

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

Jonathan Lees Professor

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February 24, 2017

Nick Siedentop Curriculum Director for Undergraduate Curricula Office of Undergraduate Education CB #3504, 3010 Steele Building, 214 E. Cameron Avenue Chapel Hill, North Carolina 27599

Dear Nick,

Earth scientists investigate diverse earth systems, from the surface to the core, and everything in between. Our current curriculum was developed over ten years ago and was created to accommodate the diversity in earth science careers that our majors pursued, both professionally and in graduate school. To do this we created separate B.S. tracks in Earth Science, Environmental Geology, Geophysics, Geochemistry, and Paleobiology. This multitrack system served its purpose but over the years some of the tracks (specifically Environmental Geology and Paleobiology) have become problematic because students have been having trouble satisfying their complicated requirements. The biggest problem has been that many of the required courses for these tracks are no longer being taught regularly. The existing Geophysics and Geochemistry tracks have simpler requirements but have suffered from similar problems.

Our aim with the proposed curriculum is to provide an opportunity for students to complete a rigorous BS degree with requirements that are not so logistically problematic. We do this by shrinking the number of BS tracks from five to two; and by increasing the number of courses that they may use to satisfy their core geology requirements. For the two remaining tracks (Earth Science and Environmental Geoscience) the core requirements are mostly 300-level and 400-level GEOL courses. The BS Earth Science track includes geochemistry and geophysics course that would allow a student to essentially concentrate in either of those subspecialties. The BS Environmental Geoscience now includes a diverse set of course options from both GEOL as well as ENEC that will provide a sound preparation for a student wishing to pursue Environmental Geology.

Some highlights of the new curriculum are:

• Every BS student will now take a two-semester "core" sequence consisting of GEOL 200 and 201. These courses will provide a rigorous introduction to both the Solid Earth (200) and the Earth's Surface (201).

- Total credit hour requirements are similar to previous BS degrees.
- Every BS student and BA student will complete a 6-credit-hour capstone experience.

In addition to the revised BS curricula, we have also slightly modified the BA and the Minor. These changes bring these degree requirements into alignment with our current course offerings.

Sincerely,

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JONATHAN M. LEES PROFESSOR AND DEPARTMENT CHAIR THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Department of Geological Sciences <u>NOTE: We have</u> requested new numbers for many of our existing classes. Old numbers are in parentheses.

• Use this document to submit curriculum changes for the 2017-2018 academic year.

Geological Sciences Major, B.A.–Earth Systems Science Concentration

Core Requirements

• GEOL <u>202-200</u> and <u>301201</u>

• A minimum of 11 credits from the following <u>GEOL</u> courses: <u>GEOL first year seminar, 204202</u>, <u>211, 213215, 221, 324/324L, 302 (401), 303 (402), 304 (404)</u>

401, 402, and 404

• One of the following field-oriented courses: ANTH 451; BIOL 459; GEOL 395 (six credits over two semesters with a preapproved field component), 396 (six credits over two semesters with a preapproved field component), 413, 601, 602; or MASC 472

Additional Requirements

• One of the following courses: GEOL 101/101L, 103/101L, 105/101L, 109/101L, 110/101L, or 159/101L (only one of GEOL 101, 105, 109, and 110 may be taken for course credit)

- CHEM 101/101L
- MATH 130

• At least three geology and/or allied science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, and 414; any ASTR; any BIOC except 107 and 108; BIOL 101/101L or any BIOL above 113; any CHEM above 101; any COMP except 50, 70, and 380; ECON 101 and 454; ENEC 489 and 490; any ENVR except 600; GEOG 370, 410, 412, 414, 416, 440, 441, 444, any GEOG above 477; any GEOL-except 101, 105, 109, and 110; any MASC above 101; any MATH above 130; any PHYS except 101, 132, and 313; any STOR 155 or above

<u>Capstone, one of the following 6-credit combinations:</u>

GEOL 4985 (601)/4986 (602)

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GEOL 691H/692H

GEOL 395 (6 credits total of independent research)

Science-oriented Experiential Education (EE) courses (6 credits total). Must be pre-approved by the Departmental Director of Undergraduate Studies

Students also must satisfy all General Education requirements.

