

GEOLOGY AND GEOPHYSICS, B.S.

The interdisciplinary department of Geoscience offers an undergraduate degree in geology and geophysics, with graduate degrees offered in both disciplines.

The Geology and Geophysics major offers unusual opportunities to integrate knowledge and technology from chemistry, biology, physics, engineering, space science, and other disciplines to understand processes that have shaped the Earth, its environments, and the life that it has sustained over billions of years. Geoscientists provide insight on surface and ground water resources and how to protect and preserve them. They probe the causes and potential risks associated with natural hazards including earthquakes, volcanoes, floods, hurricanes, landslides, climate change, and sea level rise. Sustainable exploration and extraction of key mineral resources needed to build and power a resilient and green society depends on well-trained geoscientists. To explore Earth history, develop materials and energy resources, and to take the pulse of a dynamic planet, geoscientists use an extraordinary array of tools including satellites to measure changes of Earth's surface, sensitive instruments to detect seismic waves for exploring resources underground, cutting-edge instrumentation to measure the composition of minerals and rocks at microscopic scales, and computational approaches to assemble and interrogate enormous sets of data acquired from rocks and fossils across the globe.

Geology students have a strong interest in the natural environment as it is today and as it has developed over the past 4.5 billion years. The department of Geoscience challenges students to develop skills in sequential thought, inductive reasoning, and three-dimensional perception. Moreover, students who concentrate in geophysics learn basic physical laws and processes involving gravity, magnetism, heat flow, and seismic wave propagation within Earth. Opportunities also include learning how satellite-based measurements, and computational approaches, are used to measure and monitor geothermal resources, volcanic activity, earthquakes, and groundwater movement.

Geology and Geophysics students prepare for careers in hydrogeology, energy, mining, engineering, and education. Students are exceptionally well-prepared for graduate studies in a broad array of geoscience fields.

HOW TO GET IN

To declare a major, students should meet with the undergraduate advisor.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition

to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatetext>) section of the *Guide*.

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|-------------------|--|
| General Education | <ul style="list-style-type: none"> • Breadth—Humanities/Literature/Arts: 6 credits • Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits • Breadth—Social Studies: 3 credits • Communication Part A & Part B * • Ethnic Studies * • Quantitative Reasoning Part A & Part B * |
|-------------------|--|

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF SCIENCE (B.S.)

Students pursuing a Bachelor of Science degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either the Bachelor of Arts or the Bachelor of Science degree requirements.

BACHELOR OF SCIENCE DEGREE REQUIREMENTS

| | |
|---|---|
| Mathematics | Complete two courses of 3+ credits at the Intermediate or Advanced level in MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP SCI and STAT subjects counts toward this requirement. |
| Foreign Language | Complete the third unit of a foreign language. |
| L&S Breadth | Complete: <ul style="list-style-type: none"> • 12 credits of Humanities, which must include at least 6 credits of Literature; and • 12 credits of Social Science; and • 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science. |
| Liberal Arts and Science Coursework | Complete at least 108 credits. |
| Depth of Intermediate/Advanced Coursework | Complete at least 60 credits at the Intermediate or Advanced level. |
| Major | Declare and complete at least one major. |
| Total Credits | Complete at least 120 credits. |
| UW-Madison Experience | Complete both: <ul style="list-style-type: none"> • 30 credits in residence, overall, and • 30 credits in residence after the 86th credit. |

Quality of Work • 2.000 in all coursework at UW–Madison
 • 2.000 in Intermediate/Advanced level coursework at UW–Madison

NON–L&S STUDENTS PURSUING AN L&S MAJOR

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

REQUIREMENTS FOR THE MAJOR

Prospective majors are strongly encouraged to seek assistance from a faculty advisor in order to choose courses appropriate to their interests and career plans. Advisors can also assist students in choosing a track that is appropriate for their interests and career goals.

