

# Department of Geology and Environmental Science

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## Professors

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## Associate Professors

S. Baedke, L. Eaton, E. Pyle, K. St. John

## Assistant Professors

A. Courtier, E. Johnson, J. Haynes, S. Whitmeyer

## Instructor

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## Mission Statement

Our mission is to serve two vital needs of the JMU students. First, the majors in geology present high quality programs of specialized study focusing on Earth materials, internal and external Earth processes, analysis of Earth history and application of geology to environmental and engineering issues. In support of this mission is a commitment to foster the ability to think analytically and to communicate both within the discipline and with non-scientists. Course work and research experiences prepare the student for postgraduate study or professional careers that are subject to rapidly changing societal needs. Second, our department strives to enhance the university's general education program by offering timely and challenging courses that provide insight into Earth processes and human-environment interactions. These courses promote life long liberal learning by fostering critical thinking and an awareness of natural science.

## Goals

- Provide a stimulating, intellectual environment for students in geology and environmental science that will generate interest and enthusiasm for learning and will provide a solid foundation for graduate work and careers in geology and environmental science.
- Teach science as science is practiced. Since the advancement of scientific knowledge often occurs within a social context – collaboration among scientists, conferences, workshops – the goal is to develop a similar mode of operation for the geology program.
- Provide high quality, relevant general studies courses within the discipline that will probe the philosophy of science and the history of geologic thought. These courses will incorporate critical thinking and an appreciation of the human environment.

## Career Opportunities and Marketable Skills

- Earth Science Teacher
- Engineering Geologist
- Environmental Geologist
- Environmental Scientist/Specialist
- Geochemist

- Government or Industry Geologist
- Geological oceanographer
- Geomorphologist
- Geophysicist
- Hydrologist
- Meteorologist
- Science Museum Curator
- Paleoclimatologist
- Paleontologist
- Petroleum Geologist
- Soil Scientist

## Co-curricular Activities and Organization

The department encourages majors and interested non-majors to participate in the student Geology Club, which sponsors field trip, camping excursions, and hosts educational activities for elementary school students. Geology majors are encouraged to apply to be laboratory teaching assistants and research assistants for faculty in the department. Majors are also strongly encouraged to become members of one or more of the following geoscience organizations and to present their research at the affiliated regional or national meetings:

- Geological Society of America (GSA)
- American Geophysical Union (AGU)
- National Association of Geoscience Teachers (NAGT)

## Degree and Major Requirements

There are two bachelor degrees offered in the Department of Geology and Environmental Science, a B.S. in geology and a B.A. in Earth science. The B.S. degree has two concentrations: a general geology concentration designed for students that want to take a wider range of geology elective courses and an environmental and engineering geology concentration designed for students that want to focus their geology electives toward applied environmental science. The B.A. in Earth science prepares individuals to work in a wide range of professional public sector service careers where preparation in Earth science and communication of science to nonscientific audiences is a requirement or an asset. This includes the preparation of Earth science teachers.

## Bachelor of Science in Geology

### Degree Requirements<sup>1</sup>

Required Courses	Credit Hours
General Education <sup>2</sup>	41
Quantitative requirement (in addition to General Education)	3
Scientific Literacy requirement (in addition to General Education)	3-4
Major requirements (listed below) and electives	70-74
	<hr/> 120

<sup>1</sup> Students must follow the "Degree Requirements at James Madison University" as stated in this catalog.

<sup>2</sup> The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

### Major Requirements

The following are core courses required for B.S. degree students:

Core Requirements	Credit Hours
GEOL 110. Physical Geology	4
GEOL 230. Evolution of Earth	4
GEOL 280. Mineralogy	4
GEOL 300. Introduction to Petrology	3
GEOL 364. Stratigraphy and Basin Analysis	4
GEOL 365. Structural Geology	3
GEOL 399. Field Geology	6
Choose one from the following:	3-6
GEOL 491. Geological Literature Research	
GEOL 494. Internship in Geology	
GEOL 497. Problems in Geology	
GEOL 499. Honors in Geology	
	<hr/> 31-34

The B.S. degree in geology is designed for students who plan to obtain professional employment in geology or enter graduate school upon graduation. It is recommended that incoming B.S. degree students complete the following courses prior to enrolling in required geology courses numbered 300 and higher.