Geological Sciences Major, B.S.–Earth Science Concentration

Core Requirements

• All of the following courses: GEOL 301, 401, 402, 404, 601, and 602200 and 201

• 13 credit hours from the following options:

GEOL 202, 302 (401), 303(402), 304(404), 405(512), 406(515), 417+417L,

• Four geology courses numbered above <u>400-300</u> and not otherwise required for the major (GEOL 395 and 396 count if taken for two or three credit hours)

Additional Requirements

• One of the following courses: GEOL 101/101L, 103/101L, 105/101L, 109/101L, or 110/101L (only one of GEOL 101, 105, 109, and 110 may be taken for course credit)

• CHEM 101/101L and 102/102L

• MATH 231 and 232, and one of the following: any COMP 110 or above, except 380; GEOL 520 (this course may also be used to satisfy one of the required GEOL courses numbered above 400300); any MATH above 232; any STOR 155 or above

• One of the following courses: PHYS 104-or, 114-or, 116-or, 118

• One of the following courses: BIOL 101/101L; any CHEM above 102; PHYS 105-or, 115-or, 117, or 119

• At least five science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, 414, and 451; any ASTR except a first-year seminar; any BIOC except a first-year seminar, 107, and 108; any BIOL above 113; any CHEM above 102; any COMP_ 110 or above, except 380; any ENVR-ENEC above 201 except a first-year seminar and 600; GEOG 370, 410, 412, 414, 416, 477, 491, 577, 591, 592, 594, 597, and any GEOG above 477; any GEOL except 101, 105, 109, 110; any MASC_ 101 and above; any MATH above 232; any PHYS except a first-year seminar, 101, 132, and 313; any STOR_ 155 and above

Capstone, one of the following 6-credit combinations:

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GEOL 4985 (601)/4986 (602)

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GEOL 691H/692H

GEOL 395 (6 credits total of independent research)

<u>Science-oriented Experiential Education (EE) courses (6 credits total). Must be pre-approved by</u> <u>the Departmental Director of Undergraduate Studies</u>

Geological Sciences Major, B.S.–Environmental Geology Geoscience Concentration

Core Requirements

• All of the following courses: GEOL 301, 401, 402, and 404200, 201, 324/324L

• 13 credit hours from the following options:

<u>GEOL 202, 302 (401), 303(402), 304(404), 310, 405(512), 417+417L</u>, 409435(509), -436(510), 432, ENEC 203417+417L,

• Four Three geology courses numbered above 300 and not otherwise required for the major

• ANTH 451; or BIOL 459; or CHEM 481/481L and 482/482L; or GEOL 430 and 434; or GEOL 601 and 602; or GEOL 691H and 692H (with a field component previously approved by the department); or MASC 472; or PHYS 201 and 211

Additional Requirements

• One of the following courses: GEOL 101/101L, 103/101L, 105/101L, 109/101L, or 110/101L (only one of GEOL 101, 105, 109, and 110 may be taken for course credit)

• CHEM 101/101L and 102/102L

• MATH 231 and 232, and one of the following: any COMP 110 or above, except 380; GEOL 520 (this course may also be used to satisfy one of the required GEOL courses numbered above 300); any MATH above 232; any STOR 155 or above

• One of the following courses: PHYS 104, 114, 116, 118

• One of the following courses: BIOL 101/101L; any CHEM above 102; PHYS 105, 115, 117, or 119

• At least five science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, 414, and 451; any ASTR except a first-year seminar; any BIOC except a first-year seminar, 107, and 108; any BIOL above 113; any CHEM above 102; any COMP, 110 or above, except 380; any ENEC above 201; GEOG 370, 410, 412, 414, 416, 477, 491, 577, 591, 592, 594, 597; any GEOL; any MASC, 101 and above; any MATH above 232; any PHYS except a first-year seminar, 101, 132, and 313; any STOR, 155 and above

Capstone, one of the following 6-credit combinations:

GEOL 485 (601)/486 (602)

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GEOL 691H/692H

GEOL 395 (6 credits total of independent research)

Science-oriented Experiential Education (EE) courses (6 credits total). Must be pre-approved by the Departmental Director of Undergraduate Studies

• CHEM 101/101L and 102/102L

• MATH 231 and 232

• One of the following courses: any COMP 110 or above, except 380; GEOL 520 (note that this course may also be used to satisfy one of the required GEOL courses numbered 400 and higher); any MATH above 232; any STOR 155 and above

• One of the following sets of PHYS courses: PHYS 104 and 105, or 114 and 115, or 116 and 117, or 118 and 119

 One of the following combinations: BIOL 201 and ENEC 489, or ENEC 490 and GEOG 253, or GEOL 411 and MASC 470

• At least five science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, 414, 451; any ASTR except a first year seminar; any BIOC except a first year seminar, 107, and 108; BIOL 101, any BIOL above 113; any CHEM above 102; any COMP except 50, 70, and 380; any ENVR except a first year seminar and 600; GEOG 370, 410, 412, 414, 416, and any GEOG above 477; any GEOL except 101, 105, 109, 110; any MASC 101 and above; any MATH above 232; any PHYS except a first year seminar, 101, 132, and 313; any STOR 155 and above

Geological Sciences Major, B.S.-Geochemistry Concentration

The departmental requirements for the concentration in geochemistry are identical to those for earth science except that CHEM 481 and 482 substitute for GEOL 601 and 602.