BACKGROUND REQUIREMENTS

| Code | Title | Credits |
|--|---|--------------|
| Calculus (complete one sequence): | | 9–14 |
| MATH 221 & MATH 222 | Calculus and Analytic Geometry 1 and Calculus and Analytic Geometry 2 (recommended) | |
| MATH 211 & MATH 222 | Calculus and Calculus and Analytic Geometry 2 | |
| MATH 171 & MATH 217 & MATH 222 | Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II and Calculus and Analytic Geometry 2 | |
| Chemistry (complete one sequence) | | 5–10 |
| CHEM 109 | Advanced General Chemistry | |
| CHEM 103 & CHEM 104 | General Chemistry I and General Chemistry II | |
| CHEM 115 & CHEM 116 | Chemical Principles I and Chemical Principles II | |
| Physics (complete one sequence): | | 10–11 |
| PHYSICS 207 & PHYSICS 208 | General Physics and General Physics (recommended) | |
| PHYSICS 201 & PHYSICS 202 | General Physics and General Physics | |
| PHYSICS 247 & PHYSICS 248 | A Modern Introduction to Physics and A Modern Introduction to Physics | |
| <i>Geophysics and Engineering Geology Track option (complete all):</i> | | |
| E M A 201 & E M A 202 | Statics and Dynamics | |
| PHYSICS 208 | General Physics | |
| | or PHYSICS 202 General Physics | |
| | or PHYSICS 248A Modern Introduction to Physics | |
| Total Credits | | 24–35 |

GEOLOGY & GEOPHYSICS CORE COURSE WORK

| Code | Title | Credits |
|---------------------------------------|---|-----------|
| Complete all of the following: | | |
| GEOSCI 100 | Introductory Geology: How the Earth Works | 3 |
| or GEOSCI/ ENVIR ST 106 | Environmental Geology | |
| GEOSCI 202 | Introduction to Geologic Structures | 4 |
| GEOSCI 204 | Geologic Evolution of the Earth | 4 |
| GEOSCI/G L E 360 | Principles of Mineralogy | 3 |
| GEOSCI/G L E 370 | Elementary Petrology | 3 |
| Total Credits | | 17 |

GEOLOGY & GEOPHYSICS TRACKS

Complete one of the following:

Geology Track

| Code | Title | Credits |
|--|---|-----------|
| GEOSCI/G L E 350 | Introduction to Geophysics: The Dynamic Earth | 3 |
| GEOSCI 375 | Principles of Geochemistry | 3 |
| GEOSCI 430 | Sedimentology and Stratigraphy | 3 |
| GEOSCI/G L E 455 | Structural Geology | 4 |
| 4 credits of GEOSCI 300–699 ¹ | | 4 |
| Total Credits | | 17 |

1

Except GEOSCI 331.

Geophysics and Engineering Geology Track

| Code | Title | Credits |
|----------------------|---|--------------|
| GEOSCI/G L E 431 | Sedimentary & Stratigraphy Lab | 1 |
| GEOSCI/G L E 455 | Structural Geology | 4 |
| GEOSCI/G L E 474 | Rock Mechanics | 3 |
| or GEOSCI/ G L E 350 | Introduction to Geophysics: The Dynamic Earth | |
| GEOSCI/G L E 594 | Introduction to Applied Geophysics | 3 |
| GEOSCI/G L E 595 | Field Methods in Applied and Engineering Geophysics | 1 |
| GEOSCI/G L E 627 | Hydrogeology | 3–4 |
| or GEOSCI/ G L E 350 | Introduction to Geophysics: The Dynamic Earth | |
| E M A 303 | Mechanics of Materials | 3 |
| or M E 306 | Mechanics of Materials | |
| or PHYSICS 311 | Mechanics | |
| or PHYSICS 322 | Electromagnetic Fields | |
| MATH 234 | Calculus--Functions of Several Variables | 3–4 |
| or MATH 319 | Techniques in Ordinary Differential Equations | |
| or MATH 320 | Linear Algebra and Differential Equations | |
| or MATH 340 | Elementary Matrix and Linear Algebra | |
| Total Credits | | 21–23 |

Environmental Geoscience Track

| Code | Title | Credits |
|--|--|--------------|
| GEOSCI/GEOG 320 or GEOSCI/ GEOG 420 or GEOSCI 430 or GEOSCI/ G L E 627 | Geomorphology Glacial and Pleistocene Geology Sedimentology and Stratigraphy Hydrogeology | 3-4 |
| GEOSCI 375 or GEOSCI 610 or GEOSCI/ G L E 629 | Principles of Geochemistry Geochronology, Timescales, and Rates of Geologic Processes Contaminant Hydrogeology | 3 |
| GEOSCI 304 or GEOSCI/ ZOOLOGY 541 or GEOSCI/ ZOOLOGY 542 | Geobiology Paleobiology Invertebrate Paleontology | 3 |
| GEOSCI/ ENVIR ST 411 or GEOSCI/ G L E 455 or GEOSCI 515 or GEOSCI/ G L E 594 | Energy Resources Structural Geology Principles of Economic Geology Introduction to Applied Geophysics | 3-4 |
| Electives | | 3-5 |
| Total Credits | | 17-19 |

1

Except GEOSCI 331.

