Earth Sciences

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Faculty

Ilya N. Bindeman, professor (stable isotope geochemistry, volcanology). BS, 1988, Moscow; PhD, 1998, Chicago. (2004)

Edward B. Davis, assistant professor (vertebrate paleontology). BS, 1999, Tennessee, Knoxville; PhD, 2005, California, Berkeley. (2013)

Rebecca J. Dorsey, professor (sedimentology, basin analysis). BS, 1983, Vermont; MA, 1986, PhD, 1989, Princeton. (1997)

Thomas Giachetti, assistant professor (volcanology). MS, 2006, PhD, 2010, Université Blaise Pascal, Clermont-Ferrand. (2015)

Emilie Hooft Toomey, associate professor (marine geophysics). BSc, 1990, Trinity College, Toronto; PhD, 1997, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. (1999)

Eugene D. Humphreys, professor (seismology, regional tectonics). BS, 1974, MS, 1978, California, Riverside; PhD, 1985, California Institute of Technology. (1985)

Qusheng Jin, associate professor (biogeoscience). BS, 1994, Nanjing; MS, 1997, Chinese Academy of Sciences; PhD, 2003, Illinois, Urbana-Champaign. (2005)

A. Dana Johnston, professor (experimental petrology, geochemistry). BS, 1976, Bates; MS, 1978, PhD, 1983, Minnesota. (1986)

Leif A. Karlstrom, assistant professor (volcanology, geomorphology, fluid mechanics). BS, 2006, Oregon; PhD, 2011, California, Berkeley. (2011)

Marli B. Miller, senior instructor (structural geology). BA, 1982, Colorado College; MS, 1987, PhD, 1992, Washington (Seattle). (1997)

Matthew Polizzotto, assistant professor (soil and environmental hydrogeochemistry). BS, BA, 2001, Rochester; PhD, 2007, Stanford. (2016)

Mark H. Reed, professor (mineral deposits, aqueous geochemistry). BA, 1971, Carleton; MS, 1974, PhD, 1977, California, Berkeley. (1979)

Alan W. Rempel, professor (geomechanics and applied mathematics). BASc, 1991, MSc, 1995, British Columbia; PhD, 2001, Cambridge. (2004)

Gregory J. Retallack, professor (paleobotany, paleosols). BA, 1973, Macquarie; PhD, 1978, New England University, Australia. (1981)

Joshua J. Roering, professor (surface processes, geomorphology). BS, 1994, MS, 1995, Stanford; PhD, 2000, California, Berkeley. (2000)

David A. Sutherland, associate professor (physical oceanography). BA, 2001, North Carolina, Wilmington; PhD, 2008, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. (2011)

Amanda M. Thomas, assistant professor (earthquake seismology and fault mechanics). BS, 2007, Georgia Institute of Technology; PhD, 2012, California, Berkeley. (2015)

Douglas R. Toomey, professor (seismology, tectonics, midocean ridges). BS, 1981, Pennsylvania State; PhD, 1987, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. (1990)

Paul J. Wallace, professor (igneous petrology, volcanology, geochemistry). BS, 1986, George Washington University; PhD, 1991, California, Berkeley. (2001)

James M. Watkins, assistant professor (experimental petrology, geochemistry, volcanology). BS, 2005, Wisconsin, Eau Claire; PhD, 2010, Cailfornia, Berkeley. (2012)

Ray J. Weldon, professor (neotectonics, structural and quaternary geology). BA, 1977, Pomona; PhD, 1986, California Institute of Technology. (1987)

Courtesy

Katharine V. Cashman, courtesy professor (volcanology, igneous petrology, crystallization kinetics). BA, 1976, Middlebury; MS, 1979, Victoria, New Zealand; PhD, 1987, Johns Hopkins. (1991)

David Krinsley, courtesy professor (electron microscopy). PhB, 1948, SB, 1950, SM, 1950, PhD, 1956, Chicago. (1991)

John M. Logan, courtesy professor (rock mechanics). BS, 1956, Michigan State; MS, 1962, PhD, 1965, Oklahoma. (1997)

Special Staff

Dennis K. Fletcher, research assistant. BS, 1996, Oregon. (2006)

James Palandri, research associate. PhD, 2000, Oregon. (2001)

Emeriti

Sam Boggs, professor emeritus. BS, 1956, Kentucky; PhD, 1964, Colorado. (1965)

