**Fall 2010 Assessment Report on Minors**
**Offered by the Department of Geological Sciences**

**Written by the Department of Geological Sciences**
**Thomas I. Wilch, Chair**

The Department of Geological Sciences offers several minors, including some that are general (Geology and Earth Science minors) and some that more focused and prescriptive (Paleontology, GIS, Environmental Geology.) Assessment of minors will begin in the 2010-11 academic year. This report covers steps 1-4 in assessment process. Steps 5 and 6 will be developed after assessment data are collected.

Our assessment plan addresses individual or sets of minors separately, as listed below:



## Part I. The Geology and Earth Science Minors

### Step1: Department/Program Mission

Catalog description of the Geology Minor:

- Five units in geology, including: Geology 101 or 103 plus four other geology courses, three of which are courses at the 200- or 300-level selected in consultation with and approved by the department chair.
- Completion of a field experience equivalent to one-half unit.
- All courses for the minor must be taken for a numerical grade.
- Departmental Colloquia: All geology minors are required to attend departmental colloquia regularly and to participate once each semester for two semesters.

Catalog description of the Minor in Earth Science with Secondary Education Certification

- Six units in geology, including: Geology 101, 103, 104 and 115 and the completion of all other requirements as outlined above in the section "Requirements for Minor in Geology."
- Physics 105.
- Demonstrated mathematics proficiency at the Mathematics 125 level.
- Completion of all other requirements for teacher certification.

The mission of the geology and earth sciences minors is two-fold:

1. to prepare geology and earth science minors for graduate school or careers in the geological sciences, education, and related fields and

2. to provide students with no professional aspirations in geology with an opportunity to explore an area in which they have interest.

**Step 2: List goals/outcomes for the Geology and Earth Science Minors**
The goals/outcomes for the minors are the same as those for the majors. Many of these are assessed in individual courses in which no distinction is made between those majoring and those minoring. Students in the minor will be asked to take the same senior exam as those majoring, but their results will be evaluated separately and in the context of the courses each student chose to complete the minor.

**Learning Goals & Outcomes**

**1. Content Goals/Outcomes:** 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. Our students will also develop a set of general, computer, field, laboratory, and interpretive skills appropriate to their major or minor.

**2. Communication Goals/Outcomes:**

A. Students are able to effectively articulate their ideas in writing.

B. Students are able to effectively articulate their ideas orally.

**3. Critical Thinking Goals/Outcomes:** Students are able to generate, manipulate and interpret quantitative data, use geologic concepts to solve problems and understand and apply scientific methodology. Specific goals are under discussion.

**4. Creativity & Initiative Goals/Outcomes:**

A. Students demonstrate independence of thought and expression. Student work also demonstrates integrative thinking by approaching problems through multiple approaches.

B. Students demonstrate initiative in pursuit of research and solution to problems.

**5. Earth Science Methods Goals/Outcomes:** Students possess a demonstrated ability to apply field/laboratory skills, map interpretation/geographical information skills, and information technology skills.

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

**Step 3: Identify program components**

Required courses, elective courses, out-of-classroom or other experiences that are designed to achieve each educational objective. NOTE: Every class will not, nor is it expected to, achieve each outcome. The goal is to get an even distribution of experiences that achieve the outcomes.

Goals/Outcomes 1-5 will be achieved through experiences in specific courses, research experiences, and weekly departmental colloquia. The table below shows where in our curriculum specific goals/outcomes will be introduced, emphasized, and comprehensively assessed.

See the attached pdf file GeoMatrix_GoalsCourses.pdf, which shows where goals are introduced, emphasized or comprehensively covered.

**Step 4: Select methods/data sources and instruments**

We will use a variety of quantitative and qualitative methods/data sources and instruments.

**1. Assessment of Content Goals/Outcomes**.

A. Incremental assessment of understanding of goals will be carried out in individual courses beginning in 2009-10. Probably final exam scores or key questions on final.