Geological Sciences Major, B.S.-Geophysics Concentration

Core Requirements

• All of the following courses: GEOL 301, 401, 404, and 515

• Four GEOL courses numbered above 400, not otherwise required for the major

Additional Requirements

• One of the following courses: GEOL 101/101L, 103/101L, 105/101L, 109/101L, 110/101L (only one of GEOL 101, 105, 109, and 110 may be taken for course credit)

• CHEM 101/101L and 102/102L

- MATH 231, 232, 233, and 383
- PHYS 116 or 118, 117 or 119, 201, 211, and 331

• At least three geology and/or science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, 414, 451; any ASTR except a first year seminar; any BIOC except a first year seminar, 107, and 108; BIOL 101, any BIOL above 113; any CHEM above 102; any COMP except 50, 70, and 380; any ENVR except a first year seminar and 600; GEOG 370, 410, 412, 414, 416, any GEOG above 477; any GEOL except 101, 105, 109, 110; any MASC 101 and above; any MATH above 232; any PHYS except a first year seminar, 101, 132, and 313; any STOR 155 and above

Geological Sciences Major, B.S. Paleobiology Concentration

Core Requirements

• All of the following courses: GEOL 159/101L, 301, 401, 402, 413, and 478

• One of the following courses: GEOL 395 (for four credits), or 396 (for four credits), or 434, or 691H and 692H with approved field component, or another approved field-oriented experience in biology or paleobiology

• Three geology courses numbered above 400 not otherwise required for the major (GEOL 395 for two or three hours credit, 396 for two or three hours credit, 431, 501, 555, and GEOL 691H and 692H are specifically recommended)

Additional Requirements

• One of the following courses: GEOL 101/101L, 103/101L, 105/101L, 109/101L, or 110/101L (only one of GEOL 101, 105, 109, and 110 may be taken for course credit)

• BIOL 101/101L

• CHEM 101/101L and 102/102L

• MATH 231 and 232

• One of the following courses: any COMP except 50, 70, and 380; GEOL 520 (note that this course may also be used to satisfy one of the required GEOL courses numbered above 400); any MATH above 232; any STOR 155 and above

• PHYS 104 or 114 or 116 or 118

• At least three geology and/or science electives not otherwise required for the major, including ANTH 143, 220, 315, 317, 412, 414, 451; any ASTR except a first year seminar; any BIOC except a first year seminar, 107, and 108; any BIOL above 113; any CHEM above 102; any COMP except 50, 70, and 380; any ENVR except a first year seminar and 600; GEOG 370, 410, 412, 414, 416, any GEOG above 477; any GEOL except 101, 105, 109, 110; any MASC 101 and above; any MATH above 232; any PHYS except a first year seminar, 101, 132, and 313; any STOR 155 and above; any course in vertebrate paleontology from North Carolina State University; any systematics course from the Department of Biology at Duke University.

Paleobiology students are encouraged but not required to take as electives a course in systematics in the Department of Biology at Duke University and a course in vertebrate paleontology at North Carolina State University. Interinstitutional enrollment is possible through a UNC–Chapel Hill/Duke/North Carolina State agreement.

Geological Sciences Minor

Students majoring in another department may elect to pursue completion of a minor in geology. The undergraduate minor in geology consists of the following four courses (minimum of 12 semester hours).

• One of the following<u>Any</u> introductory <u>GEOL</u> courses: <u>GEOL</u> 101, 103, 105, 109, 110, or 159 * (only one of <u>GEOL</u> 101, 105, 109, and 110 may be taken for course credit)

and a aAt least three geology GEOL courses numbered 2002 or higher. above GEOL 110

Per Kevin Stewart (2/27/2017), the requirement should read "any GEOL course numbered below 200" This includes first-year seminar.