M. Allan Kays, professor emeritus. BA, 1956, Southern Illinois; MA, 1958, PhD, 1960, Washington (St. Louis). (1961)

Alexander R. McBirney, professor emeritus. BS, 1946, United States Military Academy, West Point; PhD, 1961, California, Berkeley. (1965)

William N. Orr, professor emeritus. BS, 1961, Oklahoma; MA, 1963, California, Riverside and Los Angeles; PhD, 1967, Michigan State. (1967)

Jack M. Rice, professor emeritus. AB, 1970, Dartmouth; MS, 1972, PhD, 1975, Washington (Seattle). (1977)

Norman M. Savage, professor emeritus. BSc, 1959, Bristol; PhD, 1968, Sydney. (1971)

Harve S. Waff, professor emeritus. BS, 1962, William and Mary; MS, 1966, PhD, 1970, Oregon. (1978)

Daniel Weill, professor emeritus. BA, 1956, Cornell; MS, 1958, Illinois; PhD, 1962, California, Berkeley. (2002)

The date in parentheses at the end of each entry is the first year on the University of Oregon faculty.

- **Bachelor of Arts: Geology Track**

- **Bachelor of Arts: Geophysics Track**
- **Bachelor of Arts: Environmental Geoscience Track**
- **Bachelor of Arts: Paleontology Track**
- **Bachelor of Science: Geology Track**
- **Bachelor of Science: Geophysics Track**
- **Bachelor of Science: Environmental Geoscience Track**
- **Bachelor of Science: Paleontology Track**
- **Minor**

Undergraduate Studies

The undergraduate program in the Department of Earth Sciences provides an understanding of the materials that constitute the earth and the processes that have shaped the earth from deep in its interior to the surface environment—geology. Geology applies all the basic sciences—biology, chemistry, mathematics, and physics—to understanding earth processes in the historical context of geologic time. It is a science that explores problems by combining field investigations with laboratory experiments and theoretical studies.

Geology also addresses many natural hazards—earthquakes, flooding, and volcanic eruptions—that affect humans. It addresses the impact of humans on the earth's surface environment, where we pollute rivers and ground water, cause rapid erosion and landslides, or attempt to re-engineer rivers and shorelines.

Preparation

High school students planning to major in geological sciences should include in their high school program as much mathematics and science (physics, chemistry, biology, or earth science) as possible.

Students who transfer to the department after two years of college work elsewhere should have completed a year of general chemistry, a year of general physics, and two quarters or a semester of calculus. A year of general geology with laboratory is recommended.

Careers

Students with a degree in earth sciences are qualified for employment in a broad range of careers: geotechnical and environmental consultants; K–12 school teachers (with an additional teaching certificate); laboratory technicians; professional geologists, geophysicists, or geochemists; and positions in the petroleum and mining industries or in state and federal agencies such as the United States Geological Survey or the Environmental Protection Agency. The current climate for employment in the earth sciences is good. Geoscience jobs require skills in critical thinking and problem solving, quantitative analysis, oral and written communication, and team work. The Department of Earth Sciences curriculum emphasizes these skills.

Geological Sciences Curriculum

The Department of Earth Sciences offers a bachelor of science (BS) or a bachelor of arts (BA) degree with a major in earth sciences.

Major Tracks

Earth science is an unusually broad subject. It addresses everything from the chemical processes that make rocks and minerals to the physics behind plate tectonics and the travel of earthquake waves through the planet. It explores the history of the evolution of life revealed in fossils, and it probes the earth processes that affect how humans can survive on the surface of the planet. To address this breadth, the department offers four curricular tracks for a major in earth sciences: geology, geophysics, environmental geoscience, and paleontology.

All of the tracks require a common core of general chemistry, calculus, general geology, and physics, except that paleontology- and environmental geoscience–track students may take two terms of biology in place of two terms of physics. Beyond the core, each track requires certain additional courses and a selection of electives.

Undergraduate Research

As many as 4 credits of research can be counted toward electives in any of the tracks. To receive such credit, students must

- submit a short letter, approved by the faculty research advisor and addressed to the head undergraduate advisor in earth sciences, stating the nature of the research and asserting that there is faculty supervision
- submit a final written report to the faculty advisor describing the results of the research

Students may earn credit in this category by registering for any of the following:

GEOL 401	Research: [Topic]	1-21
GEOL 406	Field Studies: [Topic]	1-6
GEOL 408	Laboratory Projects: [Topic]	1-6

Students who complete an honors thesis may not apply this option toward elective credits.