B. Senior Exam. We will administer a senior exam to graduating Geology and Earth Science minors to assess whether they have obtained a comprehensive understanding of the geological sciences. Graduating seniors in both majors will take an unannounced written exam covering all of the basic fields of geology. Current exam is under review.

**2. Assessment of Communication Goals/Outcomes.**

A. Writing. Departmental Writing Rubric to be used for writing assignments in designated courses and for written component of senior thesis and directed studies. Rubric was implemented in 2009-10.

B. Oral Communication. Beginning in 2009-10, performance on colloquium presentations (done two times by each of our minors) was assessed using the Departmental Oral Presentation Rubric. In the past, assessment of the required colloquia was informal and qualitative.

**3. Assessment of Critical Thinking Goals/Outcomes.**

A. Quantitative Reasoning. Performance on quantitative areas of specific advanced geology courses.
B. Application of Scientific Methodology. This is being assessed in introductory geology lab courses in since spring 2009 and will be assessed in select upper level courses with research projects.

**4. Assessment of Creativity & Initiative Goals/Outcomes.**

A. As these are newly articulated goals the department has not yet assessed. Assessment tools for independent thinking, integrative thinking and initiative are under discussion.

**5. Assessment of Earth Science Methods Goals/Outcomes.**

A. Field Skills 1. Incremental assessment. Field geology skills will be assessed incrementally by performance in specified courses, Geology 210, field-based research projects, and/or Geology 314. Rubric will include assessment of field notebooks and completion of specific field assignment.

B. Field Skills 2. Comparison of Albion student versus non-Albion student preparation for field camp (Geology 314). Field Camp (Geology 314) final grades for Albion College students will be compared to those of students from top echelon colleges and universities and better than those of students from lesser institutions. The expected outcome is that upper class students and graduates will be as well prepared for geology field camp as students from top-echelon colleges such as Brown, Franklin and Marshall, Macalester, Whitman, and Williams.

C. Lab Skills. Rubric will use some combination of lab exam scores and/or key exam questions in combination with assessment of lab reports of student research projects. This is under discussion.

**6. Assessment of Graduate Preparedness Goals /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. Specifically we will use alumni data to assess the following outcomes:

A. Graduates will have the proper academic background for success in graduate school.

B. Graduates will have the proper academic background for a geology-related career.

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

D. Graduates who minored in Geology or Earth Science who have gone on in other fields will report that the general skills (learning outcome 2: communication, learning outcome 3: critical thinking, and learning outcome 4: creativity and initiative) they attained through their minor helped to prepare them for graduate school or employment in their chosen field.

| Goal Areas | Courses in Geology Curriculum (2009-10 Version) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **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** |
| **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 | | | | EA | | E | E | E | | E | E | | | | C A | | |
| **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 Sci. 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 | |
| **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 | A* |
| Initiative | I | I | I | I | I | | I | I | | E | E | | E | E | | | I | E | E | E | E | | | C | C | CA | |
| **Earth Science Methods** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field Skills | I | | | | I | | | CA | | E | E | C | | CA | | | I | CA | | | | | | 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 | CA | | E | I | | E | | C | | | 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 | |
| **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, C = comprehensively covered; E = topic emphasized

A = item is assessed beginning 2009-10; A* = Senior exam will be expanded to include minors

## Part II. The Environmental Geology Minor

### Step1: Department/Program Mission

Catalog description of the Environmental Geology Minor

- Six units in geology, including: Geology 101, 202, 208, 216; one unit selected from 306, 307 or 312; one unit selected from Geology 104, 106, 111, 115, 211, or ENVN 102, or a one-unit equivalent of approved independent research (Geology 412, Geology 411 taken twice, or a summer research experience). Note: This minor may not be elected by geology majors.
- All courses for the minor must be taken for a numerical grade.

### Mission of minor

The mission of the Environmental Geology Minor is to providing students not majoring in geology with a working knowledge of the ways in which professional geologists contribute to the understanding and solution of environmental problems. The minor gives students an understanding of the Earth's surface and near-surface processes which most influence our environment, and develops the skills needed to professionally address many environmental problems.