General Geology Track

| Code | Title | Credits |
|---------------------------------|-------|-----------|
| Any GEOSCI 300-699 ¹ | | 17 |
| Total Credits | | 17 |

1

Except GEOSCI 331.

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in all GEOSCI and major courses
- 2.000 on 15 upper-level major credits, taken in residence¹
- 15 credits in GEOSCI, taken on campus

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GEOSCI 300-699, excluding GEOSCI 331, are considered Upper Level in the Major

HONORS IN THE MAJOR

Students may declare Honors in the Geology and Geophysics Major in consultation with the departmental undergraduate advisor.

HONORS IN THE MAJOR IN GEOLOGY AND GEOPHYSICS: REQUIREMENTS

To earn Honors in the Geology and Geophysics Major, students must satisfy both the requirements for the major (above) and the following additional requirements:

- Earn a 3.300 University GPA
- Earn a 3.400 GPA in all GEOSCI and major courses
- Complete GEOSCI 681 and GEOSCI 682, for a total of 6 credits, with a grade of B or better.

UNIVERSITY DEGREE REQUIREMENTS

Total Degree To receive a bachelor's degree from UW-Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

Residency Degree candidates are required to earn a minimum of 30 credits in residence at UW-Madison. "In residence" means on the UW-Madison campus with an undergraduate degree classification. "In residence" credit also includes UW-Madison courses offered in distance or online formats and credits earned in UW-Madison Study Abroad/Study Away programs.

Quality of Work Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

LEARNING OUTCOMES

1. Acquire quantitative and spatial reasoning skills and the ability to apply those skills to problems in geoscience.
2. Be able to explicate key biological, chemical and physical Earth structures, processes, the interactions between them, and the roles that they play in determining the state of the Earth system.
3. Utilize geological observations and measurements to solve problems involving the timing of geological events in Earth history.
4. Combine data and lab/field-based observations into a novel synthesis and/or description/model of how Earth systems operate.
5. Be able to critique published scientific data, results, and interpretations thereof, as well as identify and assess related work in the scientific literature.
6. Be able to effectively communicate scientific concepts, methods, and results.

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

First Year

| Fall | Credits | Spring | Credits |
|-------------------------------------|-----------|---|-----------|
| MATH 221 (Quantitative Reasoning B) | | 5 MATH 222 | 4 |
| GEOSCI 100 or 106 | | 3 PHYSICS 207 or 201 | 5 |
| L&S Breadth | | 3 Ethnic Studies (take within first 60 credits) | 3 |
| Foreign Language | | 4 Comm A (take during first year) | 3 |
| | 15 | | 15 |

Second Year

| Fall | Credits | Spring | Credits |
|--------------------|-----------|--------------------|-----------|
| PHYSICS 208 or 202 | | 5 GEOSCI/G L E 370 | 3 |
| GEOSCI 202 | | 4 GEOSCI 204 | 4 |
| GEOSCI/G L E 360 | | 3 L&S Breadth | 3 |
| Comm B | | 3 CHEM 103 | 4 |
| | | Elective | 2 |
| | 15 | | 16 |

Third Year

| Fall | Credits | Spring | Credits |
|-------------------------------------|-----------|---------------------------------------|-----------|
| CHEM 104 | | 5 L&S Breadth | 3 |
| L&S Breadth | | 3 GEOSCI Elective 300 level and above | 3 |
| L&S Breadth | | 3 L&S Breadth | 3 |
| GEOSCI Elective 300 level and above | | 4 Elective | 3 |
| | | GEOSCI Elective 300 level and above | 3 |
| | 15 | | 15 |

Fourth Year

| Fall | Credits | Spring | Credits |
|-------------------------------------|-----------|---------------------------------------|-----------|
| GEOSCI elective 300 level and above | | 4 GEOSCI elective 300 level and above | 4 |
| GEOSCI elective 300 level and above | | 3 L&S Breadth | 3 |
| Elective | | 5 Elective | 4 |
| L&S Breadth | | 3 L&S Breadth | 3 |
| | 15 | | 14 |

Total Credits 120**ADVISING AND CAREERS****ADVISING****Sabrina Manero, Undergraduate advisor (general advising)**

smanero@wisc.edu

230 Weeks Hall

Annie Bauer, Undergraduate advisor in the major: geochemistry, geochronology, tectonic processesannie.bauer@wisc.edu (<http://guide.wisc.edu/undergraduate/letters-science/geoscience/geology-geophysics-bs/annie.bauer@wisc.edu>)

