

Department Chair: Dirk Baron
Program Coordinator: Staci Loewy
Program Office: Science Building II, 338
Telephone: (661) 654-2550
email: sloewy@csub.edu
Website: www.csub.edu/Geology
Faculty: D. Baron, J. Gillespie, R. Horton, S. Loewy, R. Negrini

Program Description

The Department of Geology offers a comprehensive graduate program leading to the Master of Science in Geology degree. A Petroleum Geology and a Hydrogeology option are available for the MS degree. The program is intended to prepare students for professional positions in the petroleum industry, the environmental and geotechnical consulting industries, government agencies, and for graduate studies at the doctoral level. A broad range of faculty research interests, the proximity of the campus to the petroleum industry, easy access to diverse geological environments, and a range of modern research facilities permit the student to select from a wide spectrum of research topics.

Research facilities include: (1) a Hitachi S-3400 variable pressure scanning electron microscope equipped with Oxford Inca energy dispersive x-ray spectrometer and Gatan ChromaCL live color catholuminescence imaging system; (2) a geochemistry lab with a Perkin Elmer Elan 6100 ICP-MS, a Cetac LSX-200 Laser Ablation system, a Microwave Digester, an Ion Chromatograph, and a GC/MS; (3) petrographic microscopes including luminescence and epifluorescence; (4) geophysics equipment including a paleomagnetism lab, 12-channel seismograph, magnetometer, gravimeter, and electrical resistivity meter; (5) a Rigaku X-Ray diffractometer; (6) a PC lab with software including GeoGraphix and ArcGIS for petroleum reservoir modeling and geographical information systems (GIS), and industry-provided seismic datasets; and (7) a wide range of field hydrology equipment. The California Well Core Sample Repository, containing cores and samples from more than 5,000 wells from both on- and offshore California and 1,500 catalogued micropaleontological samples, is located on campus.

Post-Baccalaureate Certificate in Hydrogeology

In addition to the MS degree, the Department of Geology offers a post-baccalaureate Certificate in Hydrogeology. The certificate is designed primarily to give professionals additional training in Hydrogeology and Hydrogeochemistry.

APPLICATION PROCESS AND PROGRAM REQUIREMENTS

Application for the Master of Science in Geology

Persons seeking an MS in Geology must apply to the Office of Admissions and Records for admission to the University. Students must also apply to the Graduate Committee of the Department of Geology for formal admission to the graduate program in Geology as either classified or conditionally classified graduate students.

After admission by the Graduate Committee of the Department, the Graduate Program Coordinator serves as adviser. Once the student embarks on the MS Thesis research, the faculty member directing the research project will serve as advisor.

Once a student has started on a MS Thesis research project, the research adviser will assemble a thesis committee.

Academic advising is available through the Graduate Program Coordinator and the research adviser of the student.

Admission Requirements for the Master of Science in Geology

1. An acceptable baccalaureate degree from an accredited institution.
2. An undergraduate GPA of at least 3.0 in the last 90 quarter (60 semester) units of course work; or Graduate School Examination scores of 1,000 or greater (verbal and quantitative); or a GPA of 3.0 or

higher in all previous graduate course work (at least 20 quarter units); or an approved petition to the Graduate Committee of the Department waiving this requirement by proposing other evidence of adequate prior academic preparation.

3. Formal decision by the Department Graduate Committee to accept the student into the graduate program. The decision will be based on a formal application procedure, which includes evaluation of GPA, Graduate Record Examination scores, letters of recommendation, and other materials which may be required by the Committee and/or offered by the student.

Graduate Student Classifications

Classified Standing. Acceptance as a Classified Student indicates that all prerequisite course work has been completed, that a formal Plan of Study has been developed, and that the student's progress in graduate level courses warrants continuation in the program. Specific requirements for Classified Status are listed below:

1. Completion of 60 units in Geology; the last 40 units must be courses above the introductory level. Required courses (or their equivalents) are GEOL 303 Mineralogy, 309 Sedimentation and Stratigraphy, 306 Petrology and Petrography, 307 Structural Geology and a summer field course in Geology.
2. Completion of the following prerequisite courses in cognate areas: CHEM 211 Principles of General Chemistry I, CHEM 212 Principles of General Chemistry II, PHYS 201 Basic Principles of Newtonian Physics, PHYS 202 Basic Principles of Maxwellian Physics, MATH 140 Elementary Statistics or PHYS 203 Basic Principles of Contemporary Physics, MATH 201 Calculus I, MATH 202 Calculus II, MATH 222 Laboratory Experience,
3. Satisfactory completion of the Graduate Record Examination (Advanced Test in Geology) and other examinations or course work which may be assigned by the Graduate Committee of the Department.
4. Formal acceptance of the student's Plan of Study by the Graduate Committee of the Department.

Conditionally Classified Standing. Applicants may be admitted as Conditionally Classified Graduate Student if, in the judgment of the Graduate Committee, the applicant has potential for successful completion of all the "conditions" specified by the faculty committee for admission as a Classified Graduate Student and potential for successful completion of all the requirements for the graduate program. Upon satisfactory completion of all "conditions" specified by the Committee, the student's status will be administratively changed to Classified Graduate Student.