### Step 2: List goals/outcomes

### Learning Goals & Outcomes

1. **Content Goals/Outcomes:** Students can articulate and apply fundamental concepts of physical geology, geomorphology, and hydrogeology and can relate these to broader environmental issues.

**2. Communication Goals/Outcomes:**

A. Students are able to effectively articulate their ideas in writing.

B. Students are able to effectively articulate their ideas orally.

**3. Critical Thinking Goals/Outcomes:** Students are able to generate, manipulate and interpret quantitative data, use geologic concepts to solve problems and understand and apply scientific methodology. Specific goals are under discussion.

**4. Creativity & Initiative Goals/Outcomes:**

A. Students demonstrate independence of thought and expression. Student work also demonstrates integrative thinking by approaching problems through multiple approaches.

B. Students demonstrate initiative in pursuit of research and solution to problems.

**5. Earth Science Methods Goals/Outcomes:** Students possess a demonstrated ability to apply field/laboratory skills, map interpretation/geographical information skills, and information technology skills.

**6. Graduate Preparedness Goals /Outcomes.** Combined with their majors**,** the attainment of goals 1-5 (above) will prepare graduates well for further education or for careers as environmental scientists, educators or as other professionals working at an intersection with earth science.

**Step 3: Identify program components**

The components of the minor are required courses (Geology 101, 202, 208, 216), elective courses (one unit selected from 306, 307 or 312; one unit selected from Geology 104, 106, 111, 115, 211, or Env 102, or a one-unit equivalent of approved independent research (Geology 412, Geology 411 taken twice, or a summer research experience), and participation in the Geology Colloquium. NOTE: Every class will not, nor is it expected to, achieve each outcome. The goal is to get an even distribution of experiences that achieve the outcomes.

Goals/Outcomes 1-5 will be achieved through experiences in specific courses, and weekly departmental colloquia. The table 1 below shows where in our curriculum specific goals/outcomes will be introduced, emphasized, and comprehensively assessed.

**Step 4: Select methods/data sources and instruments**

We will use a variety of quantitative and qualitative methods/data sources and instruments.

**1. Assessment of Content Goals/Outcomes**.

A. Incremental assessment of understanding of goals will be carried out in individual courses beginning in 2010-11. The courses in the minor are shown in the matrix, table 1, which is adapted from the matrix of all geology courses. This table shows where we intend to develop the specific skills listed above. Because students shift among several majors, minors and concentrations, we can assess the general student achievement of goals in these courses, but it is not practical to separate out the performance of individual students who may not even be in the concentration at the time in which they are enrolled in the classes.

B. Senior Exam. We administer a senior exam to students graduating with Environmental Geology minors to assess whether they have obtained an integrated understanding of the disciplines listed above. Graduating seniors in the minor will take an unannounced written exam covering all of the basic listed above. This exam will be written by the instructors of Geol 202, 208 & 216.

**2. Assessment of Communication Goals/Outcomes.**

A. Writing. Geology Departmental Writing Rubric to be used for writing assignments in designated courses and for written component of senior thesis and directed studies. Rubric is under development and will be implemented in 2009-10.
B. Oral Communication. Beginning in 2009-10, performance on colloquium presentations (done two times by each of our minors) will be assessed using the newly developed Departmental Oral Presentation Rubric. In the past, assessment of the required colloquia was informal and qualitative.

**3. Assessment of Critical Thinking Goals/Outcomes.**

A. Quantitative Reasoning. Performance on quantitative areas of specific advanced geology courses.

B. Application of Scientific Methodology. This is being assessed in introductory geology lab courses in spring 2009 and will be assessed in select upper level courses with research projects.

**4. Assessment of Creativity & Initiative Goals/Outcomes.**

A. under development

**5. Assessment of Earth Science Methods Goals/Outcomes.**

A. Field Skills 1. Incremental assessment. Field geology skills will be assessed incrementally by performance in specified courses, Geology 210, field-based research projects, and/or Geology 314. Rubric will include assessment of field notebooks and completion of specific field assignment.