Courses	Credit Hours
CHEM 131-131L; 132-132L. General Chemistry I-II	8
Choose one of the following:	8
MATH 231-232. Calculus with Functions I-II	
MATH 235-236. Calculus I-II	
Choose one of the following:	8
PHYS 140-140L; PHYS 150-150L. College Physics I-II with Laboratories	
PHYS 240-140L; PHYS 250-150L. University Physics I-II with Laboratories	
	<hr/> 24

Students planning graduate study in some areas of the geosciences should consider additional courses in mathematics, physics or chemistry beyond those required for the B.S. major

### Concentrations

The B.S. degree option requires that each student complete at least 12-13 credit hours chosen from one of the following two concentrations.

#### General Geology Concentration

GEOL 220. Genetic Mineralogy	
GEOL 340. Soils and Land Use	
GEOL 350. Invertebrate Paleontology	
GEOL 355. Geochemistry of Natural Waters	
GEOL 385. Geomorphology	
GEOL 390. Laboratory Techniques in Geology	
GEOL 395. Geological Perspectives in Materials	
GEOL 398. Topics in Geology (must be approved by advisor)	
GEOL 405. Vertebrate Paleontology	
GEOL 410. Engineering Geology	
GEOL 415. Geological Evolution of North America	

GEOL 460. Geohydrology	
GEOL 489. Quantitative Methods in Geology	
GEOL 440. Geophysics	

#### Environmental and Engineering Geology Concentration

GEOL 340. Soils and Land Use	
GEOL 355. Geochemistry of Natural Waters	
GEOL 385. Geomorphology	
GEOL 390. Laboratory Techniques in Geology	
GEOL 395. Geological Perspectives in Materials	
GEOL 398. Topics in Geology (must be approved by advisor)	
GEOL 410. Engineering Geology	
GEOL 460. Geohydrology	
GEOL 489. Quantitative Methods in Geology	
GEOL 440. Geophysics	

## Bachelor of Arts in Earth Science

The B.A. in Earth Science degree is designed to integrate all the Earth sciences in a systems approach to understanding the Earth. This includes incorporating and integrating subjects such as oceanography, meteorology and astronomy. The emphasis is on the preparation of individuals to work in a wide range of professional public sector service careers where preparation in Earth science and communication of science to non-scientific audiences is a requirement or an asset.

### Degree Requirements<sup>1</sup>

Required Courses	Credit Hours
General Education <sup>2</sup>	41
Foreign Language classes (intermediate level required) <sup>3</sup>	0-14
Philosophy course(s) (in addition to General Education courses) <sup>4</sup>	3
Major requirements (listed below) and electives	60-71
	<hr/> 120

<sup>1</sup> Students must follow the "Degree Requirements at James Madison University" as stated in this catalog.

<sup>2</sup> The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

<sup>3</sup> The foreign language requirement may be satisfied by successful completion of the second semester of the intermediate level of the student's chosen language (typically 232), or by placing out of that language through the Department of Foreign Languages, Literatures and Cultures' placement test. 4 100-, 200-, 300- or 400-level course acceptable or consult the list of courses satisfying B.A. degree requirements at <http://www/jmu.edu/registrar>.

### Major Requirements

B.A. degree students are expected to complete CHEM 131-131L before enrolling in required geology courses numbered 300 and higher.

The following are core courses required for B.A. degree students:

Core Requirements	Credit Hours
GEOL 110. Physical Geology	4
GEOL 167. History & Philosophy of the Geosciences	3
GEOL 211. Introduction to Oceanography	3
GEOL 230. Evolution of Earth	4
GEOL 320. Meteorology	3
GEOL 367. Genesis of Solid Earth Material	4
GEOL 377. Earth Surface Processes	3
GEOL 467. Stratigraphy, Structure and Tectonics	4
GEOL 477. Contemporary Issues in the Geosciences	3
ASTR 220. Astronomy	3

Choose one from the following:

GEOL 491. Geological Literature Research	
GEOL 494. Internship in Geology	
GEOL 497. Problems in Geology	
GEOL 499. Honors in Geology	

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31-34

The B.A. degree option requires that each student complete at least 16 hours of cognate science credit hours chosen from:

<b>Biology</b>	
BIO/GEOL 350. Invertebrate Paleontology Or BIO 114. Organisms	4

**Chemistry**

CHEM 131-131L. General Chemistry I	4
CHEM 132-132L. General Chemistry II	4

**Physics**

PHYS 140-140L. College Physics I	4
PHYS 150-150L. College Physics II or GEOL 440. Geophysics	3-4