GEOLOGICAL SCIENCES MAJOR, B.A.-EARTH SYSTEMS CONCENTRATION

Contact Information

Department of Geological Sciences http://www.geosci.unc.edu 104 South Road, Mitchell Hall, CB# 3315 (919) 966-4516

Jonathan Lees, Chair

Kevin Stewart, Director of Undergraduate Studies kgstewar@email.unc.edu

Deborah Harris, Student Services Manager

djharris@email.unc.edu

The study of earth's dynamic systems is a field that has seen major advances over the last few decades. Geologists investigate diverse systems that play a large role in controlling the environment at the earth's surface.

Department Programs

Majors

- Geological Sciences Major, B.A.-Earth Science (p. 1)
- Geological Sciences Major, B.S. Earth Science (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-bs-earth-science-concentration)
- Geological Sciences Major, B.S. Environmental Geoscience (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-bs-environmental-geology-concentration)

Minor

 Geological Sciences Minor (http://catalog.unc.edu/undergraduate/ programs-study/geological-sciences-minor)

Graduate Programs

- M.S. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)
- Ph.D. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)

Requirements

In addition to the program requirements listed below, students must

- attain a final cumulative GPA of at least 2.0
- complete a minimum of 45 academic credit hours earned from UNC-Chapel Hill courses
- take at least half of their major course requirements (courses and credit hours) at UNC-Chapel Hill
- earn a minimum of 18 hours of C or better in the major core requirements (some majors require 21 hours).

For more information, please consult the degree requirements section of the catalog (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements/#degreerequirementstext).

Core Requirements			
GEOL 200	The Solid Earth	3	
GEOL 201	Earth's Surface: Processes, Landforms, and History	3	
A minimum of 11	credits from the following GEOL courses:	11	
GEOL 202	Earth Systems History		
GEOL 215	Energy Resources		
GEOL 221	Geology of North America		
GEOL 302	Structural Geology		
GEOL 303	Sedimentology and Stratigraphy		
GEOL 304	Petrology and Plate Tectonics		
GEOL 324 & 324L	Water in Our World: Introduction to Hydrologic Science and Environmental Problems and Water in Our World Laboratory		
Capstone require	ment:	6	
GEOL 485 & GEOL 486	Summer Field Course in Geology and Summer Field Course in Geology		
GEOL 691H & GEOL 692H	Honors and Honors		
GEOL 395	Undergraduate Research in Geology ¹		
Science-oriente total). ²	ed Experiential Education (EE) courses (6 credits		
Additional Requir	ements		
CHEM 101 & 101L	General Descriptive Chemistry I and Quantitative Chemistry Laboratory I	4	
MATH 130	Precalculus Mathematics	3	
At least three geo required for the m	logy and/or allied science electives not otherwise najor (see below chart)	9	
Total Hours		39	

¹ 6 credits of independent research

² Must be pre-approved by the Director of Undergraduate Studies.

Geology and/or Allied Science Electives Not Otherwise Required for the Major

ANTH 143	Human Evolution and Adaptation	3
ANTH 220	Principles of Archaeology	3
ANTH 315	Human Genetics and Evolution	3
ANTH 317	Evolutionary Perspectives on Human Adaptation and Behavior	3
ANTH 412	Paleoanthropology	3
ANTH 414	Laboratory Methods: Human Osteology	3
any Astronomy (A	STR)	
any Biochemistry	(BIOC) except BIOC 107 and BIOC 108	
BIOL 101 & 101L	Principles of Biology and Introductory Biology Laboratory ^H	4
or any Biology (Bl	OL) above BIOL 113	
any Chemistry (CH	IEM) above CHEM 101	
any Computer Sci COMP 380	ence (COMP) except COMP 50, COMP 70, and	
ECON 101	Introduction to Economics ^H	3

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ECON 454	Economics of Population	3
ENEC 489	Ecological Processes in Environmental Systems	4
ENEC 490	Special Topics in Environmental Science and Studies ^H	1-12
any Environment	al Health Sciences (ENVR) except ENVR 600	
GEOG 370	Introduction to Geographic Information	3
GEOG 410	Modeling of Environmental Systems	3
GEOG 412	Synoptic Meteorology	3
GEOG 414	Climate Change	3
GEOG 416	Applied Climatology: The Impacts of Climate and Weather on Environmental and Social Systems	3
GEOG 440	Earth Surface Processes	3
GEOG 441	Introduction to Watershed Systems	3
GEOG 444	Landscape Biogeography	3
any Geography (O	GEOG) above GEOG 477	
any Geological So	ciences (GEOL)	
any Marine Scien	ces (MASC) above MASC 101	
any Mathematics	s (MATH) above MATH 130	
any Physics (PHYS) except PHYS 101, PHYS 132, and PHYS 313		
any Statistics and Operations Research (STOR) STOR 155 or above		

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

Students also must satisfy all General Education requirements.