B. Lab Skills. Rubric will use some combination of lab exam scores and/or key exam questions in combination with assessment of lab reports of student research projects. This is under discussion.

**6. Assessment of Graduate Preparedness Goals /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. Specifically we will use alumni data to assess the following outcomes:

A. Graduates will have the proper academic background for success in graduate school.

B. Graduates will have the proper academic background for an environmental geology-related career.

C. Education candidates minoring in Environmental Geology will be well prepared for careers as secondary educators.

| **Goal Areas** | **Courses in Environmental Geology Minor (2009-10 Version)** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **101** | 202 | 208 | 216 | | | Env 02 | 104 | 106 | 111 | 115 | 211 | | 306 | 307 | **Colloquium** | Dir. St. Research | **Senior Exam** |
| | **Intro** | GdWater | Geomorph | Env. Eng. Geo | | | Intro to the Environment | Resources | Hazards | GIS | Oceans | Rem Sens | | Glaciers | Geochem | | | |
| **Communication** | | | | | | | | | | | | | | | | | | |
| Writing Skills | I | | E | E | | | | I | I | | I | | | E | | | C | |
| Oral Skills | I | I | | E | | | | I | I | | I | | | E | | C A | | |
| **Critical Thinking** | | | | | | | | | | | | | | | | | | |
| Problem Solving | I | C | E | I | | | | I | | | I | I | | E | C | | C | A* |
| Critical Reading | | E | E | | | | | | | | | | | C | | C A | | |
| Quantitative Reasoning | I | E | E | E | | | | | | | | | | I | C | | | A* |
| Application of Scientific Methodology | E**A** | E | E | I | | | | | | | I | | | E | E | | C | |
| Independent Research | I | E | E | E | | | | | | | | | | E | E | | C | |
| **Creativity & Initiative** | | | | | | | | | | | | | | | | | | |
| Independence of Thought | I | I | | | | | | I | | | | | | E | E | C | CA | |
| Integrative Thinking | E | E | E | E | | | | I | I | I | I | E | | E | C | C | CA | A* |
| Initiative | I | I | | I | | | | I | I | I | | | | E | E | C | CA | |
| **Earth Science Methods** | | | | | | | | | | | | | | | | | | |
| Field Skills | I | CA | C | I | | | | | | I | | | | CA | | | E | |
| Lab Skills | I | C | E | E | | | | | | | | | | E | C | | E | |
| Map, Imagery, GIS Skills | I | I | C | E | | | | | I | CA | | C | | E | | | | A* |
| Info. Technology Skills | I | E | E | I | | | | I | | C | | C | | E | E | C | E | |
| **Content Areas** | | | | | | | | | | | | | | | | | | |
| Soil processes | I | I | C | E | | | I | I | | | | | | | | | | |
| Stream processes | I | E | C | | | | | | I | | | | | | | | | |
| Groundwater processes | I | C | I | E | | | | I | | | | | | | | | | |
| Climate -related processes | I | | E | | | | E | | I | | E | | | C | | | | |
| Soil/water interactions | I | E | I | | | | | I | | | | | | | C | | | |
| erosion & mass wasting | I | | C | C | | | | | E | | | E | | E | E | | | |

I = topic introduced

E = topic emphasized

C = comprehensively covered

A = topic assessed

**Part III. The GIS Minor**

**Step1: Department/Program Mission**

**Catalog Description of Minor in Geographic Information Systems (GIS)**

- Three units in GIS and remote sensing: Geology 111, 211, 311.
- One unit in statistics, mathematics or computer science, selected from Mathematics 109, 210, E&M 235 or 235H, Mathematics 141 (or a higher level mathematics course), or CS 171.
- One unit selected from Geology 202, 208 or 216, or a pre-approved course with a significant GIS and/or remote sensing component.
- A pre-approved experience focusing on the application of GIS or remote sensing in the student's field of study. This could be satisfied by a directed study, a summer research experience, or an internship/work experience.
- Formal presentation of the research or work experience is required at a Geology Department colloquium.
- All courses for the minor must be taken for a numerical grade, except those offered only on a credit/no credit basis.

