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CHARGE TO REVIEW COMMITTEE

Texas A&M University
Academic Program Review (APR)

Charge to the Peer Review Team
Department of Geology and Geophysics

The Academic Program Review (APR) process at Texas A&M University provides the occasion for academic units to plan strategically, assess the quality and efficacy of their programs, and determine the best courses of action for ongoing improvement. APR is at the heart of our institutional commitment to excellence, and we sincerely thank you for assisting us. This letter provides you with the charge to the committee and a brief overview of the department.

Peer Review Team Charge
Please examine the department and its programs and make recommendations that will help in planning improvements. Your resources are a self-study report prepared by the department, copies of materials from the program’s last review, information you gain through personal interactions while visiting Texas A&M University, copies of strategic plans and goal-setting documents at the department, college, and/or university level, and any additional information requested by you or by the department. Within the broad charge of recommending ways the department can continue to improve are some specific questions that we would like you to address:

• Based on the data / information provided in the self-study report or gathered by the review team, what are the department’s overall strengths and weaknesses?

• Describe the alignment of degree program’s strategic goals and priorities with college and institutional goals and priorities.

• How would you compare this department with its peers?
• What improvements (including student learning and faculty development) has the department made since the previous program review?

• With only current resources or a modest infusion of new ones, what specific recommendations could improve the department’s performance, marginally or significantly?

We look forward to meeting with you during your time on campus. If you have any questions or require additional information prior to your visit, Ms. Bettyann Zito, APR Program Coordinator, at apr@tamu.edu. Thank you.
WELCOME FROM THE DEPARTMENT HEAD

The Department of Geology and Geophysics welcomes you to Texas A&M University (TAMU). We are grateful to you for agreeing to serve as external reviewers of our academic program. Our last external review was completed in 2009-2010, and it is TAMU policy to conduct an academic review once every eight years to assess the standards of the programs and to learn from review team members’ experiences with similar programs. This year’s review seeks an evaluation of all of our educational programs, graduate and undergraduate, and our research using the materials that will be provided, information you gain through personal interactions while visiting Texas A&M, and any additional information that you might request. We look forward to the opportunity for a comprehensive evaluation of our department. We have grown our Ph.D. program substantially in the last eight years as we seek to address fundamental questions about the Earth, but the consequences of this shift are only now playing out. Over the last eight years we saw a large increase in undergraduate majors, followed by a slow, steady decline. For the last 5-6 years we have had approximately 400-500 undergraduate students enrolled in Geology or Geophysics degrees, with maximum numbers near 530 and now about 390. Throughout this period approximately 100–125 graduate students were enrolled in graduate degree programs in Geology or Geophysics. We acknowledge our responsibilities to the state and nation, because as a large department at a land-grant university, we are called to educate geologists and geophysicists to be able to solve scientific problems, to become educators at all levels, and to tackle problems of energy, environment, and climate.

Our goal in this self-study report is to introduce you to our intellectual home, the Department of Geology and Geophysics, within its unique setting, the College of Geosciences, its affiliated departments, and research centers. We prepared this report specifically for your review. We seek your evaluation of our current educational and research programs, and we seek your perspectives and advice as we plan to build and improve our educational and research programs. We include a brief history of Texas A&M and the Geology and Geophysics Department. This is followed by a comparison of the department, with its current faculty, students, and staff, to the department at the time of our last review. We offer information on the Department’s organization, facilities, finances, mission, goals, strategic plans, as well as affiliations with other departments and centers on campus. Academic curricula and student demographics are reviewed separately for undergraduate and graduate degree programs, as are program assessments and outcomes. We describe our faculty and identify areas of research strength and outline ways to continue our growth toward excellence. We provide a profile of
our undergraduate and graduate students. We conclude with an internal assessment and initiatives we plan to pursue in the near future. We provide, under separate cover, extensive appendices that provide curricula vitae for the faculty, details of the undergraduate and graduate curricula and their assessment, service to the scientific community, and the strategic plans that built upon our last external review.

While evaluating the program, please consider the allocation of resources within the department (both human and fiscal) and the absolute level of support the Department receives from the University. Please comment as appropriate on current and potential leveraging of these resources, as well as the current and potential interaction with other departments and groups, both on campus and off.

Also, please address the issue of learning-based outcomes:

- Does the department have ongoing and integrated planning and evaluation processes that assess its programs and services, result in continuing improvement, and demonstrate that the department is effectively accomplishing its mission?
- Has the department identified expected outcomes for its educational programs?
- Does the department have evidence of improvement based upon analysis of results?

We look forward to receiving your evaluation and recommendations as we prepare to develop a new strategic plan to build and improve our department’s academic program. We understand that the request we make of you requires significant time and effort. Let me assure you of the importance of your review and that your contribution is greatly appreciated. I look forward to meeting with you and the entire committee in November 2017. If you have any questions or require additional information, please contact me.

Michael C. Pope
Professor and Department Head
EXECUTIVE SUMMARY OF THE SELF-REPORT

The Texas A&M University Department of Geology and Geophysics is making strides in its goal to better serve the State of Texas through its research into the Earth, its climate, its energy and water resources, its complex structural and depositional history.