Course descriptions for:

- Astronomy (ASTR) and Physics (PHYS) (http://catalog.unc.edu/ undergraduate/departments/physics-astronomy/#coursestext)
- Biochemistry (BIOC) (http://catalog.unc.edu/undergraduate/ departments/biochemistry-biophysics/#coursestext)
- Biology (BIOL) (http://catalog.unc.edu/undergraduate/departments/ biology/#coursestext)
- Chemistry (CHEM) (http://catalog.unc.edu/undergraduate/ departments/chemistry/#coursestext)
- Computer Science (COMP) (http://catalog.unc.edu/undergraduate/ departments/computer-science/#coursestext)
- Environmental Health Sciences (ENVR) (http://catalog.unc.edu/ undergraduate/departments/environmental-sciences-engineering/ #coursestext)
- Geography (GEOG) (http://catalog.unc.edu/undergraduate/ departments/geography/#coursestext)
- Geological Sciences (GEOL) (http://catalog.unc.edu/undergraduate/ departments/geological-sciences/#coursestext)
- Marine Sciences (MASC) (http://catalog.unc.edu/undergraduate/ departments/marine-sciences/#coursestext)
- Mathematics (MATH) (http://catalog.unc.edu/undergraduate/ departments/mathematics/#coursestext)
- Statistics and Operations Research (STOR) (http://catalog.unc.edu/ undergraduate/departments/statistics-operations-research/ #coursestext)

Special Opportunities in Geological Sciences

Honors in Geological Sciences

The honors program in the Department of Geological Sciences is open to undergraduates with an overall grade point average of 3.3 or better as of the beginning of the fall semester of the senior year. To participate in this program, the student chooses a research topic in consultation with his or her chosen faculty sponsor and conducts the research during the last two semesters in residence. The research project should represent the equivalent time expenditure of six hours of course credit and is taken as GEOL 691H (fall semester) and GEOL 692H (spring semester).

Upon recommendation of the faculty, students may be awarded the degree with honors or highest honors. Highest honors is reserved for students who have distinguished themselves in both coursework and independent research. In order to obtain this distinction the student must maintain a grade point average of 3.60 or higher and complete a research project that is worthy of peer-reviewed publication.

Departmental Involvement

The Department of Geological Sciences encourages the active participation of undergraduates in department research, teaching, and social life. In addition to opportunities for experiential education and teaching internships described below, the department has an active Geology Honor Fraternity and Geology Club and regularly sponsors field excursions, career information sessions, and social events. Dates, times, and locations for all events are posted on the Web site and in the main lobby on the first floor of Mitchell Hall.

Experiential Education

Many geology courses emphasize experiential learning through field and laboratory work. Most degree tracks include a field geology course (GEOL 485 and GEOL 486 or a similar course in another department) that fulfills the experiential education General Education requirement for the College of Arts and Sciences. Additionally, all students are encouraged to contact faculty members about conducting independent research, either as an honors thesis or a senior thesis project.

UNC-BEST

The UNC Baccalaureate Education in Science and Teaching (UNC-BEST) Program is a collaboration between the School of Education and the College of Arts and Sciences and is designed to allow undergraduate science majors interested in teaching high school science the opportunity to earn their science degree and obtain licensure as a North Carolina high school science teacher in four years. The program consists of core education classes (EDUC 516 or EDUC 689 or EDUC 690, EDUC 532, EDUC 615, EDUC 593, and EDUC 601) and a teaching methods class (GEOL 412) that is housed in the Department of Geological Sciences. For more details on admission requirements, application deadlines, and submitting an online application, visit the School of Education Web site (http://soe.unc.edu/academics/uncbest).

Study Abroad

Although the department has no formalized study abroad program, many students participate in a study abroad program, and some receive credit for geology coursework completed abroad. Students interested in a study abroad program should contact the director of undergraduate studies. Students must receive approval from the director of undergraduate studies prior to taking courses abroad for geology credit.

GEOLOGICAL SCIENCES MAJOR, B.S.-EARTH SCIENCE CONCENTRATION

Contact Information

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The study of earth's dynamic systems is a field that has seen major advances over the last few decades. Geologists investigate diverse systems that play a large role in controlling the environment at the earth's surface.

