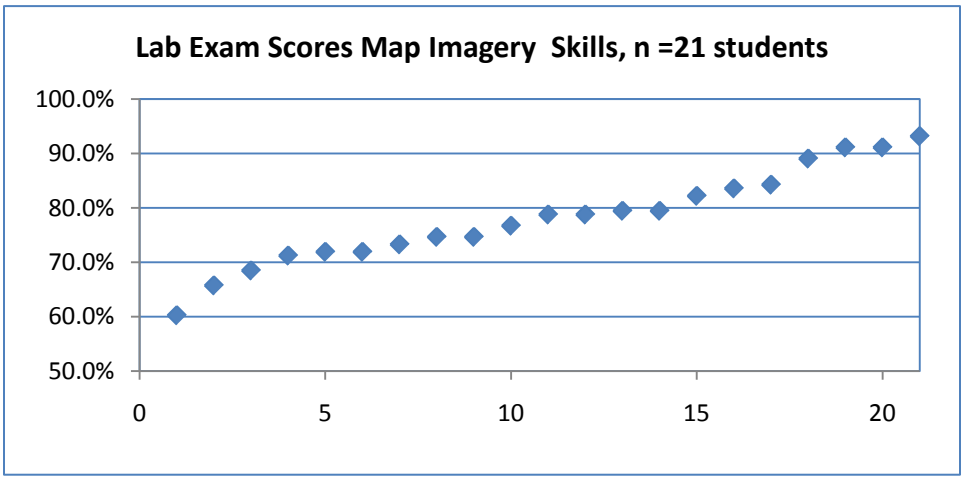
Map & Imagery Interpretation Skills Goals. All students will score at least 70% on the lab exam demonstrating basic competence in map and imagery interpretation skills. At least 50% of students will score 80% on the lab exam demonstrating a strong level of competence in map and imagery interpretation skills.

Map & Imagery Interpretation Skills Assessment and Outcomes.

Geomorphology (Geol 208) is lecture/lab course on the study of earth surface processes and landforms. Throughout the lab students develop landscape interpretation skills with specific labs on introduction to maps, and tectonic, volcanic, mass wasting landforms. Students can work in groups of 2-3 but each student hands in an individual write-up. Group composition is not regulated by the instructor and tends to be largely based on friendships and unchanging through the semester. The lab write-ups are graded and are followed later in the semester with a 3-hour lab exam. During the lab exam students examine stereo pairs of aerial photographs, Google Earth satellite imagery, and topographic maps. The students have not seen any of the maps or images prior to the exam. In other words, the exam is assessing skills rather than recall from a previous exercise. Specific skills that are being evaluated include:

- Constructing and interpreting topographic contour lines
- Numerical calculation of slope, map scale, area and volume of features on map
- Air photo interpretation- including landform identification, rock type interpretation
- Construction of topographic profiles
- Construction of cross-sections to illustrate structures and rock types in 3-D

The table below shows exam scores of map/imagery skills questions from the Spring 2011 lab exam.

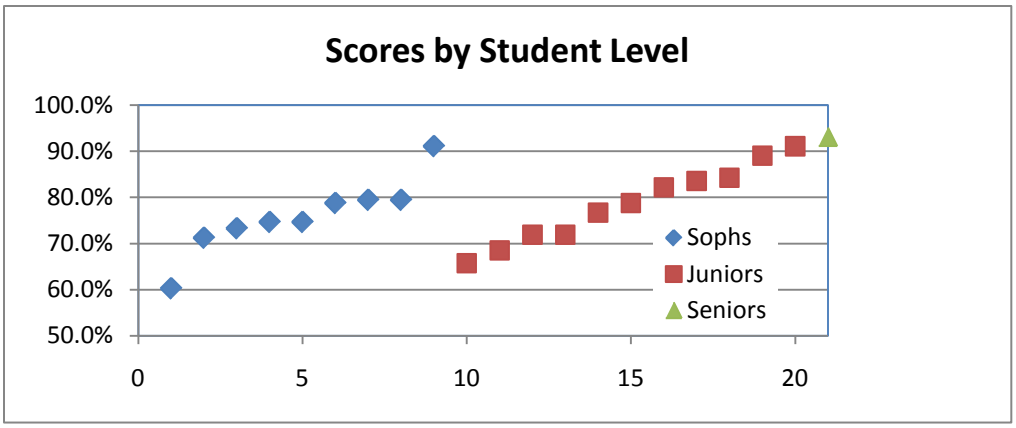


The score range was 60.3% to 93.2%. The mean score was 78.1 +/- 8.7 % (1 s.d.). The individual results include, 18 of 21 students (86%) scored above 70%; 7/21 (33%) students scored above 80% or better. Neither of the assessment goals was achieved.

