

Geosciences Department

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**Degrees Awarded**

M.S. in Geosciences; Ph.D. in Geosciences; M.A.T. in Earth Sciences

**Application**

[https://app.applyyourself.com/AYApplicantLogin/fl\\_ApplicantLogin.asp?id=sunysb-gs](https://app.applyyourself.com/AYApplicantLogin/fl_ApplicantLogin.asp?id=sunysb-gs)

Geosciences Department

As the core discipline examining Earth's natural processes and materials, Geosciences boasts unparalleled diversity. Spurred by urgent scientific and social questions, ranging from environmental concerns to the origin and evolution of the planet itself, the Geosciences are experiencing remarkable growth, with excellent career opportunities. The Geosciences encompass many disciplines including geology, geochemistry, and geophysics, and its interdisciplinary nature fosters natural links not only with chemistry and physics, but also with environmental science, materials science, engineering, biology, and health fields. Developments in technology and new innovative approaches have transformed graduate study in many areas within Geosciences, and students participate in research utilizing state-of-the-art instrumentation and facilities.

Graduate students may choose among degree programs with emphasis in different areas in Geosciences. Ph.D. and M.S. thesis-based programs are offered with concentrations in areas including seismology and tectonics, mineral and rock physics, crystal chemistry, geochemistry, petrology, sedimentary geology, planetary geosciences, and hydrogeology (described in more detail below). Also offered is an M.A. in Teaching Earth Science, which leads to provisional certification for teaching earth science in secondary schools of New York State.

**Areas of Emphasis in Graduate Study and Research**

The Department's philosophy has been to pursue excellence by concentrating its research initiatives in specific areas of the Geosciences. Graduate students benefit from greater focus and also enjoy close interaction with faculty members. A distinctive aspect of graduate study in the Geosciences department is the opportunity for collaborative research, often involving several faculty members. The department's extensive state-of-the-art computers, laboratory facilities and modern instrumentation have helped to foster a well-earned reputation for observational, experimental, multifaceted approaches to Geosciences research. Cooperative programs with other departments, nearby institutions, and national laboratories provide access to unique facilities (e.g., NSLS).

**Seismology, Tectonics, and Shallow Surface Geophysics**

A primary focus in seismology and tectonics is the determination of detailed three dimensional earth structure, from the core to the surface, and related studies on the dynamics that drives mantle convection, deformation of the lithosphere, and plate tectonics in general. Particular emphasis is placed on interdisciplinary research and collaboration, where inferences made from seismological, geodynamic, and geodetic investigations are integrated with findings from the fields of mineral and rock physics, geochemistry, and petrology. Areas of specific focus in seismology include inner core structure, anisotropy, and attenuation, outer core structure, core-mantle boundary structure, upper mantle structure, strong ground motion studies, earthquake source parameter studies, and theoretical studies on seismic wave propagation. Investigations in tectonophysics include the coupling between mantle convection and lithospheric dynamics, the development of the kinematics, mechanics, and seismicity within plate boundary deformation zones, and the inference of mantle flow beneath the lithosphere. Current projects involve using earthquake and space geodetic data to infer the deformation fields and employing numerical, analytical, and analog modeling to understand surface geodynamical observations, ranging from geoid, topography, plate motions and surface deformations in the global and regional scales to the partitioning of strain and tectonic implications at geometrically complex plate margins. All of these projects emphasize the use of integrated seismic, structural, geodetic, and field data to understand the structure, composition, and dynamics of the Earth's interior, as well as the driving forces for plate movements and deformations. The topics in shallow surface geophysics include field geophysical surveys of glaciotectonic deformation of Long Island sediments using ground penetrating radar, and electrical resistivity.