Grade Options and Standards

Undergraduate majors must take for letter grades (the pass/no pass option is not acceptable) all the courses required in their degree program. Required courses must be completed with grades of C– or better. Exceptions for honors students are noted under Honors in Earth Sciences.

Bachelor of Arts: Geology Track

Code	Title	Credits
Core Courses		
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201–202	General Physics	8
or PHYS 251 & PHYS 252	Foundations of Physics I and Foundations of Physics I	
CH 221–222	General Chemistry	8
or CH 224H–225H	Honors General Chemistry	
One from the following:		4
CH 223	General Chemistry III	
CH 226H	Honors General Chemistry	
PHYS 203	General Physics	
PHYS 253	Foundations of Physics I	
MATH 246–247	Calculus for the Biological Sciences I-II	8

or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 331	Mineralogy	5
GEOL 332	Introduction to Petrology	5
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350 & GEOL 351 & GEOL 352	Structural Geology and Structural Geology Problems and Structural Geology Laboratory and Field	5
GEOL 406	Field Studies: [Topic]	12
Electives		
See Electives table for choices		20
Total Credits		**106**

[1] The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Biology		
Courses numbered 306 or higher		
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 331	Organic Chemistry I	4
CH 335	Organic Chemistry II	4
CH 336	Organic Chemistry III	4
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4
GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 485–486	Remote Sensing I-II	8
GEOG 491	Advanced Geographic Information Systems	4
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 410	Experimental Course: [Topic]	5
GEOL 407	Seminar: [Topic] (Current Topics in Geology) [1]	3
Courses higher than 410 [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420	Ordinary Differential Equations	4
MATH 421–422	Partial Differential Equations: Fourier Analysis I-II	8
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 203	General Physics	4
or PHYS 253	Foundations of Physics I	
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12

[1] Pass/no pass

[2] May include one course numbered 304–310.

Bachelor of Science: Geology Track

Code	Title	Credits
Core Courses		
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201–202	General Physics	8
or PHYS 251 & PHYS 252	Foundations of Physics I and Foundations of Physics I	
CH 221–222	General Chemistry	8

or CH 224H–225H	Honors General Chemistry	
One from the following:		4
CH 223	General Chemistry III	
CH 226H	Honors General Chemistry	
PHYS 203	General Physics	
PHYS 253	Foundations of Physics I	
MATH 246–247	Calculus for the Biological Sciences I-II	8
or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 331	Mineralogy	5
GEOL 332	Introduction to Petrology	5
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350 & GEOL 351 & GEOL 352	Structural Geology and Structural Geology Problems and Structural Geology Laboratory and Field	5
GEOL 406	Field Studies: [Topic]	12
Electives		
See Electives table for choices		20
Total Credits		**106**

[1] The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Biology		
Courses numbered 306 or higher		
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 331	Organic Chemistry I	4
CH 335	Organic Chemistry II	4
CH 336	Organic Chemistry III	4
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4
GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 485–486	Remote Sensing I-II	8
GEOG 491	Advanced Geographic Information Systems	4
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 410	Experimental Course: [Topic]	5
GEOL 407	Seminar: [Topic] (Current Topics in Geology) [1]	3
Courses higher than 410 [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420	Ordinary Differential Equations	4
MATH 421–422	Partial Differential Equations: Fourier Analysis I-II	8
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 203	General Physics	4
or PHYS 253	Foundations of Physics I	
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12

[1] Pass/no pass

[2] May include one course numbered 304–310.

Bachelor of Arts: Geophysics Track

Code	Title	Credits
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
CH 221–222	General Chemistry	8
or CH 224H–225H	Honors General Chemistry	
MATH 251–253	Calculus I-III	12
PHYS 251–253	Foundations of Physics I	12
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 311	Earth Materials	5-10
or GEOL 331 & GEOL 332	Mineralogy and Introduction to Petrology	
GEOL 455	Mechanical Earth	4
MATH 281–282 & MATH 256	Several-Variable Calculus I-II and Introduction to Differential Equations	12
PHYS 351–353	Foundations of Physics II	12
or PHYS 411–413	Mechanics, Electricity, and Magnetism	
Electives		
See Electives table for choices		16
Total Credits		**104-109**

[1] The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 411	Physical Chemistry	4
Earth Sciences		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350	Structural Geology	3
GEOL 351	Structural Geology Problems	1
GEOL 352	Structural Geology Laboratory and Field	1
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 407	Seminar: [Topic] (Current Topics in Geology) [1]	1-5
Courses numbered 408 or higher		
Mathematics		
MATH 341–342 or MATH 421–422	Elementary Linear Algebra Partial Differential Equations: Fourier Analysis I-II	8