Note: No more than three courses (15 units) may be taken for graduate credit until all prerequisites have been satisfied.

Time limits have been set for completion of requirements at each level of status. Advancement to Classified Status must be accomplished within two calendar years after acceptance as a Conditionally Classified Student.

All requirements, and graduation, must be completed within five calendar years after formal acceptance to the graduate program. The five-year time limit may be extended by petition to the Graduate Committee of the Department.

Completion of all requirements for the Master of Science in Geology requires satisfactory completion of all courses in an approved Plan of Study and satisfactory completion of a thesis, including oral examination and any revisions required by the Thesis Committee or Departmental Graduate Committee, and maintaining a 3.0 GPA.

Course Requirements for the Master of Science in Geology (A minimum of 45 units of course work is required for the MS in Geology)

The following courses are required of all students:

GEOL 606 or
GEOL 610
GEOL 604 or

GEOL 609
GEOL 585
GEOL 690A
GEOL 690B

For students choosing the Petroleum Geology option the following courses are required:

GEOL 460
GEOL 570

For students choosing the Hydrogeology concentration (this concentration will appear on the diploma) the following courses are required:

GEOL 475
GEOL 555

All students need at least 15 additional units from the following (all courses are 5 units credit unless noted):

GEOL 420
GEOL 450
GEOL 460
GEOL 475
GEOL 477 (variable credit)
GEOL 515
GEOL 525
GEOL 555
GEOL 570
GEOL 577 (variable credit)
GEOL 580 (variable credit)
GEOL 604
GEOL 605
GEOL 606
GEOL 607
GEOL 609
GEOL 610
GEOL 625
GEOL 650

Appropriate graduate level classes in related fields.

Application for Professional Certificate in Hydrogeology

Applicants must be accepted as post-baccalaureate students at CSUB. Admission Requirements for Certificate in Hydrogeology Applicants should have a BA or BS in Geology or a directly related field. Applicants in related fields should have completed course work in Physical and Historical Geology, Stratigraphy and Sedimentation, Structural Geology, and one year each of college chemistry, physics and calculus. Some of the courses in the Certificate program may have additional prerequisites.

Course Requirements for Certificate in Hydrogeology

The certificate will require at least 25 units of credit, 15 units of which must be completed at the CSUB campus, and shall be composed of the following required and elective courses.

Courses required for a certificate in Hydrogeology are:

GEOL 475
GEOL 525
GEOL 555

A minimum of two courses (10 units) are to be selected from the following:

GEOL 420
GEOL 477 - when pertinent (variable credit)
GEOL 580 (variable credit)
GEOL 625
GEOL 650
GEOL 577/677 - when pertinent (variable credit)

COURSE DESCRIPTIONS

GEOL 515 Paleoclimate of Western North America (5)

Fundamentals of the earth's climate and a survey of the geologic record of climate change focusing temporally on the past 70 million years and spatially on western North America. Topics will include the processes behind the earth's climate system and its dynamic nature, the Monterey (Fm) Hypothesis, glacial/interglacial swings in the Quaternary Period, interactions between the climate, geological processes, humans, and the biosphere during the late Quaternary. Lectures will be supplemented by laboratory and field study. Two lectures, two labs, plus required field trip. Prerequisites: Geol 201 or equivalent, two quarters of college-level chemistry and physics, and at least 20 units of upper division coursework in Geology, Chemistry, Physics, Biology, or Physical Anthropology.

GEOL 525 Applied Hydrogeochemistry (5)

After a review of the pertinent principles of aquatic geochemistry, this course focuses on the practical application of these principles to groundwater issues. Topics include water sampling protocol, graphical and statistical methods for the interpretation of hydrogeochemical data, composition and evolution of natural waters, and environmental issues such as mobility of metals in the subsurface, acid mine drainage, and risk assessment and clean-up at hazardous waste sites. Throughout the course, the geochemical speciation model MINTQA2 will be used to model the composition of pristine and contaminated waters. Two lectures, two labs, plus required field trip. Prerequisite: GEOL 420, GEOL 475, or consent of instructor.

GEOL 555 Contaminant Hydrogeology (5)

Course will provide an understanding of the processes that govern the mobility and fate of contaminants in subsurface environments and of the methods that are used to remediate contaminated sites. Topics include a review of the equations describing the flow of groundwater and the transport of contaminants in groundwater, processes that control the transport and transformation of contaminants in the saturated zone and the vadose zone, multiphase flow, reactions of organic and inorganic contaminants, soil and groundwater sampling, and remediation technology for contaminated soils and groundwater. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 420, GEOL 475, or consent of instructor.

GEOL 570 Oil Field Development (5)

Formation evaluation and testing, production methods, water drive, methods of enhanced oil recovery. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 460 or permission of instructor.

GEOL 577 Advanced Topics in Geology (1-5)

Topics and prerequisites to be announced. May be repeated for different topics. General prerequisite: major or minor in Geology. A field trip fee may be required.