**Mission of Minor in GIS**

Geographic information systems (GIS) is an interdisciplinary tool that is increasingly used by geologists, as well as biologists, archeologists, historians, political scientists, and economists to map, evaluate, interpolate, and manipulate all types of spatial data. The goal for the GIS minor is to provide undergraduate students proficient in the use and application of GIS for future employment and research. We are providing students valuable and transferrable GIS skills for future employment and graduate studies in whatever field(s) their primary interests lie.

**Step 2: List goals/outcomes**

**Learning Goals & Outcomes**

1. Content Goals/Outcomes: Students are able to complete sophisticated spatial analyses that include interpreting spatial relationships, efficiently searching and selecting specific subsets from large datasets based on their spatial patterns or attributes, deriving new data, maps, and information from given data, and design and create effective, concise maps.

2. Communication Goals/Outcomes
   A. Students are able to effectively articulate their ideas in writing.

   B. Students are able to effectively articulate their ideas orally.

3. Critical Thinking Goals/Outcomes: Students are able to generate, manipulate and interpret spatial data to solve problems, create models, and test theories. Specific goals are under discussion.

4. Creativity & Initiative Goals/Outcomes:
   A. Students demonstrate independence of thought and expression. Student work also demonstrates integrative thinking by approaching problems through multiple

approaches.

B. Students demonstrate initiative in pursuit of research and solution to problems.

**5.** Earth Science Methods Goals/Outcomes**:** Students possess a demonstrated ability to apply Map Interpretation, Geographical Information skills, and Information Technology skills.

**6.** Graduate Preparedness Goals/Outcomes: Combined with their majors**,** the attainment of goals 1-5 (above) will prepare graduates well to apply their GIS and remote sensing skills to graduate research and/or to employment in their major discipline and have the foundation to continue building upon those skills to meet the needs of their specific projects.

**Step 3: Identify Program Components**

The components of the minor are required courses (Geology 111, 211, 311), one elective in statistics, mathematics, or computer science (Math 109, 210, 141 or higher level math course, E&M235 or 235H, or CS171), one elective selected from Geology 202, 208, or 216, or other pre-approved course that contains a significant GIS or remote sensing component, a pre-approved research, work, or other experience applying GIS or remote sensing to their major field of study, and participation in the Geology Colloquium. NOTE: Every class will not, nor is it expected to, achieve each outcome. The goal is to get an even distribution of experiences that achieve the outcomes.

Goals/Outcomes 1-5 will be achieved through experiences in specific courses, and weekly departmental colloquia. The table 1 below shows where in our curriculum specific goals/outcomes will be introduced, emphasized, and comprehensively assessed.

**Step 4: Select methods/data sources and instruments**

1. **Assessment of Content Goals/Outcomes**
   Incremental assessment of understanding of goals will be carried out in individual courses beginning in 20010-11. The courses in the minor are shown in the matrix below, which is adapted from the matrix of all geology courses. This table shows where we intend to develop the specific skills listed above. Because students shift among several majors, minors and concentrations, we can assess the general student achievement of goals in these courses, but it is not practical to separate out the performance of individual students who may not even be in the concentration at the time in which they are enrolled in the classes.

2. **Assessment of Communication Goals/Outcomes**
   **A.** Writin**g**. Geology Departmental Writing Rubric is to be used for evaluating thesis, directed studies, and summaries of student work or research fulfilling the GIS research/work experience requirement. This rubric will also be applied to
   **B.** Oral Communication. Beginning in 2009-10, performance on colloquium presentations (done two times by each of our minors) will be assessed using the

newly developed Departmental Oral Presentation Rubric. In the past, assessment of the required colloquia was informal and qualitative.