Our revised undergraduate curriculum should produce undergraduate students with better skills than their predecessors, providing the new students with more bridges between the courses, better utilization of their supporting sciences and math classes, and multiple high-impact learning experiences. As our undergraduate enrollments stabilize and the number of faculty teaching each course increases, we hope that our teaching loads will decrease, allowing us the opportunity for more undergraduate-centered research.
We have improved the quality of our graduate students and our percentage of Ph.D. students has risen steadily over the last five years to just over 50%; however, we are still learning how to accommodate longer residence times, and assure that most graduate students publish their research in a timely manner.

We have invested heavily in new faculty members over the last 4-5 years and they provide much of the excitement around our program. However, salaries of our graduate students and faculty in our department, with respect to our peer institutions are low. In the past academic year, the college executive committee recognized excellence and provided a 5% equity raise for all assistant and associate professors. However, we need to determine a long-term mechanism to increase pay or we risk losing some of our best young geoscientists.

By hiring ten tenure-track faculty members and a visiting lecturer in the last five years and increasing our collaborations with other departments our research record is improving. We still need to increase the rate of externally funded research and building a culture of having successful post-doctoral researchers.

Increased use of the Michael T. Halbouty Visiting Professor funds will continue to bring excellent faculty members to our campus and increase our research profile and visibility. These Visiting Professors also act as informal mentors for many of our young faculty members.

The infrastructure in our department, in addition to collaborations and university centers across campus provide adequate or above adequate facilities for most faculty members. However, aging equipment, especially in the John Handin Rock Deformation Laboratory does need to be replaced in the near future, in order to maintain its position as one of the premiere structural geology research laboratories in the United States.
SCHEDULE OF DEPARTMENT OF GEOLOGY & GEOPHYSICS EXTERNAL REVIEW

Travel/Welcome (Sunday, November 12, 2017)
2:00-5:00 p.m. Review team arrives in College Station, picked up at airport and escorted to One Circle Drive (on campus) by Department Head, Mike Pope
6:30-8:30 p.m. Mike Pope hosts dinner at local restaurant

Day 1 (Monday, November 13, 2017)
8:00-8:45 a.m. Entry interview at One Circle Drive with Dr. Michael Stephenson, Associate Provost for Academic Affairs, Dr. Sumana Data, Assistant Provost for Undergraduate Studies, Dr. Leonard Bright, Assistant Provost for Graduate and Professional Studies.
Breakfast served. Associate Provost for Academic Affairs provide charge to reviewers and provides institutional perspective.
8:45-9:00 a.m. OPEN/Travel time, Review team transported to campus by Dept. Head
9:00-10:15 a.m. Meet with Interim Dean of College of Geosciences, Debbie Thomas (202 O&M)
10:15-11:00 a.m. Meet with Department Head, Michael Pope, and Associate Heads, Dr. Mark Everett (Graduate Program), Franco Marcantonio (Facilities) and David Sparks (Undergraduate Program) in Halbouty Lounge.
11:00-11:30 a.m. Meet with staff in Halbouty Lounge
11:30-11:45 a.m. OPEN/Travel Time
11:45-1:15 pm Lunch with Department Heads or their representatives at the University Club. Ping Yang (Atmospheric Sciences), David Cairns (Geography), Shari Yvon-Lewis (Oceanography), and Dan Hill (Petroleum Engineering) and with International Ocean Discovery Program (IODP) Director Brad Clement
1:15-1:30 p.m. OPEN/Travel Time
1:30-3:00 p.m. Tour departmental facilities, Mike Pope, Franco Marcantonio and others
3:00-4:20 p.m. Meet with Faculty (327 Halbouty)
4:20-4:30 p.m. OPEN
4:30-5:10 p.m. Meet with Senior Faculty (Professors, 327 Halbouty)
5:10-5:30 p.m. Travel Time
5:30-7:00 p.m. Reception with Faculty at the University Club in Rudder Tower
7:00-7:30 p.m. OPEN/Travel Time
7:30 p.m. Dinner and work session for review team, escorted to One Circle Drive by Pope
Day 2 (Tuesday, November 14, 2017)

7:30-8:30 a.m.  Reviewers eat breakfast on their own at One Circle Drive, escorted to Halbouty Bldg by Franco Marcantonio

8:30-8:45 a.m.  OPEN/Travel Time

8:45-11:40 a.m.  Meet with Faculty Groups (327 Halbouty)
  8:45 a.m. - Petroleum Geosciences and Geophysics
  9:20 a.m. - Water Resources & Environmental Geosciences

10:00-10:10 a.m.  OPEN
  10:10 a.m. - Life, Climate, and Earth History
  10:55 a.m. - Tectonophysics, Deep Crust and Mantle Dynamics

11:40-11:50 a.m.  OPEN/Travel Time

11:50-1:00 p.m.  Lunch at Café Eccell

1:00-2:45 p.m.  Meet with Students (327 Halbouty)
  1:00 p.m. - Undergraduate students
  1:35 p.m. - Masters students
  2:10 p.m. - Ph.D. students and Postdocs