[1] Pass/no pass

Bachelor of Science: Geophysics Track

Code	Title	Credits
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
CH 221–222	General Chemistry	8
or CH 224H–225H	Honors General Chemistry	
MATH 251–253	Calculus I-III	12
PHYS 251–253	Foundations of Physics I	12
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 311	Earth Materials	5-10
or GEOL 331 & GEOL 332	Mineralogy and Introduction to Petrology	
GEOL 455	Mechanical Earth	4
MATH 281–282 & MATH 256	Several-Variable Calculus I-II and Introduction to Differential Equations	12
PHYS 351–353	Foundations of Physics II	12
or PHYS 411–413	Mechanics, Electricity, and Magnetism	
Electives		
See Electives table for choices		16
Total Credits		**104-109**

[1] The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 411	Physical Chemistry	4
Earth Sciences		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350	Structural Geology	3
GEOL 351	Structural Geology Problems	1
GEOL 352	Structural Geology Laboratory and Field	1
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21

GEOL 403	Thesis	1-6
GEOL 407	Seminar: [Topic] (Current Topics in Geology) [1]	1-5
Courses numbered 408 or higher		
Mathematics		
MATH 341–342	Elementary Linear Algebra	8
or MATH 421–422	Partial Differential Equations: Fourier Analysis I-II	

[1] Pass/no pass

Bachelor of Arts: Environmental Geoscience Track

Code	Title	Credits
Core Courses		
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201	General Physics	4
or PHYS 251	Foundations of Physics I	
PHYS 202	General Physics	4
or PHYS 252	Foundations of Physics I	
or BI 211	General Biology I: Cells	
Select one of the following:		4
PHYS 203	General Physics	
BI 212	General Biology II: Organisms	
BI 213	General Biology III: Populations	
CH 223	General Chemistry III	
CH 226H	Honors General Chemistry	
PHYS 253	Foundations of Physics I	
CH 221–222	General Chemistry	8
or CH 224H–225H	Honors General Chemistry	
MATH 246–247	Calculus for the Biological Sciences I-II	8
or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
Select two of the following:		10
GEOL 311	Earth Materials	
GEOL 331	Mineralogy	
GEOL 332	Introduction to Petrology	
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 310	Earth Resources and the Environment	4
GEOG 323	Biogeography	4
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 353	Geologic Hazards	4
BI 370	Ecology	4
or GEOL 451	Hydrogeology	
Electives		
See Electives table for choices		24
Total Credits		**109**

Electives

Code	Title	Credits
Biology		
BI 212	General Biology II: Organisms	4
BI 213	General Biology III: Populations	4
Courses numbered 306 or higher		
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4
GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 485–486	Remote Sensing I-II	8
GEOG 491	Advanced Geographic Information Systems	4
GEOG 493	Advanced Cartography	4
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350	Structural Geology	3
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21

GEOL 403	Thesis	1-6
GEOL 406	Field Studies: [Topic]	1-6
GEOL 410	Experimental Course: [Topic]	5
Courses numbered 411 and higher [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420	Ordinary Differential Equations	4
MATH 421–422	Partial Differential Equations: Fourier Analysis I-II	8
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 203	General Physics	4
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 253	Foundations of Physics I	4
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12
Engineering		
Oregon State University engineering courses, by permission of a departmental advisor		

1 The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

2 May include courses numbered 304-310.

Bachelor of Science: Environmental Geoscience Track

Code	Title	Credits
Core Courses		
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201	General Physics	4
or PHYS 251	Foundations of Physics I	
PHYS 202	General Physics	4
or PHYS 252	Foundations of Physics I	
or BI 211	General Biology I: Cells	
Select one of the following:		4
PHYS 203	General Physics	
BI 212	General Biology II: Organisms	
BI 213	General Biology III: Populations	
CH 223	General Chemistry III	
CH 226H	Honors General Chemistry	
PHYS 253	Foundations of Physics I	
CH 221–222	General Chemistry	8
or CH 224H–225H	Honors General Chemistry	
MATH 246–247	Calculus for the Biological Sciences I-II	8
or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
Select two of the following:		10
GEOL 311	Earth Materials	
GEOL 331	Mineralogy	
GEOL 332	Introduction to Petrology	
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 310	Earth Resources and the Environment	4
GEOG 323	Biogeography	4
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 353	Geologic Hazards	4
BI 370	Ecology	4
or GEOL 451	Hydrogeology	
Electives		
See Electives table for choices		24
Total Credits		**109**