3. **Assessment of Critical Thinking Goals/Outcomes**
   - **A. Independent Research**. Evaluation of students critical thinking skills as applied to an independent research project is assessed as part of their experience fulfilling the GIS research/work experience requirement.
   - **B. Assessment of Creativity and Initiative Goals/Outcomes**
   - **C.** Under development

4. **Assessment of Earth Science Methods Goals/Outcomes**
   - A. Map, Imagery, and GIS Skills. This is evaluated in both the introductory and advanced GIS courses. In both classes, each of two midterm exams includes a take-home practical exam. By the second midterm exam students should be able to complete spatial analyses that include interpreting spatial relationships, efficiently searching and selecting specific subsets from large datasets based on their spatial patterns or attributes, deriving new data, maps, and information from given data, and design and create effective, concise maps. Students are expected to complete much more complex analyses and interpretations in Geology 311 than in Geology 111.

5. **Assessment of Graduate Preparedness Goals/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. Specifically we will use alumni data to assess the following outcomes:

   A. Graduates will have the proper academic background to use GIS and remote sensing effectively in graduate-level research.

   B. Graduates will have the proper academic background to use GIS and remote sensing effectively in employment within their fields.

## GIS Goal Area/ Course Matrix

| **Goal Areas** | | | | | |
|---|---|---|---|---|---|
| | **111** | **211** | **311** | Colloquium | Dir. St. Research |
| | **GIS** | **Rem Sens** | **AdvGIS** | | |
| **Communication** | | | | | |
| Writing Skills | | | | | C |
| Oral Skills | | | | C A | |
| **Critical Thinking** | | | | | |
| Problem Solving | | I | E | | C |
| Quantitative Reasoning | | | E | | |
| Independent Research | | | E | | CA |
| **Creativity & Initiative** | | | | | |
| Independence of Thought | | | | C | CA |
| Integrative Thinking | I | E | E | C | CA |
| Initiative | I | | | C | CA |
| **Earth Science Methods** | | | | | |
| Field Skills | I | | | | E |
| Map, Imagery, GIS Skills | CA | C | CA | | |
| Info. Technology Skills | C | C | C | C | E |
| **Content Areas** | | | | | |
| Surface & Atmos. Processes | I | I | | | |

I = topic introduced
E = topic emphasized
C = comprehensively covered
A = topic assessed

## Part IV. The Paleontology Minors

### Step1: Department/Program Mission

**Catalog Description**

Requirements for Minor in Paleontology (for Geology Majors)

- Six units, including: Biology 195, two units from Biology 216, 225, 227, 237, or 310, Geology 208, 314, and a one-unit equivalent of approved independent research (Geology 412, Geology 411 taken twice, or a summer research experience), selected in consultation with and approved by the department.
- All courses for the minor must be taken for a numerical grade.
- Geology majors completing a minor in paleontology must take Geology 209 and Geology/Biology 309 as part of the geology major requirements or as electives beyond the major requirement.

Requirements for Minor in Paleontology (for Biology Majors)

- Six units, including: Geology 103, 205, 209, Biology 309, and two units from Geology 101, 111 or 211, 208, or a one-unit equivalent of approved independent research (Geology 412, Geology 411 taken twice, or a summer research experience), selected in consultation with and approved by the department.
- All courses for the minor must be taken for a numerical grade.

Requirements for Minor in Paleontology (for Majors Except Biology and Geology)

- Six units, including: Geology 103, 205, 209, 309, Biology 195, and one unit from Biology 216, 225, 227, 237, or a one-unit equivalent of approved independent research (Geology 412, Geology 411 taken twice, or a summer research experience), selected in consultation with and approved by the department.
- All courses for the minor must be taken for a numerical grade.
- All courses for the minor must be taken for a numerical grade.

**Missions of Paleontology Minors**

The Paleontology Minor at Albion College was designed to serve different missions depending on the individual student's intended career path. The overall mission of the Paleontology Minor is to provide students with a working knowledge of the ways in which paleontologists contribute to our understanding of the history of life on Earth and how climate change and geological evolution have helped shape that history.