**Mineral and Rock Physics**

Research in these fields focuses on the investigation of the structure and composition of the Earth, geophysical properties of Earth materials, and the mechanical behavior of the crust and mantle. An important emphasis is the study of high-pressure and high-temperature phases and assemblages, particularly those of relevance to the mantle. In situ measurement of elastic properties, compressibility, and determination of crystal structure complement studies of high-pressure phase relations for constraining models for Earth's mantle and equations of state for mantle phases. Specific projects include determination of ultrasonic wave velocities of minerals and rheological determination of the strength of minerals at the pressure and temperature conditions of the Earth's mantle to depths greater than 500 km. Research initiatives in these areas are closely linked to the activities of the Mineral Physics Institute at Stony Brook and the NSF Consortium for Materials Properties Research in Earth Sciences [COMPRES]. Facilities available in the Department of Geosciences and the Mineral Physics Institute include equipment for ultrasonic interferometry, Brillouin spectroscopy, and multi-anvil apparatus for experiments at high pressure and temperature; these are all integrated with synchrotron X-ray sources at the NSLS. Complete single-crystal and powder X-ray diffraction facilities and transmission electron microscopy

and electron diffraction are available. Another important area of study is rock physics, fluid flow and earthquake mechanics. Experimentally and theoretically based, this program focuses on brittle fracture, mechanical compaction of porous rock, strain localization, frictional instability, and hydromechanical behavior. The rock mechanics laboratory includes a triaxial press, an acoustic emission system, and permeameters.

### **Crystal Chemistry and Crystallography**

The department has a strong background in the study of earth materials at the atomic and molecular level, and in using the results of these studies to interpret the properties of materials constituting Earth from crust to core. Two centers of excellence, the Center for Environmental Molecular Sciences (CEMS) and the Mineral physics Institute (MPI) concentrate on the behavior of upper crustal and Earth's Interior, respectively. Both employ a wide range of structural probes, some located in the department and others located at national and international synchrotron X-ray and neutron facilities. Within the department, extensive facilities for single-crystal and powder X-ray diffraction, with capabilities for in situ high-temperature and high-pressure studies exist. Projects emphasize crystal structure studies on oxides, hydroxides, sulfides, carbonates, and silicates, including characterization of phase transitions, ordering phenomena, and ion exchange. Convenient access to the Brookhaven National Laboratory and the National Synchrotron Light Source, NSLS, provides opportunities for unique experiments requiring a high-intensity X-ray source. Other projects utilize X-ray absorption spectroscopy to examine local structure in minerals, neutron diffraction for studies of hydrous phases, and solid-state NMR spectroscopy to investigate crystal chemical substitutions and defects. Many of the department's faculty are actively engaged in the design and construction of the next generation of beamlines required for high pressure and environmental investigations. These facilities are being designed with the requirements of the Stony Brook and wider national and international user base in mind. This work is complemented by electron diffraction using the department's transmission electron microscope.

### **Geochemistry**

There are broad opportunities for graduate study and research in many areas of geochemistry. Major initiatives exist in isotope and trace-element geochemistry, aqueous and hydrothermal geochemistry, geochemistry of mineral/fluid interfaces, and theoretical and experimental geochemistry of mineral-melt systems. All programs have a strong experimental foundation, and many integrate experimental work with field studies.

Specific areas of research utilizing trace elements and radiogenic isotopes include evolution of Archean and Phanerozoic crust and geochronology of lithologic assemblages. These integrate with petrologic studies of sedimentary, metamorphic, and igneous terranes throughout the world. Research involving the chemistry and structure of sulfide and carbonate mineral surfaces are among the programs in low-temperature aqueous geochemistry; these include emphasis on geocatalysis, crystallization and trace element incorporation mechanisms, as well as the role of sulfides in the origin of life. Field-related studies focus on fluid chemistry in active hydrothermal systems. Research on silicic melts combines theoretical and experimental approaches for characterizing speciation and crystal-melt equilibria, and also for examining nucleation and growth. Closely related experimental studies focus on phase equilibria, solid-solution models, and the development of geothermometers and geobarometers, including applications in field studies.

Experimental and analytical work makes use of the department's electron microprobe, transmission electron microscope, thermal ionization mass spectrometers, FT-IR, Mössbauer lab, DCP and ion chromatography labs, X-ray diffraction facilities, and three synthesis and experimental petrology labs. Additional work uses facilities in other Stony Brook departments, including NMR spectrometers located in the Dept. of Chemistry, as well as facilities at nearby Brookhaven National Laboratory, including the NSLS.

### **Petrology**

Opportunities for graduate study and research in petrology range from atomic-scale investigations, for example, dealing with the structure of glasses, to global questions regarding the relationships of magmatic suites to large-scale mantle and crustal processes. Projects include spectroscopic and quantum chemical approaches for examining mechanisms of volatile dissolution and crystal nucleation in melts and experimental investigations of the effects of pressure, temperature, and volatile composition on stabilities of minerals and melts, with corresponding development of thermodynamic models. Field and laboratory work are integrated in some studies. Experiments are being applied to Martian meteorites.