Electives

Code	Title	Credits
Biology		
BI 212	General Biology II: Organisms	4
BI 213	General Biology III: Populations	4
Courses numbered 306 or higher		
Chemistry		
CH 223	General Chemistry III	4
CH 226H	Honors General Chemistry	4
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4

GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 485–486	Remote Sensing I-II	8
GEOG 491	Advanced Geographic Information Systems	4
GEOG 493	Advanced Cartography	4
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350	Structural Geology	3
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 406	Field Studies: [Topic]	1-6
GEOL 410	Experimental Course: [Topic]	5
Courses numbered 411 and higher [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420	Ordinary Differential Equations	4
MATH 421–422	Partial Differential Equations: Fourier Analysis I-II	8
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 203	General Physics	4
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 253	Foundations of Physics I	4
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12
Engineering		
Oregon State University engineering courses, by permission of a departmental advisor		

1 The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

2 May include courses numbered 304-310.

Bachelor of Arts: Paleontology Track

Code	Title	Credits
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201	General Physics	4
or PHYS 251	Foundations of Physics I	
Select one of the following:		8
BI 211–213	General Biology I-III	
PHYS 202–203	General Physics	
PHYS 252–253	Foundations of Physics I	
CH 221–223	General Chemistry	12
or CH 224H–226H	Honors General Chemistry	
MATH 246–247	Calculus for the Biological Sciences I-II	8
or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
GEOL 311	Earth Materials	5-10
or GEOL 331 & GEOL 332	Mineralogy and Introduction to Petrology	
GEOL 315	Earth Physics	4
or GEOL 316	Introduction to Hydrogeology	
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350 & GEOL 351 & GEOL 352	Structural Geology and Structural Geology Problems and Structural Geology Laboratory and Field	5
GEOL 406	Field Studies: [Topic]	12
Select two of the following:		8
GEOL 431	Paleontology I: Paleozoic Marine Fossils	
GEOL 433	Paleobotany	
GEOL 434	Vertebrate Paleontology	
GEOL 435	Paleopedology	
Electives		
See Electives table for choices		16
Total Credits		**105-110**

1 The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Anthropology		
ANTH 361	Human Evolution	4
ANTH 366	Human Osteology Laboratory	4

ANTH 466	Primate Feeding and Nutrition	4
ANTH 468	Evolutionary Theory	4
ANTH 471	Zooarchaeology: [Topic]	4
Biology		
Courses numbered 306 or higher		
Chemistry		
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 223	General Chemistry III	4
CH 331,335–336	Organic Chemistry I-III	12
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4
GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 410	Experimental Course: [Topic]	5
GEOL 407	Seminar: [Topic] [1]	3
Courses higher than 410 [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420 & MATH 421	Ordinary Differential Equations and	4
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12

1 Pass/no pass

2 May include one course numbered 304–310.

Bachelor of Science: Paleontology Track

Code	Title	Credits
GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History [1]	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
PHYS 201	General Physics	4
or PHYS 251	Foundations of Physics I	
Select one of the following:		8
BI 211–213	General Biology I-III	
PHYS 202–203	General Physics	
PHYS 252–253	Foundations of Physics I	
CH 221–223	General Chemistry	12
or CH 224H–226H	Honors General Chemistry	
MATH 246–247	Calculus for the Biological Sciences I-II	8
or MATH 251–252	Calculus I-II	
Select one of the following:		4
MATH 253	Calculus III	
MATH 343	Statistical Models and Methods	
MATH 425	Statistical Methods I	
GEOL 418	Earth and Environmental Data Analysis	
PHYS 481	Design of Experiments	
GEOL 311	Earth Materials	5-10
or GEOL 331 & GEOL 332	Mineralogy and Introduction to Petrology	
GEOL 315	Earth Physics	4
or GEOL 316	Introduction to Hydrogeology	
GEOL 318	Introduction to Field Methods	3
Additional Requirements		
GEOL 334	Sedimentology and Stratigraphy	4
GEOL 350 & GEOL 351 & GEOL 352	Structural Geology and Structural Geology Problems and Structural Geology Laboratory and Field	5
GEOL 406	Field Studies: [Topic]	12
Select two of the following:		8
GEOL 431	Paleontology I: Paleozoic Marine Fossils	
GEOL 433	Paleobotany	
GEOL 434	Vertebrate Paleontology	
GEOL 435	Paleopedology	

Electives	
See Electives table for choices	16
Total Credits	**105-110**

[1] The 200-level sequence is recommended for majors; however, the 100-level sequence may be substituted if the courses are passed with grades of mid-B or better.