2:45-3:10 p.m.  OPEN

3:10 -3:50 p.m.  Meet with Junior Faculty (Assist. & Assoc. Professors; 327 Halbouty)

3:50-5:00 p.m.  Meet with Selected Faculty Committees (327 Halbouty)
  3:50 p.m. - Graduate Admissions and Recruiting Committee
  4:25 p.m. - Tenure and Promotion Committee

5:00 p.m.  Review team escorted to One Circle Drive by Mike Pope

5:30-6:30 p.m.  Dinner catered at Reviewers’ hotel workroom

6:30 p.m.  Reviewers’ work session, preparation of draft report for exit interview, and faculty debriefing
Day 3 (Wednesday, November 15, 2017)

7:30-8:45 a.m. Exit interview at One Circle Drive with Dr. Carol Fierke, Provost and Executive Vice President and Dr. Debbie Thomas, Interim Dean, College of Geosciences, Dr. Michael Stephenson, Associate Provost for Academic Affairs, Dr. Sumana Data, Assistant Provost for Undergraduate Studies, Dr. Leonard Bright, Assistant Provost for Graduate and Professional Studies and Reviewers.

Breakfast served. Reviewers present summary of their on-site review. Review team escorted to the Halbouty Building.

8:45-9:10 a.m. OPEN/Travel time (bring luggage to campus)

9:10-10:10 a.m. Reviewers debrief Department Head and Associate Heads (Halbouty Lounge)

10:10-11:00 a.m. Reviewers make final changes to draft report, as necessary (Halbouty Lounge)

11:00-12:00 p.m. Reviewers brief Faculty and Students on final report (101 Halbouty)

12:00-1:00 p.m. Lunch with Department Head and Faculty in 327 Halbouty (catered)

1:00-3:00 p.m. Reviewers depart College Station. Escorted to airport by Mike Pope
WE BUILD
EXPERIENCES
1 | INTRODUCTION

1.1 BRIEF HISTORY OF DEPARTMENT

Texas A&M University
Texas A&M University (TAMU) is the oldest public institution of higher learning in Texas. Established in 1876 as an all-male military college, named the Agricultural and Mechanical College of Texas, it is now among the largest research universities in the nation, with a student body of over 66,000, of which 9,100 are graduate students, and a faculty of over 4,900. The Corps of Cadets is still an active part of the student population, but membership is not compulsory and the campus has been coeducational since 1963.

TAMU is designated as a land grant university (http://www.tamu.edu/) and it also has the distinctions of being a sea grant and a space grant institution. The Texas A&M System endowment is valued at $9.8 billion. TAMU annual research expenditures for 2016 exceeded $900M, placing it in the top 20 academic research performers by the National Science Foundation in October, 2016. In the U.S News and World Report survey of Dec. 1, 2016, TAMU was ranked 105th of all research universities of the World and 74th best University in the United States and 27th of all public universities in the United States.

In 1997, Texas A&M initiated a process of self-examination leading to the university's Vision 2020 plan to become one of the top ten public research universities in the country. This led to concrete proposals for faculty hiring under the University’s Faculty Reinvestment Initiative and over 450 new faculty hires were made across campus between 2003-2010, in addition to replacing faculty losses. Current initiatives are in progress to foster interdisciplinary research, improve the assessment of our academic programs and their outcomes, increase international and undergraduate research experiences, and increase the diversity of TAMU faculty and students.

Department of Geology and Geophysics
The first geology course taught at TAMU was offered in 1903 in the Department of Chemistry and Mineralogy, just two years after the January 10, 1901 Spindletop discovery near Beaumont, Texas. The current department (http://geoweb.tamu.edu/) has its origins in the Department of Geology established in 1922 in the School of Engineering, initiated with two faculty members and twelve course offerings. The first geology undergraduate bachelor degrees were granted in 1930. The first graduate level courses were offered during the 1928-1929 academic year, and the first graduate degree, a Masters of Science in Petroleum Geological Engineering, was granted in 1931. This degree was awarded to a young Mr. Michel T. Halbouty, whose thesis was on the Geology of Atascosa County, Texas. Mr. Halbouty later became one of the department’s benefactors and our building bears his name.
Geophysics was introduced to the curriculum and course offerings in geophysical methods were steadily increased during the 1950s, ultimately leading to the first B.S. in Geophysics in 1957. The first M.S. in Geology was awarded in 1951 and the first M.S. in Geophysics was awarded in 1959. Doctoral degrees in both Geology and Geophysics were first conferred in 1959. The department was renamed the Department of Geology and Geophysics in 1964 as the School of Engineering became the College of Engineering. It was then split into two departments, the Department of Geology and Geography and the Department of Geophysics in 1965 as academic units of the newly formed College of Geosciences. In 1969, Geography became its own department. The Departments of Geology and Geophysics were merged again in 1995.