GEOL 580 Advanced Research Participation (1-5)

Individual scientific investigation, under supervision (experience as a research assistant does not count for credit). Prerequisite: consent of instructor. If applied toward the MS degree, research must be different from the student's thesis topic.

GEOL 585 Research Methods and Strategies (4)

Preparation of proposal for thesis research project and peer-reviewed presentation of initial results. Research project will consist of laboratory and/or field investigation of sufficient scope as determined by the thesis committee. This course is to be taken by all first-year graduate students.

GEOL 604 Advanced Sedimentation (5)

Classification and genesis of sedimentary rocks with emphasis on textural analysis, depositional processes and paleoenvironmental interpretation. Field and laboratory studies will focus on Cenozoic sedimentary rocks of southern California and computer modeling of depositional systems. Two lectures, two labs, plus required field trip. Prerequisite: GEOL 309.

GEOL 605 Advanced Micropaleontology (5)

Advanced studies in the morphology, taxonomy, ecology, and paleoecology of microfossils, with emphasis on foraminifera, radiolaria, ostracods, and pollen. Field oriented laboratory projects will focus on biofacies analysis, stratigraphic sequences of microfauna, microfaunal correlation, phylogenesis of foraminifera, and applied micropaleontology. Two lectures, two labs, plus required field trip. Prerequisite: GEOL 309.

GEOL 606 Advanced Sedimentary Petrology (5)

Mineralogy, petrology, classification and genesis of sedimentary rocks with emphasis on geochemistry and post-depositional processes including diagenesis. Field and laboratory studies will focus on outcrop and cores of Cenozoic rocks of southern California. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 306 and 309.

GEOL 607 Advanced Structural Geology (5)

Topics in advanced structural geology based on petrographic, geophysical, and experimental data combined with field observations. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 306, 307, and 325.

GEOL 609 Advanced Stratigraphy (5)

Application of principles and techniques of stratigraphic analysis to the interpretation of time equivalence, depositional systems, and paleogeography of stratigraphic sequences. Lithostratigraphy, biostratigraphy, and sedimentological and petrologic approaches will be incorporated into laboratory/field projects. Emphasis will be on Cenozoic rock units in Southern California. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 305 and 309.

GEOL 610 Low Temperature Geochemistry (5)

Introduction to low-temperature rock-water interactions and aqueous geochemistry including weathering and surface-water chemistry, mechanisms of authigenesis and diagenesis, pore-fluid chemistry, clay mineralogy, and environmental geochemistry. Laboratory work will focus on the examination of rock-water interactions in fresh- and saltwater aquifers in the San Joaquin Basin. Two lectures, two labs, plus required field trip. Prerequisites: CHEM 212, GEOL 306, 309, and 310.

GEOL 625 Shallow Subsurface Exploration Methods (5)

Advanced study of shallow subsurface exploration methods. Topics may include surface methods such as reflection and refraction seismology, gravity, magnetics, electrical resistivity, electromagnetics and ground penetrating radar. Geophysical well logging may also be included. Classroom component consists of brief overview of methods followed by advanced topics such as signal processing, advanced interpretation techniques, and critique of case studies. Field and lab components consist of acquisition, processing, and modeling of gravity, magnetic, seismic refraction, electrical resistivity, electromagnetic and ground penetrating radar data. Two lectures, two labs, plus required field trip. Prerequisite: calculus and an introductory course in geophysics or permission of the instructor.

GEOL 650 Groundwater Flow Modeling (5)

Course will include a review of the principles of groundwater flow and transport equations and models. Special emphasis and hands-on experience with the USGS models MODFLOW and MOC. Two lectures, two labs, plus required field trip. Prerequisites: GEOL 475 and familiarity with MSDOS operating system. Students are encouraged to have completed GEOL 555.

GEOL 677 Advanced Topics in Geology (5)

Topics and prerequisites to be announced. May be repeated for different topics. These will include such subjects as: advanced economic geology; advanced seismology; computer applications in geology/geostatistics; exploration geophysics; exploration techniques in groundwater geology; hydrogeology; neotectonics; photogeology and remote sensing; seismic stratigraphy; tectonic evolution of California; underground fluids; and West Coast stratigraphy. Specific areas designated when offered, and prerequisites listed depending on the specific topics. A field trip fee may be required.

GEOL 690A Master's Thesis I (4)

Peer-reviewed presentation of results of ongoing M.S. Thesis research. This course is to be taken by all second- year graduate students. Prerequisite: GEOL 585.

GEOL 690B Master's Thesis II (2)

Completion of research, writing and oral presentation of M.S. Thesis. Credit on acceptance of the thesis by thesis committee. Required for M.S. degree. Prerequisite: GEOL 690A.

GEOL 700 Continuous Enrollment (1-5)

Registration required for all students who have completed course work, but have not completed the thesis. The student will continue to register each quarter for GEOL 700 until the thesis is completed and successfully defended. Prerequisite: prior registration in GEOL 690B with a grade of SP.