Electives

Code	Title	Credits
Anthropology		
ANTH 361	Human Evolution	4
ANTH 366	Human Osteology Laboratory	4
ANTH 466	Primate Feeding and Nutrition	4
ANTH 468	Evolutionary Theory	4
ANTH 471	Zooarchaeology: [Topic]	4
Biology		
Courses numbered 306 or higher		
Chemistry		
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 223	General Chemistry III	4
CH 331,335–336	Organic Chemistry I-III	12
CH 411–413	Physical Chemistry	12
CH 431–433	Inorganic Chemistry	12
CH 444	Chemical Thermodynamics	4
CH 445	Statistical Mechanics	4
Computer and Information Science		
CIS 122	Introduction to Programming and Problem Solving	4
CIS 210–212	Computer Science I-III	12
CIS 315	Intermediate Algorithms	4
Geography		
GEOG 181	Our Digital Earth	4
GEOG 321	Climatology	4
GEOG 322	Geomorphology	4
GEOG 323	Biogeography	4
GEOG 360	Watershed Science and Policy	4
GEOG 361	Global Environmental Change	4
GEOG 421	Advanced Climatology: [Topic]	4
GEOG 423	Advanced Biogeography: [Topic]	4
GEOG 425	Hydrology and Water Resources	4
GEOG 427	Fluvial Geomorphology	4
GEOG 430	Long-Term Environmental Change	4
GEOG 481–482	GIScience I-II	8
GEOG 495	Geographic Data Analysis	4
Earth Sciences		
GEOL 315	Earth Physics	4
GEOL 316	Introduction to Hydrogeology	4
GEOL 353	Geologic Hazards	4
GEOL 363	MATLAB for Earth Scientists	2
GEOL 401	Research: [Topic]	1-21
GEOL 403	Thesis	1-6
GEOL 410	Experimental Course: [Topic]	5
GEOL 407	Seminar: [Topic] [1]	3
Courses higher than 410 [2]		
Mathematics		
MATH 256	Introduction to Differential Equations	4
MATH 281–282	Several-Variable Calculus I-II	8
MATH 341–342	Elementary Linear Algebra	8
MATH 411–412	Functions of a Complex Variable I-II	8
MATH 420 & MATH 421	Ordinary Differential Equations and	4
MATH 425–426	Statistical Methods I-II	8
Physics		
PHYS 204–206	Introductory Physics Laboratory	6
PHYS 290	Foundations of Physics Laboratory	1
PHYS 351–353	Foundations of Physics II	12
PHYS 411–413	Mechanics, Electricity, and Magnetism	12

[1] Pass/no pass

[2] May include one course numbered 304–310.

Honors in Earth Sciences

Application for graduation with honors in earth sciences must be made no later than spring term of the student's junior year. To be eligible for graduation with honors, a student must

- maintain a grade point average (GPA) of 3.50 or better in geological sciences courses or a 3.00 or better in all science courses
- submit and orally present an acceptable honors thesis written under the supervision of a department faculty member and evaluated by a committee consisting of three faculty members including the supervisor. The thesis should be presented no later than three weeks before final examinations during the term the student plans to graduate

Honors students may register for 3 credits of Research: [Topic] (GEOL 401) the term before they intend to graduate, and 3 credits of Thesis (GEOL 403) the term of graduation. These credits may be applied toward electives.

Minor Requirements

GEOL 101 & GEOL 102 & GEOL 103	Earth's Dynamic Interior and Environmental Geology and Landform Development and Earth History	12
or GEOL 201 & GEOL 202 & GEOL 203	Earth's Interior Heat and Dynamics and Earth Surface and Environmental Geology and Evolution of the Earth	
Choose from the following courses: [1]		15
GEOL 213	Geology of National Parks	
GEOL 300-499-499		
Total Credits		**27**

[1] 15 credits of earth sciences courses (exclusive of independent study courses) must be earned with course numbers greater than GEOL 299 (GEOL 213 is acceptable, however). No more than 8 credits may be applied to the minor from the following list: Geology of National Parks (GEOL 213), The Fossil Record (GEOL 304), Dinosaurs (GEOL 305), Volcanoes and Earthquakes (GEOL 306), Oceanography (GEOL 307), Geology of Oregon and the Pacific Northwest (GEOL 308), Earth Resources and the Environment (GEOL 310).