This work is supported by experimental facilities that contain controlled-atmosphere gas-mixing furnaces, cold-seal bombs, piston-cylinder apparatus, internally heated pressure vessels, as well as multi-anvil apparatus for experiments at high temperature and pressure conditions. Analytical facilities include an electron microprobe, a transmission electron microscope, thermal ionization mass spectrometers, a Mössbauer lab, and X-ray diffraction facilities.

### **Sedimentary Geology**

Research initiatives in sedimentary geology at Stony Brook integrate geochemistry with field, petrologic, and stratigraphic studies. Trace element and isotopic studies of terrigenous sedimentary rocks provide information on their provenance, age, and composition, which yield insight to broader issues of crustal evolution, including sediment subduction, growth of continental crust and the sedimentary mass, and recycling of sedimentary rocks. Carbonate rocks and their diagenesis are another important area of research that utilizes a wide range of approaches. Petrography is combined with microanalytical techniques for trace elements and both stable and radiogenic isotopes to reconstruct the diagenetic environments and the physicochemical characteristics of paleohydrologic systems. Emphasis is also placed on the quantitative modeling of rock-water interaction. A strong component of fieldwork is common for studies of both clastics and carbonates. Analytical facilities include the department's electron microprobe, optical and cathodoluminescence petrography and electron microscopy facilities, a mass spectrometry lab, a Mössbauer lab, DCP and ion chromatography labs, X-ray diffraction facilities, and a variety of facilities at the NSLS.

### **Planetary Science**

Graduate research opportunities are available in the field of planetary science, including planetary geochemistry and petrology, planetary spectroscopy, planetary geophysics and Astrobiology with current focus on Mars and the Earth's moon. Several faculty and students have been actively involved in planetary missions, including Mars Global Surveyor, Mars Exploration Rovers and Mars Odyssey. Projects are available to evaluate geological, chemical, spectroscopic and geophysical data that have been returned from these and other missions. Planetary science research is also supported by an assortment of experimental and analytical facilities. A recently installed infrared spectroscopy laboratory supports experimental and analytical studies in emission and reflectance spectroscopy of Mars and lunar analog materials as well as investigations

of the fundamental infrared spectral properties of a wide variety of minerals. High pressure—high temperature experimental laboratories (see details under Petrology and Mineral and Rock Physics) may be used for evaluating the origin and history of igneous rocks from terrestrial planets and rocky satellites. Low temperature and hydrothermal experimental laboratories are available for the study of Martian near-surface aqueous processes and for investigating issues related to Astrobiology. Experimental laboratories are also supported by a broad array of analytical facilities (see details under Crystal Chemistry and Crystallography, Geochemistry and Sedimentary Geology)

### **Hydrogeology**

The non-thesis M.S. program with a concentration in hydrogeology is designed to give those with a B.S. degree in physical sciences a solid foundation of theoretical and practical graduate training emphasizing the physical and geochemical aspects of hydrogeology. Coursework and a final research project totaling 30 graduate credits are arranged to accommodate working professionals, with most courses taught in the evenings. This is a part-time degree program. A formal thesis is not required. Coursework includes groundwater hydrology, aqueous geochemistry, rock and soil physics, numerical hydrology, statistics and probability, and organic contaminant hydrology. Final research projects are arranged individually with faculty supervisors and are designed to give students experience in field, laboratory, or theoretical approaches.

#### Admission requirements of Geosciences Department

For admission to the Graduate Program in Geosciences, the following, in addition to the Graduate School requirements, are required:

- A. A bachelor's degree in one of the earth or space sciences or in biology, chemistry, physics, mathematics, or engineering.
- B. A minimum average of B for all undergraduate coursework and a B average for courses in the sciences.
- C. Results of the Graduate Record Examination (GRE) General Test.
- D. Acceptance by both the Department and the Graduate School.

In special cases, a student not meeting requirements A and B may be admitted on a conditional basis. Upon admission, the student will be informed of the requirements that must be satisfied for termination of this status.

The Department of Geosciences offers programs leading to the M.A.T., M.S., and Ph.D. degrees in the Geosciences.