329 Weeks Hall

Shanan Peters, Undergraduate advisor in the major: paleontology, sedimentology and stratigraphypeters@geology.wisc.edu (<http://guide.wisc.edu/undergraduate/letters-science/geoscience/geology-geophysics-bs/peters@geology.wisc.edu>)
495 Weeks Hall**Eric Roden, Undergraduate advisor in the major: biogeochemistry, geomicrobiology**erode@geology.wisc.edu (<http://guide.wisc.edu/undergraduate/letters-science/geoscience/geology-geophysics-bs/erode@geology.wisc.edu>)
A348 Weeks Hall**Basil Tikoff, Undergraduate advisor in the major: structural geology**basil@geology.wisc.edu
176 Weeks Hall**Huifang Xu, Undergraduate advisor in the major: mineral science, nanogeoscience, and electron microscopy**hfxu@geology.wisc.edu
A352 Weeks Hall**CAREERS**

More than half of all professional geologists and geophysicists work in hydrogeology, engineering geology, technical consulting, mining, or energy resource industries. The need for energy, environmental protection, and responsible land and resource management is expected to spur future demand for geoscientists. Geoscientists will be involved in discovering and developing next generation energy and mineral resources*. Such careers involve an unusual breadth of training and personal adaptability, and the M.S. degree is generally required. About one fifth of all geoscientists work in state and federal geological surveys or research activities. These positions largely involve problems in geologic mapping, mineral resources, groundwater, and engineering. Geophysics offers opportunities in earthquake studies, seismic verification of nuclear test bans, and rock characterization techniques for waste disposal and groundwater modeling. Many geology students continue on to obtain a Ph.D. degree and become faculty members at colleges or universities. A geology and geophysics major is also appropriate for those interested in careers in elementary or secondary education, environmental policy, or environmental law. Faculty advisors can provide additional information on career opportunities.

*US Bureau of Labor Statistics, November, 2022 ([http://guide.wisc.edu/undergraduate/letters-science/geoscience/geology-geophysics-bs/file:///C:/Users/ljtheo/AppData/Local/Microsoft/Windows/INetCache/Content.Outlook/EZH4LLMB/Vy%20Le%20\(left\)%20and%20Collin%20Sutton%20\(right\)%20completed%20imaging%20experiments%20in%20May%202022%20in%20the%20University%20of%20Wisconsin-Madison%20Small%20Animal%20Imaging%20and%20Radiotherapy%20Facility%20\(SAIRF\).%20Imaging%20experiments%20are%20used%20to%20quantify%20in%20situ%20flow%20and%20transport%20processes%20in%20rocks%20and%20packed%20columns/](http://guide.wisc.edu/undergraduate/letters-science/geoscience/geology-geophysics-bs/file:///C:/Users/ljtheo/AppData/Local/Microsoft/Windows/INetCache/Content.Outlook/EZH4LLMB/Vy%20Le%20(left)%20and%20Collin%20Sutton%20(right)%20completed%20imaging%20experiments%20in%20May%202022%20in%20the%20University%20of%20Wisconsin-Madison%20Small%20Animal%20Imaging%20and%20Radiotherapy%20Facility%20(SAIRF).%20Imaging%20experiments%20are%20used%20to%20quantify%20in%20situ%20flow%20and%20transport%20processes%20in%20rocks%20and%20packed%20columns/))

The College of Letters & Science encourages majors to begin working on their career exploration and preparation soon after arriving on campus. Our department partners with SuccessWorks at the College of Letters & Science. L&S graduates are in high demand by employers and graduate programs. It is important that students are career ready at the time of graduation, and we are committed to their success.

L&S CAREER RESOURCES

Every L&S major opens a world of possibilities. SuccessWorks (<https://successworks.wisc.edu/>) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and

other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (<https://careers.ls.wisc.edu/>)
- Set up a career advising appointment (<https://successworks.wisc.edu/make-an-appointment/>)
- Enroll in a Career Course (<https://successworks.wisc.edu/career-courses/>) - a great idea for first- and second-year students:
 - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
 - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (<https://successworks.wisc.edu/finding-a-job-or-internship/>)
 - INTER-LS 260 Internship in the Liberal Arts and Sciences
- Activate your Handshake account (<https://successworks.wisc.edu/handshake/>) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (<https://successworks.wisc.edu/about/mission/>)

PEOPLE

Professors Dutton, Feigl, Goodwin, Kelly, Meyers, Peters, Roden, Singer, Tikoff, Xu

Associate Professors Cardiff, Ferrier, Marcott, Zoet

Assistant Professors Bauer, Bonamici, Golos, Haseloff, Zahasky