Undergraduate minors must take all required courses for letter grades and complete them with grades of C– or better.

Group Requirements

Fourteen earth sciences courses satisfy university science group requirements. See the Group Requirements section of this catalog under **Registration and Academic Policies.**

Kindergarten through Secondary Teaching Careers

Students who complete a degree with a major in earth sciences are eligible to apply to the College of Education's fifth-year licensure program in middle-secondary teaching or the fifth-year licensure program in elementary teaching. More information is available in the College of Education (http://catalog.uoregon.edu/archive/2017-2018/education) section of this catalog.

Four-Year Degree Plan

The degree plan shown is only a sample of how students may complete their degrees in four years. There are alternative ways. Students should consult their advisor to determine the best path for them.

- **Geology Track** (p.)
- **Geophysics Track** (p.)
- **Environmental Geoscience Track** (p.)
- **Paleontology Track** (p.)

Bachelor of Arts in Earth Sciences: Geology Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Science in Earth Sciences: Geology Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**

Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Arts in Earth Sciences: Geophysics Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**

Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Science in Earth Sciences: Geophysics Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Arts in Earth Sciences: Environmental Geoscience Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**

Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Science in Earth Sciences: Environmental Geoscience Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Arts in Earth Sciences: Paleontology Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**

Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Bachelor of Science in Earth Sciences: Paleontology Track

Course	Title	Credits Milestones
First Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Second Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Third Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Placeholder		
	Credits	**0**
Winter		
Placeholder		
	Credits	**0**
Spring		
Placeholder		
	Credits	**0**
	Total Credits	**0**

Graduate Studies

The Department of Earth Sciences offers programs of graduate study leading to master of science (MS), master of arts (MA), and doctor of philosophy (PhD) degrees with opportunity for research in a wide variety of specialty fields. Course work is designed to meet individual needs, and students may pursue independent research in geobiology, geochemistry, geodesy, geomechanics, geomorphology, geophysics, mineralogy, petrology, volcanology, paleontology, stratigraphy, sedimentary petrology, structural geology, and ore deposit geology. The master's degree program requires two years or more for completion.

Admission to the graduate program is competitive and based on academic records, scores on the Graduate Record Examinations (GRE), and letters of recommendation. Nonnative speakers of English must also submit scores for the Test of English as a Foreign Language (TOEFL) and the Test of Spoken English (TSE). Applications are welcome from students who are interested in using their background in related fields, such as physics, chemistry, and biology, to solve geologic or geophysical problems.

Graduate students are advised by a guidance committee consisting of three faculty members. This committee meets with each student shortly after he or she arrives on campus and as often thereafter as necessary for planning purposes.

Requirements

Basic university requirements for graduate degrees are described in the Graduate School (http://catalog.uoregon.edu/archive/2017-2018/graduate) section of this catalog. The department sets additional examination, course work, seminar, and thesis requirements. Applicants should read the *Guide to Graduate Study* on the department website (http://earthsciences.uoregon.edu/graduate-program) or write to the Department of Earth Sciences for details.

Programs

Graduate study in earth sciences is offered in five broad areas:

1. volcanology-petrology-geochemistry
2. stratigraphy–surface processes
3. paleontology-paleopedology-geobiology
4. structural geology–geophysics
5. economic geology (mineral deposits)

Volcanology-Petrology-Geochemistry

The department has excellent analytical and other research facilities for studies in these subdisciplines, and the volcanic and metamorphic terrane of the Northwest offers unsurpassed opportunities for field studies. Active research programs are diverse and include studies of eruption dynamics, magma volatile inventories, and magma rheology; experimental studies of igneous phase equilibria and trace element partitioning; calculations of multicomponent equilibria in aqueous systems and volcanic gases; and studies of igneous protogenesis.

Stratigraphy–Surface Processes

The stratigraphic record of tectonically active sedimentary basins indicates the dynamic interactions among basin subsidence, sediment input from eroding sources, evolution of depositional systems, and active faulting and folding that govern these processes. Research in this area combines field-based stratigraphic, sedimentologic, and geomorphic analysis with provenance studies and concepts derived from theoretical models to decipher the complex structural and climatic controls on the filling histories of active basins.