The Master of Arts in Teaching degree in Earth Science is a non-thesis degree for which all requirements can be completed in three semesters.

The M.S. degree with concentration in Hydrogeology is a non-thesis M.S. with most courses offered at times appropriate for working professionals.

The M.S. degree with a concentration in Earth and Space Sciences is a nonthesis program for New York State teachers who have initial certification but need a Master's degree to become fully certified, and to become certified in Earth Science. There are no other residence or language requirements.

The M.S. degree in Geosciences with thesis is typically not a terminal degree. Many students seeking Ph.D. candidacy first earn an M.S. degree.

Students become candidates for the Ph.D. in Geosciences by completing preparatory work leading to successful completion of the Ph.D. preliminary examination. Students are urged to obtain a more detailed description of procedures from the Geosciences Graduate Handbook.

Final responsibility for adhering to degree requirements and meeting all deadlines rests solely with the student.

#### Facilities of Geosciences Department

The Department of Geosciences occupies a well-equipped building that houses extensive experimental and analytical labs, faculty and graduate student offices, numerous computers and workstations and the Geosciences Resource Room. The Mineral Physics Institute, the Long Island Groundwater Research Institute (LIGRI), the Marine Sciences Research Center (MSRC), and nearby Brookhaven National Laboratory offer additional support and laboratory facilities for graduate student research. In particular, the National Synchrotron Light Source (NSLS) at Brookhaven offers unparalleled opportunities for faculty and graduate students to perform unique experiments requiring high-intensity X-rays and is only 20 miles away.

#### Requirements for the Ph.D. Degree in Geosciences

Advancement to Ph.D. candidacy is gained after the successful completion of the Ph.D. preliminary examination. The examination is the culmination of an evaluative process that begins when the student arrives at Stony Brook. In particular, the faculty seek evidence of scientific creativity, originality, vigor, and flexibility, along with the basic background knowledge, skills, and critical faculties needed to carry out advanced independent research in the student's chosen field. The minimum residence requirement is two consecutive semesters of graduate study. There is no language requirement.

#### **A. Course Requirements**

Course requirements are flexible and are determined in consultation with the student's academic advisory committee at the beginning of studies. Academic advisory committees are assigned to students at the time of their arrival at Stony Brook, and the composition of the committee may be changed at the student's request, with the approval of the graduate program director. During their first two years in the program, students generally take one to three courses per semester. In addition, they participate in appropriate formal and informal seminars. During their first Fall semester, all students must take GEO 500, Geosciences Research Seminar. In addition, all students must register for GEO 696, Geoscience Colloquium, and GEO 697, Geoscience Seminar, each semester, and GEO 600, Practicum in Teaching, at least once. Among the courses offered are:

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GEO 500 Geosciences Research Seminar  
GEO 502 GIS for Geologists  
GEO 503 Mineral Equilibria  
GEO 504 Geology of the Turkana Basin  
GEO 507 Petrogenesis  
GEO 510 Dimensions of Global Change  
GEO 511 Computer Programming for the Geosciences  
GEO 512 Structure and Properties of Materials  
GEO 513 GIS Fundamentals I  
GEO 514 Introduction to Physical Hydrogeology  
GEO 515 Geohydrology  
GEO 517 Crystal Chemistry  
GEO 518 Carbonate Sediments  
GEO 519 Geochemistry of Natural Waters  
GEO 520 Glacial Geology  
GEO 521 Isotope and Trace Element Geology  
GEO 523 Geodatabase and Design  
GEO 524/MAR 524 Organic Contaminant Hydrology  
GEO 525 GIS Fundamentals II  
GEO 526 Low Temperature Geochemistry  
GEO 530 The Geology of Mars  
GEO 533 Geochemistry of the Terrestrial Planets  
GEO 540 Solid Earth Geophysics  
GEO 543 Stratigraphy  
GEO 546 Mineralogy and Petrology  
GEO 547 Remote Sensing in Geosciences  
GEO 549 Structural Geology  
GEO 550 Global Tectonics  
GEO 551 Physics of the Earth I  
GEO 552 Physics of the Earth II  
GEO 556 Solid State Geophysics  
GEO 564/AMS 562 Numerical Hydrology  
GEO 573 Physics of Rocks  
GEO 581 Coastal Engineering Geology  
GEO 585 Directed Studies  
GEO 588 Geological Field Methods for Earth Science Teachers  
GEO 589 Research for Earth Science Teachers  
GEO 590 Research Project