There is a trend of higher scores with the 2011 students' class status, as shown below

Sophomores (n=9)	Juniors (n=11)	Seniors (n=1)
75.9%	78.5%	93.2%

Though the mean scores are different, there is a lot of overlap in scores between different student level (see graph below).



A map/image lab exam has been given with slight variations in the past four offerings of the course. Graded exams are shown to students but the exams are not returned to students. Students do not have access to map/photo/imagery prior to the exam or after the exam has been completed. The exam always includes about 15% material that is not related to image interpretation. For 2011 assessment, only image/map interpretation questions were included.

During normal lab periods students can work together and get assistance from the instructor.

The overall performance is not surprising as the exam requires high-level spatial thinking and is considered challenging by students in the class. Given the timed nature, breadth, and length of the exam it is extremely difficult to score above 90%. The fact that there was only one Senior enrolled in 2011 may have also affected the overall class average as there is a trend toward scoring higher with more experience.

The improvement with experience is interesting and likely attributed to more advanced level students having more and thus broader experiences in geology which they are able to draw on when analyzing imagery. For several students, this was their first upper-level geology class.

Thirty of the 50 students who have completed Geology 208 since 2008 have graduated from Albion. Of those 30 Albion graduates, 14 have enrolled in graduate school, including 11 in Geology graduate school

and 3 in other professional schools (medical school and environmental policy programs). The mean scores for those attending graduate school in Geology is 86.5%; the mean for those in other professional schools is 79.8%

Recommendations for future assessments using Geology 208 Lab Exam. The low performance (below assessment goals) by several individual students can be attributed to a least three possible causes:

1. The exam is too difficult or assessment goals are set too high.
2. The assessment goals should be different depending on students' levels of prior experience.
3. Student preparation is weak and hampered by the structure of the labs.

At this point, we do not plan on changing the exam or assessment goals. I plan to use the same assessment instrument in 2012-13 offering of the course. I will attempt to address preparation for the exam by changing the structure of the labs leading up to the exam. Specifically, I will regulate group composition. The group approach is both necessary (given lab resources) and helpful for student learning as it allows weaker students to learn from better-performing peers. I believe that the static nature of groups has enabled some weaker students to realize benefits in grades but not in understanding of the material. Regulating group composition will make it less likely that students can rely on the same friends and will also allow me to identify and work with individual weaker students.

C2. Earth Science Methods: Map & Imagery Interpretation Skills/ Senior Exam Questions/Wilch

Map & Imagery Interpretation Skills Goals. All students will score at least 70% on the lab exam demonstrating basic competence in map and imagery interpretation skills. At least 50% of students will score 80% on the lab exam demonstrating a strong level of competence in map and imagery interpretation skills.

Topographic Map Interpretation Skills Assessment and Outcomes.

The Senior Exam this year included a small portion on map interpretation (11.5 points). Five Seniors took the exam and all these Seniors had also taken Geomorphology (Geol 208). The individual scores are shown in table below.

Individual Students Scores (out of 11.5)					Mean score
1	2	3	4	5	
11.5	9.5	11.5	9.5	10.5	10.5
100.0%	82.6%	100.0%	82.6%	91.3%	91.3%

The students all met the goal standards. The limited number of questions and scope of the questions on the exam make it difficult to draw major conclusions, although the results are very positive.

5. Geology Content Goals/Outcomes

For the past 7 years, we have administered a Senior Exam to graduating Geology and Earth Science majors to assess whether they have attained a comprehensive understanding of the geological sciences. Because standardized tests do not exist, the exam is written by members of the department. This is the second year that we administered a completely revised version of the Senior Exam. The "old" exam was composed of multiple-choice questions from Geology 101 and 103 final exams. This exam was general and not designed to meet standard specific learning goals. In places the exam covered material that was not covered in any subsequent courses required by students.

When we originally designed the old exam, we established the following expectations: ninety percent of Seniors will be able to answer 70% of exam questions, 67% of Seniors will be able to answer 80% of the exam questions, and 33% will be able to answer 90% of the exam questions. Overall, students fell short of meeting the goals, with 75% (vs. 90%) scoring 70% or higher, 55% (vs. 67%) scoring 80% or higher, and 13% (vs. 33%) scoring 90% or higher. It was difficult to remedy the underachievement because the old exam was not linked to specific content goals but only with general non-specific content goals. The questions were not categorized. In short, the exam allowed us to assess overall comprehension but did not allow us to address shortcomings in comprehension.