Department Programs

Majors

- Geological Sciences Major, B.A. Earth Science (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-ba-earth-systems-concentration)
- · Geological Sciences Major, B.S.-Earth Science (p. 1)
- Geological Sciences Major, B.S.–Environmental Geoscience (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-bs-environmental-geology-concentration)

Minor

 Geological Sciences Minor (http://catalog.unc.edu/undergraduate/ programs-study/geological-sciences-minor)

Graduate Programs

- M.S. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)
- Ph.D. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)

Requirements

In addition to the program requirements listed below, students must

- attain a final cumulative GPA of at least 2.0
- complete a minimum of 45 academic credit hours earned from UNC-Chapel Hill courses
- take at least half of their major course requirements (courses and credit hours) at UNC-Chapel Hill
- earn a minimum of 18 hours of C or better in the major core requirements (some majors require 21 hours).

For more information, please consult the degree requirements section of the catalog (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements/#degreerequirementstext).

Core Requirement	ts	
GEOL 200	The Solid Earth	3
GEOL 201	Earth's Surface: Processes, Landforms, and History	3
13 credit hours fro	om the following options:	13
GEOL 202	Earth Systems History	
GEOL 302	Structural Geology	
GEOL 303	Sedimentology and Stratigraphy	
GEOL 304	Petrology and Plate Tectonics	
GEOL 405	Geochemistry	
GEOL 406	Introduction to Geophysics	
GEOL 417/417L	Geomorphology	
Four geology cou required for the m	rses numbered above 300 and not otherwise najor	12
Capstone require	ment (one of the following combinations):	6
GEOL 485 & GEOL 486	Summer Field Course in Geology and Summer Field Course in Geology	
GEOL 691H & GEOL 692H	Honors and Honors	
GEOL 395	Undergraduate Research in Geology (6 credits total)	
Science-oriente total) ¹	ed Experiential Education (EE) courses. (6 credits	
Additional Requir	ements	
CHEM 101	General Descriptive Chemistry I	4
&101L	and Quantitative Chemistry Laboratory I	
CHEM 102	General Descriptive Chemistry II	4
& 102L	and Quantitative Chemistry Laboratory II ^H	
MATH 231	Calculus of Functions of One Variable I	3
MATH 232	Calculus of Functions of One Variable II	3
One of the followi	ng:	3
Any COMP 110) or above, except COMP 380	
GEOL 520	Data Analysis in the Earth Sciences ²	
Any MATH abo	ove MATH 232	
Any STOR 155	or above	
One of the followi	ng courses:	4
PHYS 104	General Physics I	
PHYS 114	General Physics I: For Students of the Life Sciences	
PHYS 116	Mechanics ^H	
PHYS 118	Introductory Calculus-based Mechanics and Relativity	
One of the followi	ng courses:	4
BIOL 101 & 101L	Principles of Biology and Introductory Biology Laboratory ^H	
Any CHEM abo	ve CHEM 102	
PHYS 105	General Physics II	
PHYS 115	General Physics II: For Students of the Life Sciences	
PHYS 117	Electromagnetism and Optics ^H	

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PHYS 119	Introductory Calculus-based Electromagnetism
	and Quanta

At least five science electives not otherwise required for the major	
(see chart below)	
Total Hours	77

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

- ¹ Must be pre-approved by the Director of Undergraduate Studies.
- ² This course may also be used to satisfy one of the required GEOL courses numbered above 300

Science Electives Not Otherwise Required for the Major

ANTH 143	Human Evolution and Adaptation	3
ANTH 220	Principles of Archaeology	3
ANTH 315	Human Genetics and Evolution	3
ANTH 317	Evolutionary Perspectives on Human Adaptation and Behavior	3
ANTH 412	Paleoanthropology	3
ANTH 414	Laboratory Methods: Human Osteology	3
ANTH 451	Field School in North American Archaeology ^H	6
any Astronomy (A	STR) except a first-year seminar	
any Biochemistry BIOC 108	(BIOC) except a first-year seminar, BIOC 107 and	
any Biology (BIOL) above BIOL 113	
any Chemistry (Cl	HEM) above CHEM 102	
any Computer Sci	ence (COMP) 110 or above, except COMP 380	
any Environment	and Ecology (ENEC) above 201	
GEOG 370	Introduction to Geographic Information	3
GEOG 410	Modeling of Environmental Systems	3
GEOG 412	Synoptic Meteorology	3
GEOG 414	Climate Change	3
GEOG 416	Applied Climatology: The Impacts of Climate and Weather on Environmental and Social Systems	3
GEOG 477	Introduction to Remote Sensing of the Environment	3
GEOG 491	Introduction to GIS	3
GEOG 577	Advanced Remote Sensing	3
GEOG 591	Applied Issues in Geographic Information Systems	3
GEOG 592	Geographic Information Science Programming	3
GEOG 594	Global Positioning Systems and Applications	3
GEOG 597	Ecological Modeling	3
any Geological Sc	iences (GEOL)	
any Marine Sciences (MASC) 101 and above		
any Mathematics (MATH) above MATH 232		
any Physics (PHYS) except a first-year seminar, PHYS 101, PHYS 132, and PHYS 313		