GEO 599 Research  
GEO 600 Practicum in Teaching  
GEO 696 Geoscience Colloquium  
GEO 697 Geoscience Seminar  
GEO 698 Geoscience Special Seminar  
GEO 699 Dissertation Research on Campus  
GEO 700 Dissertation Research off Campus Domestic  
GEO 701 Dissertation Research off Campus – International

A number of courses are offered periodically according to student demand, either in a formal classroom setting or as Directed Studies (GEO 585). These include the following courses

GEO 505 Experimental Petrology Laboratory  
GEO 506 Theoretical Petrology  
GEO 508 The Rock Forming Minerals  
GEO 522 Planetary Sciences  
GEO 528 Carbonate Geochemistry  
GEO 531 Crystalline Solids  
GEO 532 Solid State Geochemistry  
GEO 535 Regional Structure and Tectonics  
GEO 542 Inverse Theory  
GEO 562/MAR 562 Early Diagenesis of Marine Sediments  
GEO 567 Sedimentary Rocks and Crustal Evolution  
GEO 570 Earthquake Mechanics  
GEO 571 Mechanics of Geologic Materials  
GEO 572 Advanced Seismology

Specialized, advanced seminars are offered periodically by various faculty members. These include the following courses

GEO 603 Topics in Petrology  
GEO 604 Topics in Planetary Science  
GEO 605 Topics in Sedimentary Geology Paleontology  
GEO 607 Topics in Geophysics  
GEO 609 Topics in Mineralogy and Crystallography

### **B. Research Projects**

Each student carries out individual research projects, commonly with two or more faculty members, as part of the requirements leading up to the Ph.D. qualifying exam. The requirements for each of these projects are determined by the individual professors with whom the research is carried out. When working on such a project, students register for either GEO 590 or GEO 599 Research, after consultation with the appropriate professor. A student who has completed an M.S. thesis before arriving at Stony Brook will generally complete only one research project before the preliminary exam.

### **C. Ph.D. Preliminary Examination**

The preliminary examination consists of the preparation and oral defense of a thesis proposal. There are three separate steps in this procedure: (1) submission of a proposal abstract to the graduate committee, who then selects an examining committee, (2) submission of the thesis proposal to the examining committee, and (3) oral defense of the proposal.

#### **D. Thesis Proposal Abstract**

A one-page document stating the most essential aspects of the student's proposed thesis, the thesis proposal abstract must be signed by three faculty members before being given to the graduate committee. One of the three faculty members must be identified as a potential sponsor, meaning that he or she is tentatively willing to be the student's thesis advisor. This implies no commitment, either on the part of the professor or the student.

Upon receipt of the abstract, the graduate committee selects the members of the student's Ph.D. preliminary examination committee and sets a deadline (usually six weeks) for the submission of the thesis proposal to the examination committee. This committee is to consist of five scientists holding Ph.D. degrees who are experts in fields related to the proposal, at least four of whom must be members of the program.

#### **E. Thesis Proposal**

The Ph.D. thesis proposal specifies the scientific rationale for the proposed thesis work, the relevant work done thus far, and the techniques and effort required to reach the research objective. When the thesis proposal is completed, copies are given to each member of the examination committee. Within a week of receiving the proposal, the examination committee will meet to determine whether or not the thesis proposal is defensible. If it is not deemed defensible, the student is informed as to whether a resubmittal will be permitted. If the thesis proposal is deemed acceptable, the examination committee sets a date for the Ph.D. preliminary examination.

#### **F. Oral Preliminary Examination**

The student gives a short public presentation of the thesis proposal, after which there is a closed oral examination. Although much of the questioning inevitably focuses on the proposed thesis work, any topic in the geosciences and related fields may be covered in the questioning. At the end of the examination, the student and any others present who are not part of the preliminary examination committee are excused. The committee will then judge whether the student has demonstrated the ability to conceive, plan, and carry out original research.