The specific mission of the Geology Major version of the minor is to prepare students for graduate study or a career in paleontology and allied fields of geology. The minor intended for Biology majors is designed to help prepare students for careers in medicine, wildlife biology, or paleontology. The third option, for students with a major outside geology or biology, would help prepare archaeology or anthropology students for graduate studies and careers in those fields, or provide students with no professional interest in paleontology a broad background in the field.

**Step 2: List goals/outcomes**

**Learning Goals & Outcomes**

1. **Content Goals/Outcomes:** Students can articulate and apply fundamental concepts of paleontology, biology, and geology to the fossil record.

**2. Communication Goals/Outcomes:**

A. Students are able to effectively articulate their ideas in writing to a variety of audiences.

B. Students are able to effectively articulate their ideas orally to a variety of audiences.

**3. Critical Thinking Goals/Outcomes:** Students are able to generate, manipulate and interpret quantitative and qualitative data, use paleontological, geological, and biological concepts to solve problems and understand and apply scientific methodology. Specific goals are under discussion.

**4. Creativity & Initiative Goals/Outcomes:**

A. Students demonstrate independence of thought and expression. Student work also demonstrates integrative thinking by solving problems through multiple approaches.

B. Students demonstrate initiative in pursuit of research and solution to problems.

**5. Paleontological Methods Goals/Outcomes:** Students possess a demonstrated ability to apply Field/Laboratory skills, Scientific Methodology, and Information Technology skills.

**6. Graduate Preparedness Goals /Outcomes .** Combined with their majors**,** the attainment of goals 1-5 (above) will prepare graduates well for further education or for careers as paleontologists, sedimentary geologists, climate scientists, museum specialists, archaeologists, physical anthropologists, educators, or dentists and doctors with a strong understanding of evolution of human organ systems.

**Step 3: Identify program components**

The common components of the three versions of the minor are: GEOL 103: Introduction to Earth History; geol 205: Sedimentation and Stratigraphy; GEOL 209: Geochronology and Invertebrate Paleontology; GEOL/BIOL 309: Vertebrate Paleontology; BIOL 195: Ecology, Evolution, and Biodiversity; and a research component (GEOL 411 or 412, Senior Thesis, or FURSCA project). Commonly taken electives include GEOL 208: Geomorphology and one or two units of advanced study in biology (BIOL 216: Vascular Plants; BIOL 225: Invertebrate Zoology; BIOL 227: Vertebrate Zoology; BIOL 237: Ecology; or BIOL 310: Evolution). All minors participate in the Geology Department Colloquium for at least 2 semesters. Every class will not, nor is it expected to, achieve each outcome. The goal is to get an even distribution of experiences that achieve the outcomes.

Goals/Outcomes 1-5 will be achieved through experiences in specific courses, and weekly departmental colloquia. The attached table shows where in our curriculum specific goals/outcomes will be introduced, emphasized, and comprehensively assessed.

**Step 4: Select methods/data sources and instruments**

We will use a variety of quantitative and qualitative methods/data sources and instruments.

**1. Assessment of Content Goals/Outcomes**.

A. Incremental assessment of understanding of goals will be carried out in individual courses. The common courses and experiences in the minor are shown in the matrix (attached table). This table shows where we intend to develop the specific skills listed above. Because students can elect three different versions of the minor, we can assess the general student achievement of goals in the courses common to all three, but it is not practical to separate out the performance of individual students who have different majors and career goals.

B. Senior Exam. We administer a senior exam to students graduating with the Geology Major option to assess whether they have obtained an integrated understanding of the disciplines listed above. In addition, graduating seniors in the minor will take an extension of the geology written exam covering all of the basics listed above. This exam will be written by the instructor of GEOL 103, 209 and GEOL/BIOL 309.

**2. Assessment of Communication Goals/Outcomes.**

A. Writing. Geology Departmental Writing Rubric to be used for writing assignments in designated courses and for written component of senior thesis, FURSCA reports, and directed studies. The rubric will also be used to assess student papers in GEOL 205 and 209 and GEOL/BIOL 309.