With its origins in a school of engineering, the department has always had an emphasis on geological applications. As members of a research university, we are interested in both applications and in fundamental understanding and discovery. The TAMU Geology curriculum has always emphasized strong math and science backgrounds. In the 1950s, the Geology major required two years of math, one year of precalculus and one year of calculus. Today, we require two years of calculus through differential equations. We continue to offer field-based courses to our undergraduate and graduate students, in addition to laboratory and problem-solving courses.

Since our last review in 2010, we were able to grow from a low of 21 FTE faculty to our current number 29 FTE faculty, in spite of several faculty losses. Our undergraduate student numbers have doubled in the last four years and our graduate student numbers have recently stabilized. In the most recent (2016) ranking of graduate Earth science programs by the U.S. News and World Report, TAMU Geology and Geophysics ranked 32nd nationwide and 23rd of all departments at state universities. We currently have three post-doctoral fellows, in our department.

The Department of Geology and Geophysics is housed in the Halbouty Geosciences Building, built in 1932 and originally named the Petroleum Engineering, Geology, and Engineering Experiment Station Building. A new wing was added and the building was renovated in 1983. Our building features beautiful wrought iron trilobites and stained glass crystal forms, and yet this historic building presents a number of infrastructure and maintenance challenges.
1.2 STATEMENT OF DEPARTMENT MISSION

Texas A&M University is a comprehensive teaching and research university of the State of Texas, and it is the leading institution of the Texas A&M University System. The goal of the university is to serve the public good through teaching, research, and service to society.

The Department of Geology and Geophysics is dedicated to the scientific study of all aspects of the solid Earth, from fundamental processes that shape it to knowledge that benefits society. The objectives of our undergraduate programs are to provide students with a comprehensive education, emphasizing critical thinking, scientific, mathematical and communication skills, and fundamental understanding in the fields of geology and geophysics. The B.S. degrees are intended to provide students with a rigorous background that initiates their careers in the Earth sciences where as the B.A. in Geology is intended to give students greater flexibility to pursue a wide range of interests and career choices, while focusing their major studies in geology.

Graduate education and scientific research are inseparable, as we prepare graduate students for careers in geology and geophysics, and we attempt to make scientific breakthroughs that lead to better understanding of the planet and applications that benefit society. The objectives of our Masters programs are to provide a strong foundation for professional geologists and geophysicists and to develop the student’s problem solving skills through advanced course work and original research leading to a thesis. In our Ph.D. programs, we further aim to develop the student’s ability to lead original research and ask critical questions that shape scientific thought. An important goal of all of our graduate programs is to develop communication skills, both orally and in writing. Results of research are communicated through journal publications, presentations at national and international meetings, and reports submitted to industry and government agencies.

As members of a research university, faculty also engage in governance of Texas A&M University, at department, college, and university levels, and in service to the scientific community and in outreach to society. Our service goals are met by administrative and educational efforts on and off campus, contributing to educational methods in the geosciences, participation on committees of professional societies, membership on funding panels, and participation in scientific and educational workshops.
We are committed to assisting Texas A&M University and the State of Texas in their missions. The Department of Geology and Geophysics offers introductory courses in geology that fulfill broadening core requirements for non-science majors across campus. Because understanding the geology of the Earth involves applications of physics, chemistry and biology, our introductory courses expose students to a wide range of scientific principles.

**Strategic Plans – 2010 and 2014**

The last formal strategic plan of the Department of Geology and Geophysics was prepared in 2010 (Appendix A) following the arrival of Dean Kate Miller. This strategic plan was completed by Department Head Andreas Kronenberg after our last external review, discussed in a Department Retreat and then revised and ratified by the faculty in 2010. Subsequently, in 2014 Department Head Rick Giardino continued to refine the department’s priorities and provided the draft strategic plan provided in Appendix A, however it was never thoroughly discussed by the faculty and ratified. Results and changes undertaken by the Department are discussed further in Section 1.6. We look forward to the results of the present External Review and expect to develop a new strategic plan during the spring semester 2018 in light of the external review’s findings and insight.
1.3 ADMINISTRATIVE STRUCTURE

Department Head
The appointment of a Department Head is made following a formal search process, with a Search Committee that is appointed by the Dean. The Search Committee is chaired by a head or director of another unit of the college, and Search Committee members consist of faculty from our department. The Search Committee seeks and evaluates applications, and develops a short list of candidates to invite for a series of interviews with the committee and college representatives, and visits with faculty, staff and students. Candidates for Department Head normally give two talks, one that illustrates their research interests, and one on administrative philosophy.

The Search Committee seeks input and calls a vote of the entire membership of the department on short-listed candidates, and ultimately provides a recommendation to the Dean of Geoscience with ranked finalists. At the outset of the search, the Dean determines whether the search is restricted to internal candidates or includes external candidates. The current Head, Mike Pope, and all prior Heads since the 2002 review (Drs. Giardino, Kronenberg, Hajash, Carlson, and Spang) were internal candidates.