The examination committee has a range of options open to it. It may vote to deny Ph.D. candidacy, either with or without a second opportunity to pass the Ph.D. preliminary examination. It may vote to accept the proposal, but fail the student on other grounds. In doing so, the examination committee may either bar a second opportunity to take the exam, require specific remedial actions, or schedule a second opportunity to take the examination. The committee has the option to vote to reconvene in order to re-evaluate its decision, based upon actions the student has taken in response to the examination committee's recommendations.

The examination committee may also vote to pass the student contingent upon changes in or rewriting of the proposal. It is free to establish any mechanism it deems necessary to affirm whether or not its requirements have been met. All decisions must be agreed to by a majority vote and must be conveyed in writing to the graduate program director and to the student.

When the graduate program director has been informed by the chairperson of the examination committee that the student has passed the Ph.D. preliminary examination, the department recommends to the Graduate School that the student be advanced to Ph.D. candidacy.

#### **G. Teaching Requirement**

All graduate students must register for GEO 600, Practicum in Teaching, at least once, as outlined in Course Requirements on the preceding page.

#### **H. Dissertation**

The Ph.D. dissertation is the document summarizing the original scientific research in recognition of which the Ph.D. candidate seeks the doctoral degree. The University has very specific rules about the format of the thesis, but the nature of its scientific content is at the discretion of the student, his or her advisor(s), and the Ph.D. thesis defense committee. In many cases, the thesis consists of a linked set of published or soon-to-be published scientific papers.

When informed by the student's advisor that the thesis is ready to be defended, the graduate committee selects a Ph.D. thesis defense committee. The defense committee consists of five or six members, a majority of whom must be members of the department. One defense committee member, other than the thesis advisor, is appointed as committee chairperson by the graduate committee. Within two weeks of receiving the thesis, the defense committee chairperson polls the committee members to ascertain that the thesis is actually defensible. If it is, the defense committee chairperson formally schedules the oral defense.

#### **I. Ph.D. Thesis Oral Defense**

The student makes a public presentation of the major results of the thesis. There is then a closed session, during which the student is examined primarily, but not exclusively, on the dissertation topic. The committee has the option of voting to accept the thesis, reject it, or accept it with revisions. If the thesis is accepted with required revisions, the committee will decide the mechanism for determining compliance with its requirements. Voting is by majority.

Requirements for the M.S. Degree with Thesis in Geosciences

The M.S. in Geosciences with thesis is typically a nonterminal degree completed by some students before seeking Ph.D. candidacy. All requirements for the M.S. degree must be completed within a period of three years after entry. There are no residence or language requirements.

#### **A. Course Requirements**

Students must successfully complete a program of 30 graduate credits, including a minimum of 18 credits in approved academic courses. A student must achieve a 3.0 overall grade point average in all graduate courses taken at Stony Brook to receive a degree.

### **B. M.S. Thesis**

An M.S. thesis proposal of no more than two pages must be submitted to the graduate committee at the end of the first year. The proposal must be signed by two faculty members, one of whom must be designated as a potential sponsor of the research and research advisor. After the proposal has been accepted, the student may proceed with the preparation of the M.S. thesis.

When the M.S. thesis is nearing completion, the student's advisor asks the graduate committee to appoint a defense committee. This committee consists of three experts in the field who hold a PhD degree, at least two of whom must be members of the program faculty. Within two weeks of receiving the thesis, the defense committee decides whether the thesis is defensible. If it is, then an oral thesis defense is scheduled.

The M.S. thesis defense consists of a short public presentation of the major results of the thesis. This is followed by a closed examination that may cover any topic within the student's general field of study, but generally concentrates upon the thesis topic. The thesis defense committee may vote to accept the thesis, return it to the student for revisions, or reject it outright.

### Requirements for the M.S. Degree with Concentration in Hydrogeology

The non-thesis M.S. with a concentration in Hydrogeology requires a total of 30 credits. Of these 30 credits, at least 21 credits must be in the required and approved courses and at least six credits must be in approved research. A minimum overall grade point average of B is required. Students are required to complete the four core courses in category A; one course from category B (if a student is deficient in either writing or communication skills, computer programming, or statistics); and one, two, or three courses from category C. There are no residence or language requirements.