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Departmental Involvement

The Department of Geological Sciences encourages the active participation of undergraduates in department research, teaching, and social life. In addition to opportunities for experiential education and teaching internships described below, the department has an active Geology Honor Fraternity and Geology Club and regularly sponsors field excursions, career information sessions, and social events. Dates, times, and locations for all events are posted on the Web site and in the main lobby on the first floor of Mitchell Hall.

Experiential Education

Many geology courses emphasize experiential learning through field and laboratory work. Most degree tracks include a field geology course (GEOL 485 and GEOL 486 or a similar course in another department) that fulfills the experiential education General Education requirement for the College of Arts and Sciences. Additionally, all students are encouraged to contact faculty members about conducting independent research, either as an honors thesis or a senior thesis project.

UNC-BEST

The UNC Baccalaureate Education in Science and Teaching (UNC-BEST) Program is a collaboration between the School of Education and the College of Arts and Sciences and is designed to allow undergraduate science majors interested in teaching high school science the opportunity to earn their science degree and obtain licensure as a North Carolina high school science teacher in four years. The program consists of core education classes (EDUC 516 or EDUC 689 or EDUC 690, EDUC 532, EDUC 615, EDUC 593, and EDUC 601) and a teaching methods class (GEOL 412) that is housed in the Department of Geological Sciences. For more details on admission requirements, application deadlines, and submitting an online application, visit the School of Education Web site (http://soe.unc.edu/academics/uncbest).

Study Abroad

Although the department has no formalized study abroad program, many students participate in a study abroad program, and some receive credit for geology coursework completed abroad. Students interested in a study abroad program should contact the director of undergraduate studies. Students must receive approval from the director of undergraduate studies prior to taking courses abroad for geology credit.

Undergraduate Awards

The Op White Prize in Geology, established in 1966, consists of a cash prize and an engraved bronze plaque displayed in the geology office. The award is given annually to the outstanding senior in geology.

Field Camp Scholarships

Several scholarships for geology field camp are awarded each year from the Grover Murray and Anadarko funds.

Undergraduate Research

The Department of Geological Sciences encourages qualified undergraduate students to conduct independent research on an interesting geologic topic under the direction of a geological sciences faculty member. This research can be conducted as a one- to fourcredit hour project (GEOL 395) or in conjunction with the geology honors program.

GEOLOGICAL SCIENCES MAJOR, B.S.-ENVIRONMENTAL GEOLOGY CONCENTRATION

Contact Information

Department of Geological Sciences http://www.geosci.unc.edu 104 South Road, Mitchell Hall, CB# 3315 (919) 966-4516

Jonathan Lees, Chair

Kevin Stewart, Director of Undergraduate Studies kgstewar@email.unc.edu

Deborah Harris, Student Services Manager djharris@email.unc.edu

The study of earth's dynamic systems is a field that has seen major advances over the last few decades. Geologists investigate diverse systems that play a large role in controlling the environment at the earth's surface.

Department Programs

Majors

- Geological Sciences Major, B.A. Earth Science (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-ba-earth-systems-concentration)
- Geological Sciences Major, B.S. Earth Science (http:// catalog.unc.edu/undergraduate/programs-study/geologicalsciences-major-bs-earth-science-concentration)
- Geological Sciences Major, B.S. Environmental Geoscience (p. 1)

Minor

 Geological Sciences Minor (http://catalog.unc.edu/undergraduate/ programs-study/geological-sciences-minor)

Graduate Programs

- M.S. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)
- Ph.D. in Geological Sciences (http://catalog.unc.edu/graduate/ schools-departments/geological-sciences)

Requirements

In addition to the program requirements listed below, students must

- · attain a final cumulative GPA of at least 2.0
- complete a minimum of 45 academic credit hours earned from UNC-Chapel Hill courses
- take at least half of their major course requirements (courses and credit hours) at UNC-Chapel Hill

• earn a minimum of 18 hours of C or better in the major core requirements (some majors require 21 hours).

For more information, please consult the degree requirements section of the catalog (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements/#degreerequirementstext).