Under university and college policies, heads of departments at Texas A&M University have broad discretionary powers to conduct departmental affairs. Department heads are held responsible for administration of the department, its academic performance, meeting requirements of the department, college, and university, and evaluating faculty and staff for merit raises; in return, department heads receive twelve-month salaries. Since merging the separate departments of geology and geophysics, faculty of the Department of Geology and Geophysics have been directly involved in many decisions, with democratic policies that are reinforced by Vision 2020’s imperative of self-governance. The Department Head is regularly advised by faculty and student committees of the Department, and many decisions are made by seeking faculty discussion, consensus, and votes. The Department Head also receives advice from students through the undergraduate Geology and Geophysics Society and the Graduate Student Council. The Department Head and faculty have benefited from meetings and workshops with the Geology and Geophysics Advisory Council (GEODAC), composed of former students and industry recruiters.
Although the Department worked on revising our Bylaws in 2013, they were not voted upon so a single set of departmental bylaws have not been adopted, but the Department adheres to formal policies at the university, college, and department levels pertaining to faculty and staff hiring, tenure, promotion, faculty development leaves, adoption of new courses, and policies pertaining to students, involving curricula, degree requirements, submission of graduate degree plans, and procedures of M.S. and Ph.D. defenses, and Ph.D. preliminary exams. In addition, policies were adopted in the Department to provide faculty input into the distribution of teaching responsibilities, into recruiting, admitting, and advising students, and awarding student scholarships and fellowships, into managing shared facilities, and into allocating resources.

With our current policy of shared governance, relatively few decisions are made by the Department Head without extensive faculty input. Most decisions are made following faculty discussion of committee recommendations, leading to potential amendments of committee proposals, and a vote by the faculty (or call for consensus). Implementation of all policies adopted by the Department is the responsibility of the Department Head. An organizational chart for the Department of Geology and Geophysics is shown in Figure 1.1.

**Associate Department Heads**
Three Associate Department Heads (Graduate Student Program – Mark Everett; Undergraduate Program – David Sparks; Facilities – Franco Marcantonio), serve the department at times that the Department Head is unavailable. The Head and Associate Department Heads form the leadership team that help drive the department agenda forward.

**Faculty**
The faculty in the Department of Geology and Geophysics are described in Chapter 3.

**Administrative, Advising and Technical Services**

*Administrative Staff*
The current office staff consists of two Business Administrators I, a Business Associate II, and an Administrative Associate II (Table 3.17). The administrative staff is responsible for processing all administrative and business matters. The business activities include processing of employment, accounts payable/receivables, immigration, payroll, purchasing,
travel, and funds available through start-up, endowments, fellowships, gifts and scholarships. The Business staff of the Department, in addition to their departmental duties, process the scholarships/fellowships, tuition payments and account reconciliations for the College of Geosciences.

The Department’s Business Administrators, Ms. Cathy Bruton and Ms. Lisa Reichert, assist the Department Head by implementing policy, oversight of budgets, and preparing all administrative reports. They are the primary liaison between principal investigators and research administration agencies with the university, and handles State accounts, fellowship/scholarship accounts, gifts, and donations. Business administration involves the use of a
number of different university information systems, as well as knowledge of State and university rules and policies, which requires extensive training.

Allayne Babin, a Business Associate II verifies and reconciles all account transactions in the College of Geosciences. Allayne also manages payment cards and compiles back up material for card reconciliation. Allayne assists the building facilities manager (Sean Stroyick) by managing building access, and coordinating building repairs.

Ms. Elizabeth Collins (Administrative Associate II) is the point-of-contact person in the Business Office. Elizabeth meets visitors, answers phone calls, relays messages, distributes mail and receives packages, sends much of our departmental communications through the departmental listserv, coordinates the travel schedules for visitors, seminar speakers and student defenses. Elizabeth maintains the departmental calendar, our display boards, and provides facility key control for rooms in Halbouty.

Dawn Spencer (Program Coordinator) is the main administrative point of contact for the Berg-Hughes Center (BHC) in our Department. Dawn answers the BHC phones, organizes the paperwork, sends bills, and organizes the GEODAC meetings and annual Berg-Hughes research conference. Dawn coordinates financial reporting of the BHC with the Department’s Business Manager and the College. In addition to administrative duties, Dawn coordinates the large, multi-disciplinary research program on unconventional resources between Berg-Hughes and the Crisman Institute for Petroleum Research.

Advising Staff
Ms. Clare (Suzanne) Rosser is the Senior Academic Advisor and office contact for undergraduate students in the Department. She schedules and arranges new student conferences and student registration. Ms. Rosser has access to and reports on student records and performs pre-registration meetings and degree audits for students each semester. Ms. Rosser orders textbooks for all classes, and handles class rosters, grade reports, course requests, and teaching evaluations. Suzanne also schedules all undergraduate and graduate course and labs each semester, and coordinates with other departments for enrollment in Geology and Geophysics.
courses. Suzanne coordinates the GEOL 180 Geology for Freshman and Transfer Student Class, arranging speakers and participating in the fieldtrip. Suzanne also works with the student organizations to schedule their events, and she is the supervisor for student workers in the advising office.