#### **Category A**

- GEO 515 Geohydrology
- GEO 564/AMS 562 Numerical Hydrology
- GEO 526 Low-Temperature Geochemistry
- GEO 519 Geochemistry of Natural Waters

#### **Category B**

- AMS 576 Statistical Methods for Social Scientists
- EST 588 Technical Communication for Management and Engineering

#### **Category C**

- GEO 573 Hydromechanical Behavior of Geomaterials
- GEO 521 Isotope and Trace Element Geology
- GEO 524/MAR 524 Organic Contaminant Hydrology
- EST 593 Risk Assessment
- EST 595 Principles of Environmental Systems Analysis
- EST 596 Simulation Models for Environmental Waste Management
- EST 597 Waste Management: Systems and Principles
- CEY 503 Environmental Law
- CEY 509 Man, Environment, and Health

### **Research**

In addition to formal coursework, the curriculum for the M.S. with concentration in Hydrogeology includes a minimum of six credits of research, either GEO 590 or GEO 599, after consultation with the appropriate professor. This research is to be carried out over a period of two or more semesters, and will be designed through a mutual consultation between the student and one or more members of the participating faculty. The purpose of the research is to give the student experience at solving hydrogeological problems. It may utilize field, laboratory, or theoretical approaches. The program of research will culminate in a written report to be approved by three designated faculty.

### Requirements for the M.S. Degree with Concentration in Earth and Space Science

The non thesis M.S. with a concentration in Earth and Space Science requires a total of 31 credits. Of these 31 credits, 30 credits must be from courses with the ESS designator or other approved graduate courses in the fields of astronomy, atmospheric sciences or geosciences. Individual course programs will be developed for each student in consultation with the Earth Science education advisor based on the student's academic background and intended goals.

All students are required to complete

- ESS 501 Foundations of Earth Science
- ESS 610 Capstone Project in Earth and Space Sciences

## Requirements for the M.A.T. Degree in Earth Science

The Master of Arts in Teaching Earth Science leads to provisional certification for teaching earth science in secondary schools in New York State. It also prepares the student for the examination for permanent certification. There is no residence requirement. Students must complete at least one year of college-level study of a foreign language.

Students in the M.A.T. program must register through the School of Professional Development.

### **A. Formal Coursework**

Students are required to complete with an average grade of B or higher 15 credits in earth science courses and 27 credits in pedagogical courses and teaching experience. The departmental M.A.T. advisor in consultation with the student will determine a set of earth science courses for the M.A.T. degree in Earth Science.

### **B. Recommendation of the Department for the M.A.T.**

When all program requirements are completed, the departmental M.A.T. advisor will consult with the director of the Science Education Program to determine whether all state-mandated education courses have been completed. If they conclude that all requirements have been met, they will inform the associate dean of the School of Professional Development that the requirements for provisional certification have been fulfilled and recommend to the dean of the Graduate School that the M.A.T. degree should be granted.

### **C. Time Limit**

Although full-time students can complete all requirements for the M.A.T. degree within three semesters, part-time students will require additional time to complete the degree requirements.

Faculty of Geosciences Department

### **Distinguished Professors**

McLennan, Scott M., Ph.D., 1981, Australian National University: Geochemistry of sedimentary rocks; sedimentary petrology.

Parise, John, Ph.D., 1980, James Cook University of North Queensland: Synthesis and characterization of zeolites for use as selective catalysts; characterization using normal X-ray and neutron diffraction techniques; investigation of crystallizing gels using small-angle neutron scattering; structural modeling of silicates.

Weidner, Donald J., Ph.D., 1972, Massachusetts Institute of Technology: Structure of the Earth's interior as revealed by seismic waves and laboratory determinations of physical properties.

### **Distinguished Service Professors**

Hanson, Gilbert N., Ph.D., 1964, University of Minnesota: Application of radiometric and geochemical methods to petrologic and tectonic problems.

### **Professors**

Davis, Daniel M., Ph.D., 1983, Massachusetts Institute of Technology: Quantitative geophysical modeling of fold and thrustbelts; Field geophysics.

Glotch, Timothy, Ph.D., 2004, Arizona State University: Planetary geology; remote sensing; Martian surface mineralogy.

Holt, William E., Graduate Program Director, Ph.D., 1989, University of Arizona: Seismotectonics; kinematics and dynamics of crust and mantle deformation; earthquakesource parameter studies.

Li, Baosheng, Ph.D., 1996, SUNY Stony Brook: mineral physics, elasticity of minerals, high-pressure research.