The new exam mirrors our stated learning goals. The exam has a variety of question styles, including multiple-choice, fill-in-the-blank, story problems. The test asked students to interpret text, sketches and graphs, analyze maps, and to identify rock and mineral samples. Questions were categorized and assessed according to the following learning goals:

> Content Assessment Areas: plate tectonics and structure, solid earth composition, surface and atmospheric processes, and earth history.

This year the exam was expanded from last year's exam by including an open-ended problem solving question that was assessed above in the critical thinking category.

Content Assessment Goal: Students can articulate and apply fundamental concepts in core areas of geology including Plate Tectonics, Earth History, Solid-Earth Composition/Structure and Surface and Atmospheric Processes. For this year we are maintaining the same expectations as in previous exams: 90% percent of Seniors will be able to answer 70% of exam questions, 67% of Seniors will be able to answer 80% of the exam questions, and 33% will be able to answer 90% of the exam questions.

Content Assessment & Outcomes/ Senior Exam/ T. Wilch

We administered the exam to all five Senior majors. The exam took 1 to 1.5 hours. Scores ranged from 78.4 to 89.2 %; three students scored in the 80-90 percentile. Overall the students met the stated goal of 90% of students getting a 70% or higher score. The students fell short of the goal of 90% or higher by 33% of the students.

The summary results are presented in the table below:

2010 Senior Exam Results

	Content Areas				Skill Areas		
	Plate tectonics/ structure	Solid Earth Comp.	Earth History	Surface/ Atmos. Proc	Map Reading	Quant. Reas.	Total Points
Poss. Pts.	15	15	28	28	11.5	7	104.5
Mean score	11	12.5	20.2	23.3	10.5	4.6	82.1
% Score	73.3%	83.3%	72.1%	83.2%	91.3%	65.7%	78.6%

Individually the students did not meet the assessment goals (see shaded boxes in table below). Only 60% (3/5) students met the 70% performance goal, these students also met the 80% performance goal. No students met the 90% performance goal.

Student	**1**	**2**	**3**	**4**	**5**	**Mean Score**
Plate tectonics & structure (15 pts)	63.3%	80.0%	83.3%	53.3%	86.7%	73.3%
Solid Earth Comp. (15 pts)	86.7%	100.0%	93.3%	63.3%	73.3%	83.3%
Earth History (28 pts)	82.1%	78.6%	83.9%	67.9%	48.2%	72.1%
Surface & Atmos. Proc. (28 pts)	92.9%	85.7%	82.1%	80.4%	75.0%	83.2%
Content Total (86 pts)	**83.1%**	**84.9%**	**84.9%**	**68.6%**	**68.0%**	**77.9%**

The performance goals were met or very nearly met (limited sample size makes analysis difficult) in Solid Earth Composition and Surface and Atmospheric Processes content areas. Students failed to meet standards in the Plate Tectonics and Structure and Earth History content areas. We will continue to work on the exam. Specific comments on content areas and plans for next year include the following.

- Plate tectonics and structure:
  - Comments: Students performed mediocre in this area. There were very few questions on structure in this year's exam because the open-ended Problem Solving question included was focused on structure. The questions addressed problems and content that the students are introduced to in 100-level classes and focus on in upper-level courses.
  - Plan: We will look specifically at classes that emphasize plate tectonics and structure. We will review the questions and likely include more structure questions on the exam.
- Solid earth composition:
  - Comments: The questions in this area were mostly rock and mineral identification at a very basic level. Students performed well.
- Earth history
  - Comments: The questions in this area included more multiple-choice and fill-in than other parts of the exam and students performed at a slightly lower level than in other content areas.

    - Plan: we will continue to review these questions.
- Surface and atmospheric processes
    - Comments: The questions in this area were at a very basic level. Students performed well.
    - Plans: We will consider modifying the exam to include a wider range of questions.

6. Graduate Preparedness Goals/Outcomes.

Graduate Preparedness Goals The attainment of goals 1-5 (above) will prepare graduates well for further education or careers as earth scientists or educators.

Graduate Preparedness Assessment & Outcomes

Alumni data on careers, graduate school, teacher education will be used to assess career preparedness goals/outcomes. We have been tracking graduates in our alumni newsletter for the past 20 years. Data compiled for the newsletter will be used to assess preparation for careers and graduate school. We have added an exit interview for graduating Seniors to provide additional data. Specifically we will use alumni data to assess the following outcomes:

Graduate Preparedness 1. Graduates will have the proper academic background for success in graduate school.

> **Graduate Preparedness 1 Goal:** 90% of Seniors who apply will be admitted to a graduate program in geology.
>
> **Graduate Preparedness 1 Results.** 98% of Earth Science Geology Majors applying to graduate or professional school were accepted between 2002 and 2011. A total of 60% of our Majors from the past 10 years have finished or are currently enrolled in graduate or professional schools.