Ms. Trisha Fike is the office contact and advisor for the Department’s graduate students. Ms. Fike offers administrative support to the department’s Graduate Program Coordinator and the Graduate Recruiting and Admissions Committee. Ms. Fike has access to and reports on student records and meets each semester with every graduate student and prepares degree audits for students as they approach graduation. Ms. Fike maintains all graduate student files, prepares class schedules and assigns classrooms to all lecture and lab courses.

Part-time student workers are hired, either through the university’s work-study program or independently, to answer phones and assist visitors to the advising office. Student workers are asked to distribute mail, photocopy class materials, send faxes, work on files, search the internet for information, run errands, and perform a variety of jobs, as requested.

We are proud of our department’s office and advising staff. The Department of Geology and Geophysics is the largest academic unit of the College of Geosciences, and the numbers of faculty and students have grown since 2010, with a very small increase in staff numbers. The office staff members are experienced and dedicated, but they are at their capacity to fulfill their College duties, and support faculty and student activities. We are concerned about staff retention. Career development of TAMU staff within the department has improved, but it is generally thought that promotions are more readily achieved by changing academic units. We would like to offer our staff career development training, which will allow reclassification of staff positions and promotion of staff members. Looking to the near future, we will be hard pressed to maintain our academic programs, support new research programs, and assist junior faculty in new research endeavors if we are not able to retain the capable staff members that we need.

**Technical Staff**

Adlocs of our information technology (IT) staff were shifted from the Department of Geology and Geophysics to the College of Geosciences more than five years ago. The department lost its two IT staff members, Steve Tran and Mr. Ryan Young, since the last
review. These IT personnel were replaced by Ryan Baldauf, and Mark McCann, from the College IT team. Ryan has now rotated back to the O&M building and Chris King, a micro-computer expert is working in our building. Offices for IT staff were retained in the Halbouty Geosciences Building, and day-to-day interactions between IT staff and students and faculty remain strong and effective. Owing to the expertise and positive work spirit of our IT staff, support of the department’s computational facilities, network, and servers is excellent. Compared to the private job market for IT professionals, our IT staff is severely underpaid, and so retention and recruitment are always a concern in this area.

Luz Romero was hired in 2011 as the laboratory manager to support the College of Geosciences Radiogenic Isotope Laboratory. Luz is responsible for the maintenance and operation of the ultraclean laboratory and the ICP mass spectrometers in the R. Ken Williams Radiogenic Isotope Geosciences Laboratory.

The Department’s facilities manager is Sean Stroyick, he is responsible for security, maintenance, health, safety, and inventory of the Halbouty building. Sean is an employee of the College, with his permanent office in the O&M building. Sean is assisted in our department by the assistant building proctor, Allayne Babin who works in the business administrative office.

**Geology and Geophysics Advisory Council**

The Department has benefited from interactions with the department’s Geology and Geophysics Advisory Council (GEODAC), from technical seminars offered by industry experts, and from on-campus industry recruiting for jobs and internships. Our students have benefited through undergraduate scholarships, graduate scholarships and fellowships, industry support of field courses, support of the department’s seminar, and industry-university research collaborations. GEODAC is made up of former students and representatives of potential student employers (Table 1.1). Membership of GEODAC is determined by nomination and election and based on leadership in energy and environmental industries, academia and professional societies. Members serve for one to two three-year terms. The stated goal of GEODAC is to help the Department “build a geoscience community of students, staff, and faculty who excel through collaborative pursuit in teaching and research.”
In each of the last three years we have met with GEODAC in regular meetings held twice a year and extra meetings called as needed. Strategic planning workshops with GEODAC led to 1) development and adoption of a set of core values, 2) focused evaluation and development of our strategic goals, 3) significant fund raising that enabled the establishment of the Berg-Hughes Center, 4) new scholarships and fellowships, and 5) support of field courses. Members of GEODAC have even helped the department arrange for collaborative teaching with Ph.D. scientists from industry who provided lectures and seminars with rich, restricted-access datasets for our students. GEODAC Chair Matt Hammer is an alumni who has brought personal energy and passion to assist the department.