B. Oral Communication. Beginning in 2009-10, performance on colloquium presentations (done two times by each of our minors) has been assessedusing the newly developed Departmental Oral Presentation Rubric. In addition, student presentations in GEOL/BIOL 309 has been assessedusing this rubric.

**3. Assessment of Critical Thinking Goals/Outcomes.**

A. Quantitative and Qualitative Reasoning. Performance data on specific assignments and certain exams in selected advanced courses will be gathered.

B. Application of Scientific Methodology. This is being assessed in introductory geology lab courses since spring 2009 and will be assessed in select upper level courses with research projects.

**4. Assessment of Creativity & Initiative Goals/Outcomes.**

A. under development

**5. Assessment of Paleontological Methods Goals/Outcomes.**

A. Field Skills 1. Incremental assessment. Field geology and paleontology skills will be assessed incrementally by performance in GEOL 205 & 209, GEOL/BIOL 309, field-based research projects, and certain elective courses (GEOL 208; GEOL 314). The assessment rubric will include assessment of field notebooks and completion of specific field assignment.

B. Lab Skills. Rubric will use some combination of lab exam scores and/or key exam questions in combination with assessment of lab reports of student research projects. This is under discussion.

**6. Assessment of Graduate Preparedness Goals /Outcomes.**

Alumni data on careers and graduate school 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. Specifically we will use alumni data to assess the following outcomes:

A. Graduates will have the proper academic background for admittance to and success in graduate school.

B. Graduates will have the proper academic background for a paleontology-related career.

## Paleontology Learning Goals/Course Matrix

| **Goal Areas** | **Courses in Paleontology Minor** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **103** | **205** | **209** | **309** | | | **B195** | | | | | |
| | **Earth History** | **Sed-Strat** | **Geochron & Invert Paleo** | **Vert Paleo** | | | **Ecol Evol Biodiv** | | | **Colloquium** | Dir. St. Research | **Senior Exam** |
| **Communication** | | | | | | | | | | | | |
| Writing Skills | I | E | E | E | | | I | | | | C | |
| Oral Skills | | I | I | E | | | E | | | C A | C | |
| **Critical Thinking** | | | | | | | | | | | | |
| Problem Solving | I | C | E | C | | | I | | | | C | A |
| Critical Reading | | E | E | E | | | I | | | C A | C | |
| Quantitative Reasoning | | I | I | I | | | I | | | | E | A |
| Application of Scientific Methodology | E**A** | E | E | E | | | E | | | | C | |
| Independent Research | | E | E | E | | | I | | | | C | |
| **Creativity & Initiative** | | | | | | | | | | | | |
| Independence of Thought | I | E | E | E | | | I | | | C | CA | |
| Integrative Thinking | E | E | E | E | | | I | | | C | CA | A |
| Initiative | I | E | E | E | | | I | | | C | CA | |
| **Paleontology Methods** | | | | | | | | | | | | |
| Field Skills | | E | E | I | | | E | | | | E | |
| Lab Skills | E | C | C | C | | | E | | | | E | |
| Anatomy | I | | C | C | | | I | | | | E | |
| Info. Technology Skills | I | I | I | E | | | E | | | C | E | |
| **Content Areas** | | | | | | | | | | | | |
| Preservation & Taphonomy | I | I | C | C | | | | | | | E | A |
| Evolution | E | | C | C | | | E | | | | C | A |
| Systematics and Taxonomy | I | | C | C | | | E | | | | C | A |
| Climate-related processes | E | C | E | C | | | E | | | | E | A |
| Geochronology | E | E | C | E | | | I | | | | C | A |
| Tectonics and paleogeography | E | C | E | C | | | I | | | | C | A |
| Invertebrate Paleontology/Zoology | E | I | C | | | | E | | | | C/ | A |
| Vertebrate Paleontology/Zoology | E | | | C | | | E | | | | /C | A |

I = topic introduced; E = topic emphasized; C = comprehensively covered; C/, /C= depends on subject of study; A = topic assessed