Nekvasil, Hanna, Undergraduate Program Director, Ph.D., 1986, Pennsylvania State University: Experimental and thermodynamic investigations of mineral/melt equilibria in silicic magmas.

Phillips, Brian L., Department Chair, Ph.D., 1990, University of Illinois at Urbana-Champaign: Aqueous geochemistry, NMR spectroscopy, mineralogy and structural chemistry of silicates and other oxides.

Reeder, Richard J., Ph.D., 1980, University of California, Berkeley: Low-temperature geochemistry; mineralogy; crystal chemistry.

Schoonen, Martin A.A., Ph.D., 1989, Pennsylvania State University: Kinetics and thermodynamics of low-temperature and hydrothermal water-rock interaction; theoretical geochemical modeling; geochemistry of natural waters.

Wen, Lianxing, Ph.D., 1998, California Institute of Technology: Mantle rheology and dynamics; seismic structures of the Earth's mantle; new techniques for calculating viscous flow and seismic wave propagation

### **Associate Professors**

Ehm, Lars, PhD., 2003, Christian--Albrechts University zu Kiel, Germany

Rasbury, E. Troy, Ph.D., 1998, Stony Brook University: Sedimentary geochemistry; geochronology; chronostratigraphy.

Rogers, Andrea Deanne, Ph.D., 2005, Arizona State University: Remote sensing; planetary surface processes; GIS.

#### **Assistant Professor**

Henkes, Gregory A., Ph.D., 2014, The Johns Hopkins University: Stable isotope geochemistry, paleoclimatology, biogeochemistry

Hurowitz, Joel, Ph.D., 2006, Stony Brook University: Planetary geology, planetary exploration, Sedimentary geochemistry.

Shen, Weisen, Ph.D., 2014, University of Colorado Boulder: Seismic tomography

#### **Emeritus**

Lindsley, Donald H., Emeritus, Ph.D., 1961, Johns Hopkins University: Application of phase equilibrium studies of silicate and oxide minerals to metamorphic and igneous petrology.

#### **Affiliated Faculty**

#### **Distinguished Professor**

Aller, Robert C.<sup>1</sup>, Ph.D., 1977, Yale University: Marine geochemistry; early marine diagenesis

#### **Distinguished Service Professor**

Bokuniewicz, Henry J.<sup>1</sup>, Ph.D., 1976, Yale University: Marine geophysics.

#### **Professors**

Cochran, J. Kirk<sup>1</sup>, Ph.D., 1979, Yale University: Marine geochemistry; use of radionuclides as geochemical tracers; diagenesis of marine sediments.

O'Leary, Maureen<sup>2</sup>, Ph.D., 1997, Johns Hopkins: vertebrate paleontology, phylogenetic systematics, mammalian evolution.

#### **Associate Professor**

O'Leary, Maureen, Ph.D., 1997, Johns Hopkins: vertebrate paleontology, phylogenetic systematics, mammalian evolution.

#### **Research Professor**

Liebermann, Robert C., Emeritus, Ph.D., 1969, Columbia University: Mineral physics; elastic and anelastic properties of rocks and minerals and their applications to the Earth's interior.

Oganov, Artem, Ph.D., 2002, University College London: Theoretical and computational physics; simulation of minerals at high pressures and temperatures; structure and properties of solids.

Wong, Teng-fong, Ph.D., 1980, Massachusetts Institute of Technology: Experimental rock physics; fault mechanics.

#### **Research Associate Professors**

Northrup, Paul, PhD, 1996, Stony Brook University, biological imaging and microspectroscopy, synchrotron beamline

Sperazza, Michael, Ph.D., 2006, University of Montana, Paleoclimatic change over the Pleistocene and Holocene.

Vaughan, Michael T.<sup>3</sup>, Ph.D., 1979, SUNY Stony Brook: experimental geophysics, crystallography, synchrotron X-ray studies

Whitaker, Matthew, PhD, 2009, Stony Brook University, mineral physics, planetary science and experimental geochemistry/petrology

1) School of Marine and Atmospheric Sciences

2) Department of Anatomical Sciences

3) Mineral Physics Institute

NOTE: The course descriptions for this program can be found in the corresponding program PDF or at COURSE SEARCH.

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