Surface processes regulate how tectonics and climate affect landscape evolution. Field observations, numerical simulations, topographic analyses, and experimental facilities are used to study sediment transport processes over a range of spatial and temporal scales. Projects incorporate links between active tectonics and structural geology, biology, geomechanics, and surface processes to address problems such as landsliding and hill-slope evolution, biological contributions to soil creep and landscape lowering, and the geomorphic implications of seismic-induced landsliding.

Paleontology-Paleopedology-Geobiology

Studies of fossil soils, plants, and vertebrates aim to reconstruct life on land and its role in global change. Global changes of interest include Neogene paleoclimate and paleoenvironment of ape and human evolution in East Africa, environmental effects of terminal Cretaceous impact and dinosaur extinction in Montana, consequences of mass extinction and methane clathrate degassing at the Permian-Triassic boundary, and the effect of early land plants and forests on weathering and atmospheric composition during the early Paleozoic.

Geobiology focuses on the interaction of microorganisms with the geologic environment and the ways life forms affect geological processes, such as weathering and mineralization.

Structural Geology–Geophysics

Graduate work in the structural geology–geophysics area involves the study of the earth's dynamic processes.

Seismic imaging techniques using regional arrays provide tools for understanding regional tectonics. Studies of upper-mantle and lithospheric structure beneath the Rocky Mountains and in the Pacific Northwest subduction zone are providing essential constraints, unavailable from surface geology, for detailed dynamical models of plate-lithospheric deformation.

Structural geology focuses on applying modern field and analytical techniques to solving problems in Cenozoic tectonics and active faulting. Detailed field mapping, trench logging, and geomorphic analysis are combined with seismic array data, land- and space-based geodetic data, and theoretical modeling to address problems including Oregon's Basin and Range province and coastal deformation, active tectonics of the San Andreas Fault system, and seismic risk along the Pacific margin of the United States and southeast and central Asia.

Geophysical experiments conducted at sea investigate the nature of sea-floor spreading including the segregation, transport, and storage of melt; the rifting of oceanic lithosphere; and the spatial and temporal connectivity between magmatic, tectonic, and hydrothermal processes.

Mineral Deposits

Current research on ore deposits includes studies of porphyry copper deposits, epithermal veins, and active geothermal systems. These projects combine field mapping, petrography, and chemical analyses with theoretical chemical modeling of processes of ore fluid generation, alteration, and mineralization.

Related Research Activities

The Condon Collection of Fossils at the Museum of Natural and Cultural History maintains strong ties to the Department of Earth Sciences. Two geology professors are curators of the collection, and paleontology undergraduate and graduate students are often employed as assistants. The Condon Collection contains 60,000 specimens, including invertebrate and vertebrate fossils, paleobotanical remains, and an extensive collection of modern animals that are available to interested researchers for study.

Research Facilities

Students may use a variety of analytical facilities and equipment including a three-component broadband (0.03–50Hz) seismic array, an electron microprobe, a scanning electron microscope with image analysis, x-ray diffraction, FTIR spectroscopy, stable isotope mass spectroscopy, and a geobiology laboratory.

An experimental petrology laboratory covers a range of crustal temperatures and pressures and includes equipment for doing experiments in controlled atmospheres. Two piston-cylinder apparatus with pressure-temperature capability to 35 kilobars and 1,500° C may be used to study crystalline, partially molten, and molten silicates under mantlelike conditions.

Computers are used for much of the research in the department including acquisition and processing of seismic and gravity data and numerical modeling of geophysical processes and geochemical reactions. A geochemistry laboratory is equipped with sophisticated computer programs for thermodynamic calculations of gas-liquid-solid equilibria and reaction processes important in metamorphic, volcanic gas, hydrothermal, and diagenetic systems. The Internet can be accessed through the UONet fiber-optic link. A student computer facility, equipped with PC and Macintosh computers and laser printers, is also connected to the networks.

The sedimentological and paleontological laboratories have, in addition to standard laboratory equipment, an electronic particle-size analyzer, an x-radiography unit, photomicroscopes, a Leitz Aristophot unit, a

fully maintained catalog of foraminifera, an acid room, and a conodont-processing laboratory.

Financial Aid for Graduate Students

Most of the department's graduate students are fully supported through teaching and research assistantships. More information about financial assistance and department policies for awarding and renewing teaching and research fellowships may be obtained by reading the *Guide to Graduate Study* on the department website (http://earthsciences.uoregon.edu/graduate-program) or by writing to the department.