Table 1.1. Geology and Geophysics Advisory Council Fall 2017

<table>
<thead>
<tr>
<th>Member Name</th>
<th>Position/Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR. WILLIAM (BILL) BARKHOUSE</td>
<td>SEG ASSOCIATE EXECUTIVE DIRECTOR</td>
</tr>
<tr>
<td>KAMLESH LULLA</td>
<td>DIRECTOR FOR UNIVERSITY RELATIONS - NASA</td>
</tr>
<tr>
<td>DR. LEE BILLINGSLEY</td>
<td>ABRAXAS PETROLEUM CORP.</td>
</tr>
<tr>
<td>DR. JOHN BRYANT</td>
<td>PRESIDENT - BRYANT CONSULTANTS</td>
</tr>
<tr>
<td>JEFF FITZGERAL</td>
<td>PRINCIPAL, JACOBS ENGINEERING</td>
</tr>
<tr>
<td>DR. RICK GIARDINO</td>
<td>PROFESSOR, PAST CHAIR G&amp;G</td>
</tr>
<tr>
<td>KAREN GLASER</td>
<td>RETIRED FROM SCHLUMBERGER</td>
</tr>
<tr>
<td>MATT HAMMER (CHAIR)</td>
<td>EXPLORATION MANAGER, ROYAL EXPLORATION</td>
</tr>
<tr>
<td>JOHN HASTINGS</td>
<td>PARTNER/EXEC VP PALOMA RESOURCES</td>
</tr>
<tr>
<td>RICK HAUT</td>
<td>SENIOR RESEARCH SCIENTIST HARC</td>
</tr>
<tr>
<td>WALTER (WALT) HUFFORD</td>
<td>DIR. US GOVT. AFFAIRS, REPSON</td>
</tr>
<tr>
<td>DR. BARRY KATZ</td>
<td>TEAM LEAD CHEVRON ENERGY TECHNOLOGY CO.</td>
</tr>
<tr>
<td>CHANS LERCH</td>
<td>GEOSCIENCE MGR. BHP BILLITON</td>
</tr>
<tr>
<td>ZACH LEVIN</td>
<td>ACCOUNT MGR. PARADIGM</td>
</tr>
</tbody>
</table>
Some of our Ph.D. graduates are now faculty at colleges and universities while others are employed by national laboratories. Our reputation for environmental geosciences is much more recent, and we have fewer (mostly younger) graduates who are employed as environmental geoscientists. While we strive to continue strong programs in applied geosciences, we would like to increase the number of students who pursue academic careers and focus on questions of fundamental understanding and importance. As a result, we have sought advice of our council, both to maintain traditional strengths as well as build new strengths.
1.4 FACILITIES

The 2010 External Review concluded that the Department was well situated in the Halbouty Geosciences Building with pleasant open spaces, excellent teaching facilities, state-of-the-art computational facilities, and a unique rock mechanics laboratory. The Department’s research facilities were considered excellent in a few research areas and adequate in a wide range of fields. It was recommended that we improve our analytical capabilities through acquisition of state-of-the-art instrumentation and consider building shared facilities rather than invest in many single-PI laboratories. Significant developments have allowed us to follow this advice, and we have built new environmental geology and geobiology laboratories, and state-of-the-art geochemistry laboratories, which are College of Geosciences facilities that enable radiogenic and stable isotopic studies by faculty and students of three departments. Faculty and students of the Department of Geology and Geophysics also have access to research laboratories and facilities within the department, college, and university. Many of our laboratories are run as shared facilities, with access limited only by safety considerations and training in lab practice and competent use of sensitive instrumentation.

The Halbouty Geosciences Building, is one of the older buildings on campus (constructed as part of the Agricultural and Mechanical College of Texas in 1932). A new wing added in 1984 resulted in its current size of 7060 square meters. Classrooms of all sizes are available for courses from the 170-student-capacity Dudley Hughes Lecture Hall to small, graduate seminar rooms. We have a large number of teaching laboratory rooms; yet, owing to the large numbers of Geol 101 lab sections we offer, these lab rooms are in use throughout most available hours of the week.

Most classrooms now offer modern instructional technology, thanks to Classroom Instructional Technology (CIT) funds, including digital projectors, computers and/or computer hookups, and internet access. A building security system provides faculty, student, and staff access during evenings and weekends provided by ID card readers. The building’s roof was sealed in 2009 and its exterior was cleaned and sealed in 2013.

The main lecture room, Halbouty 101, the Dudley Hughes ’51 lecture hall was completely renovated in the summer of 2017. This lecture room received two new projectors, new
chairs, a state-of-the-art presentation podium, new ceiling fans, lighting, new walls, new flooring, and its wonderful stained glass windows will be cleaned, repaired and sealed. The lecture hall and the bathrooms that service handicapped students were updated and reconstructed to be ADA compliant. This update cost the University nearly $1M dollars.

There are a number of centers, research laboratories, programs, and other academic units we interact with frequently that are described in great detail in Appendix B, whereas some of these are described here briefly. We continued to upgrade our computational facilities for geophysical data analysis, high speed and 3D visualization, and numerical modeling, and were pleased to complete an overhaul of Halbouty 65, the seismic teaching lab in the summer of 2016. However, the building’s infrastructure to cool our computational facilities has not been upgraded, as college priorities shifted to support a centralized computational data center. Excellent new environmental geochemistry and geobiology laboratories were initiated in the Department and several research-grade optical microscopes with high-resolution image capture capabilities were acquired. Sedimentary geology laboratories and many core facilities were rebuilt in support of research in the new Berg-Hughes Center. However, the John Handin Rock Deformation Laboratory, established over 40 years ago, is in need of major upgrades.