The B.A. degree option requires that each student complete 6-8 credit hours of mathematics, including one of the following:

MATH 205. Introductory Calculus I	3
MATH 232. Calculus with Functions II	4
MATH 235. Calculus I	4
Cognate Science + Mathematics	<u>22-25</u>
Total Degree Hours	59-62

**Recommended Minors for the Bachelor of Arts in Earth Science**

- Astronomy
- Economics
- Environmental Information Systems
- Environmental Management
- Integrated Science and Technology
- Management Science
- Nonprofit Studies
- Secondary Education
- Technical and Scientific Communication

**Teaching Licensure**

Students interested in becoming teachers must meet specific curriculum requirements in their major as part of the undergraduate academic degree. The B.A. in Earth science includes state course requirements in astronomy, meteorology and oceanography, to total no less than 32 hours in the Earth sciences (including geology) and a minimum of 16 hours total in physics, chemistry and biology.

In addition to the general education and academic major requirements, Earth science majors desiring secondary teacher licensure must be admitted to teacher education, complete the pre-professional program in secondary education at the undergraduate level and complete the graduate level Master of Arts in Teaching degree.

It is critical that students seeking licensure consult regularly with both their education adviser and their major adviser to support their progression through the programs. For a full description of the program in secondary teaching, refer to the Department of Middle, Secondary and Mathematics Education, in addition to the College of Education section of the catalog.

**Recommended Schedule for Majors**

**B.S. Degree in Geology**

First Year	Credit Hours
CHEM 131-131L; 132-132L. General Chemistry I-II	8
GEOL 110. Physical Geology	4
GEOL 230. Evolution of Earth	4
Choose one of the following:	6-8
MATH 231-232. Introductory Calculus (six credits)	
MATH 235-236. Analytic Geometry and Calculus (eight credits)	
Cluster One: Skills for the 21st Century	<u>9-12</u>
	31-36

Second Year	Credit Hours
GEOL 280. Mineralogy	4
GEOL 364. Stratigraphy: Depositional Systems	4
Geology elective	3

Choose one of the following:	8
PHYS 140-140L; PHYS 150-150L. College Physics I-II with Laboratories	
PHYS 240-140L; PHYS 250-150L. University Physics I-II with Laboratories	
General Education courses	<u>12</u>
	31

Third Year	Credit Hours
GEOL 300. Introduction to Petrology	3
GEOL 365. Structural Geology	3
GEOL 399. Field Geology (May session)	6
Geology electives	8
General Education courses	9
Electives	<u>3</u>
	29

Fourth Year	Credit Hours
Choose from the following:	3-6
GEOL 491. Geological Literature Research (3 credits)	
GEOL 494. Internship (3 credits)	
GEOL 497. Problems in Geology (3 credits)	
GEOL 499. Honors (6 credits)	
Electives	<u>9-20</u>
	12-26

**B.A. Degree in Earth Science**

First Year	Credit Hours
Cluster One: Skills for the 21st Century	9-12
GEOL 110. Physical Geology	4
GEOL 167. History & Philosophy of the Geosciences	3
GEOL 230. Evolution of Earth	4
MATH 205. Introductory Calculus I	3
CHEM 131-131L. General Chemistry I	<u>4</u>
	27-30

Second Year	Credit Hours
GEOL 211. Oceanography	3
GEOL 320. Meteorology	3
GEOL 367. Genesis of Solid Earth Materials	4
GEOL 377. Surface Processes	3
Foreign language courses <sup>1</sup>	1-8
General Education courses	<u>12</u>
	25-32

Third Year	Credit Hours
GEOL 467. Stratigraphy, Structure & Tectonics	4
ASTR 220. Astronomy	3
Cognate science & mathematics	9-12
General Education courses	<u>9</u>
	25-28

Fourth Year	Credit Hours
GEOL 477. Contemporary Issues in the Geosciences	3
Cognate science	3-4
Choose one of the following:	3

GEOL 491. Geological Research Literature	
GEOL 494. Internship	
GEOL 497. Problems in Geology	
GEOL 499. Honors in Geology	
Geology electives	3-6
Electives	<u>12-20</u>
	24-36

<sup>1</sup> Foreign language at the intermediate level.

**Minor Requirements**

**Geology Minor**

The requirement for a minor in geology is a minimum of 18 credit hours of geology approved by the student's geology adviser.