Graduate Preparedness 2. Graduates will have the proper academic background for a geology-related career.

> **Graduate Preparedness 2a Goal:** 80% of graduates seeking employment in the field will find it within 1 year of graduation.
>
> **Graduate Preparedness 2a Result.** Between 2001 and 2010, 18 of 21 (86%) of students who reported looking for jobs in Geology found employment in the field within one year. Note that students who pursue careers in other fields or those with whom we have lost contact are not included in this data set.
>
> **Graduate Preparedness 2b Goal:** 50% of graduates on a long-term basis will remain in careers directly related to the geological sciences.
>
> **Graduate Preparedness 2b Result.** Again 60% of our Majors from the past 10 years have finished or are currently enrolled in graduate or professional schools. About 83% of these students are in geology related programs.
>
> 53.3% of all graduates (1966-2010) are reported to be in careers directly related to geology; 27.3% are reported to be in fields other than geology or retired; 19.4% are categorized as unknown (i.e., we lack employment information on them). Graduates are working in the following geologically related fields: industry (mostly environmental and petroleum) (20.0%), government service (6.8%), education (11.6%), and graduate school (8.1%). It is likely that the 53.3% reporting careers in geology underestimates the total number of graduates who are

geologists, since we do not have results for 19.1% of graduates. Non-geologists include graduates professionally employed as lawyers, doctors, business professional, etc.

Graduate Preparedness 3. Education candidates majoring or minoring in Geology or Earth Science will be well prepared for careers as elementary and secondary educators.

Graduate Preparedness 3 Goal. Education candidates majoring or minoring in Geology or Earth Science will pass the MTTC test for Earth and Space Science at a higher rate that the state average. Although this may seem to be a rather un-ambitious goal, most students taking the certification test are from large state schools that have special programs that focus specifically on teacher preparation.

Graduate Preparedness 3 Result. For the past 10 years, Albion College Geology and Earth Science graduates passed with an overall pass rate of 83.3% as opposed to the state average of 64.3%.

Graduate Preparedness 4. Graduating Seniors will be satisfied with the quality of their educational experience and preparation for post-college life.

Graduate Preparedness 4 Goal. Graduating Seniors complete an Exit Interview and are able to identifiy specific courses that meet several departmental learning goals. Graduating Seniors agree with the following statements:

- Formal, course-based laboratory experiences were important to my education.
- Formal, course-based field experiences were important to my education.
- Independent study/research activities were important to my education and professionaldevelopment.
- Overall, I rate my geology educational experience

Graduate Preparedness 4 Assessment and Outcomes. At the time we administered our Senior Exam, we also had graduating majors complete a written exit interview. A copy of the interview form is attached.

Students were able to identify specific courses that met some broad learning goals. We asked students to list the three courses that were *most important* in conveying geologic principles. The five students listed a total of 9 different courses. The mode (3) was Geology 101, Introductory Geology, which is a broad-based survey course that emphasizes geological processes. We asked students to list the three courses that *best emphasized* thinking critically about science/ geology and the Earth. Again the students listed many (7) different courses. The mode (4) was Geology 306, Glaciers and Climate Change, which is an integrative field and seminar course. We asked students to list the three courses that *best emphasized* reflecting on geology's role in contemporary scientific, environmental, or/and societal discussions and issues. Again 7 different courses were listed. The mode (4) was Geology 216, Environmental and Engineering Geology, which is an environmental category course.

The responses to the question: "What was the most beneficial/successful part of geology degree program?" yielded interesting results as well. Graduates answered in unison with three major themes: field camp and other field work (n=4), research with faculty (n=3), and colloquium (n =2). The responses to the question "What was the least beneficial/successful part of geology

degree program?" were scattered and included the senior exam, uncertainties about specific fields of interest within geology, a cognate Physics course, weakness on identifying rocks and minerals.

Students were asked to respond to the questions (listed below) by placing a number from 0 to 5 in the space to the left of each question: 5 = agree strongly, 4 = agree somewhat, 3 = neutral, 2 = disagree somewhat, 1 = disagree strongly, 0 = does not apply.

- The environment in Albion's Geology Department is stimulating and conducive to learning.
- Formal, course-based laboratory experiences were important to my education.
- Formal, course-based field experiences were important to my education.
- Independent study/research activities were important to my education and professional development.
- Overall, I rate my geology educational experience at Albion as highly satisfactory.

The scores are shown in the table below.

Q#	Subject	Mean Score
16	Stimulating and conducive to learning	5
17	Course-based laboratory experiences	4.6
18	Course-based field experiences	5
19	Independent research	4.75
20	Overal satisfaction with education	5

Overall, students expressed strong satisfaction in their geology education at Albion College.