Core Requirements

All of the followin	g courses:	
GEOL 200	The Solid Earth	3
GEOL 201	Earth's Surface: Processes, Landforms, and History	3
GEOL 324 & 324L	Water in Our World: Introduction to Hydrologic Science and Environmental Problems and Water in Our World Laboratory	4
13 credit hours fr	om the following options:	13
GEOL 302	Structural Geology	
GEOL 303	Sedimentology and Stratigraphy	
GEOL 304	Petrology and Plate Tectonics	
GEOL 310	Coastal Environmental Change	
GEOL 405	Geochemistry	
GEOL 417 & 417L	Geomorphology and Geomorphology Laboratory	
GEOL 432	Paleoclimatology	
GEOL 435	Groundwater	
GEOL 436	Geochemistry of Natural Waters	
ENEC 203	Introduction to Environmental Science Problem Solving	
Three geology (G otherwise require	EOL) courses numbered above 300 and not d for the major	9
Capstone require	ment (one of the following combinations):	6
GEOL 485 & GEOL 486	Summer Field Course in Geology and Summer Field Course in Geology	
GEOL 691H & GEOL 692H	Honors and Honors	
GEOL 395	Undergraduate Research in Geology ¹	
Science-orient	ed Experiential Education (EE) course. ²	
Additional Requir	ements	
CHEM 101 & 101L	General Descriptive Chemistry I and Quantitative Chemistry Laboratory I	4
CHEM 102 & 102L	General Descriptive Chemistry II and Quantitative Chemistry Laboratory II ^H	4
MATH 231	Calculus of Functions of One Variable I	3
MATH 232	Calculus of Functions of One Variable II	3
One of the follow	ing courses:	3
Any COMP cou COMP 380	irse numbered COMP 110 or above, except	
GEOL 520	Data Analysis in the Earth Sciences ³	
Any MATH abo	ove MATH 232	
Any STOR cou	rse numbered STOR 155 or above	
One of the follow	ing courses:	4
PHYS 104	General Physics I	
PHYS 114	General Physics I: For Students of the Life Sciences	
PHYS 116	Mechanics ^H	

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PHYS 118	Introductory Calculus-based Mechanics and Relativity	
One of the follow	ing courses:	4
BIOL 101 & 101L	Principles of Biology and Introductory Biology Laboratory ^H	
Any CHEM cou	urse above CHEM 102	
PHYS 105	General Physics II	
PHYS 115	General Physics II: For Students of the Life Sciences	
PHYS 117	Electromagnetism and Optics ^H	
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta	
At least five scient (see below chart)	nce electives not otherwise required for the major)	15
Total Hours		78

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- ¹ Six credits total of independent research.
- ² Must be pre-approved by the Director of Undergraduate Studies.
- ³ This course may also be used to satisfy one of the required GEOL courses numbered above 300.

Science Electives Not Otherwise Required for the Major

ANTH 143	Human Evolution and Adaptation	3
ANTH 220	Principles of Archaeology	3
ANTH 315	Human Genetics and Evolution	3
ANTH 317	Evolutionary Perspectives on Human Adaptation and Behavior	3
ANTH 412	Paleoanthropology	3
ANTH 414	Laboratory Methods: Human Osteology	3
ANTH 451	Field School in North American Archaeology ^H	6
any Astronomy (A	STR) except a first-year seminar	
any Biochemistry BIOC 108	(BIOC) except a first-year seminar, BIOC 107 and	
any Biology (BIOL) above BIOL 113	
any Chemistry (Cl	HEM) above CHEM 102	
any Computer Sci COMP 380	ence (COMP) COMP 110 or above, except	
any Environment	and Ecology (ENEC) above ENEC 201	
GEOG 370	Introduction to Geographic Information	3
GEOG 410	Modeling of Environmental Systems	3
GEOG 412	Synoptic Meteorology	3
GEOG 414	Climate Change	3
GEOG 416	Applied Climatology: The Impacts of Climate and Weather on Environmental and Social Systems	3
GEOG 477	Introduction to Remote Sensing of the Environment	3
GEOG 491	Introduction to GIS	3
GEOG 577	Advanced Remote Sensing	3
GEOG 591	Applied Issues in Geographic Information Systems	3
GEOG 592	Geographic Information Science Programming	3
GEOG 594	Global Positioning Systems and Applications	3

GEOG 597	Ecological Modeling	
any Geological Sc	viences (GEOL) course	
any Marine Science	ces (MASC) MASC 101 and above	
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