A state-of-the-art radiogenic isotope geochemistry laboratory, the R. Ken Williams Radiogenic Isotope Geosciences Laboratory was established in the Halbouty Building, is a college-wide asset and was endowed through a major contribution to the College (Appendix B). The stable isotope laboratory that was in the Halbouty Building in 2010 was moved to the Oceanography and Meteorology Building, combining its capabilities with those of other laboratories of the Departments of Oceanography and Geography. This college-wide laboratory now features three mass spectrometers, two of which are recent acquisitions. During the spring of 2017 the Department also acquired, with funds from the Chancellor and successful NSF submissions five new mass spectrometers. Three of these machines will be housed in the Radiogenic Isotope Laboratory, but two others will be the SIGF facility in O&M. Excellent electron microscopy, surface analysis, and CT-scanning facilities are available in centralized on-campus facilities and maintained by excellent technical staff. A 3D visualization laboratory funded as a university-wide facility is housed in the Halbouty Geosciences Building.
Despite some of the improvements just described, some classrooms and teaching labs suffer from deferred building maintenance and lack of funds to replace aging furniture. Frequent plumbing failures have threatened computers and laboratory instrumentation, and poor temperature regulation has led to excessive energy usage and unpleasant conditions in classrooms, labs, and offices. We describe centers, research laboratories, programs, and other departments we interact with frequently across the campus in Appendix B.
1.5 FINANCES

Overview
Department personnel expenditures for the last five years are summarized in Table 1.2, from the fall semester of 2013 through the spring semester of 2017. In 2013, the department was through with its Faculty Reinvestment; the number of positions had decreased from 33 to 22. Total budgets listed for faculty salary include only the nine-month academic salaries paid by State funds; they do not include salary paid by research grants over the summer, or salary supplements paid to faculty teaching the summer Geology Field course (Geol 300).

As agreed upon with the College of Geosciences administration, additional salary support of 2:1 (get paid for two weeks for every week worked) is provided for faculty and teaching assistants for Geol 300. Rapidly increasing geology majors in the department, have challenged us to meet the needs of this course. In summer 2010 enrollment was 44 and in the summer of 2017 we instructed 119 students in three separate field camps. For the last six years the Department has received a generous donation from Chevron in support of undergraduate student Summer Field Scholarships ($500-1000/student/year), and to offset the cost of graduate student salaries. The salaries of faculty come from State funds (in excess of allocations listed in Table 1.2). In the future differential tuition fees should help offset the costs of the summer field program.

Faculty salary represents the largest fraction of the Department’s budget allocated by State funds; yet, faculty salaries at Texas A&M University are typically slightly lower than of faculty at peer institutions. TAMU’s Vision 2020 Report identified fifteen state universities (Table 1.3) that were regarded as peers or target institutions we would like to resemble. At the time of the last program review, 9-month salaries of faculty in the Department were significantly below the average of similar-rank faculty at peer institutions (based on the Faculty Salary Survey by Discipline conducted by Oklahoma State University). In 2010 GEPL salaries trailed peer group salaries by 20% for Professors, and 11% for both Associate and Assistant Professors, and GEPL had the second largest overall discrepancy out of 60 TAMU departments studied. By 2016-17, these discrepancies have grown even larger, to 30%, 17% and 18%, respectively (Table 1.4). Again, GEPL has the lowest salary relative to peer-group (74%) than all other studied departments, except for Oceanography. Overall Texas A&M salaries (all rank) are at 95% of peer group faculty. This discrepancy is puzzling given that the department’s ranking (23rd of departments at US Universities; U.S. News and World
Report, 2016) is slightly better than Texas A&M’s overall ranking (27th of public universities; U.S. News and World Report, Sept. 2016). In the past academic year, the college executive committee recognized excellence and provided a 5% equity raise for all assistant and associate professors. However, we need to determine a long-term mechanism to increase faculty and graduate student pay or we risk losing some of our best young geoscientists.

Research funding generated by the Department is discussed in Chapter 3. Additional financial disclosure about scholarships and fellowships distributed through the Department are described in Chapter 4.

Table 1.2. Expenditures of the Department of Geology and Geophysics on Personnel for 2013-2017

<table>
<thead>
<tr>
<th>PERSONNEL</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACULTY (9 MOS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFESSORS</td>
<td>14</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>ASSOC. PROFESSORS</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>ASSIST. PROFESSORS</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>LECTURERS</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>RESEARCH PROFESSORS</td>
<td>2</td>
<td>2</td>
<td>2.5*</td>
<td>1</td>
<td>2</td>
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<tr>
<td>FACULTY SALARIES</td>
<td>$2,199,842</td>
<td>$2,202,709</td>
<td>$2,695,978</td>
<td>$3,083,219</td>
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<tr>
<td>STAFF (12 MOS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ADMINISTRATIVE/IT</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>9</td>
<td>9</td>
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<tr>
<td>RESEARCH</td>
<td>2</td>
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<td>1</td>
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<tr>
<td>STAFF SALARIES</td>
<td>$244,821</td>
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<td>$213,998</td>
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<td>GRADUATE ASSISTANTS</td>
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<tr>
<td>TEACHING GAT (9 MOS) - FALL</td>
<td>37</td>
<td>64</td>
<td>54</td>
<td>51</td>
<td>42</td>
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<tr>
<td>TEACHING GAT (9 MOS) - SPRING</td>
<td>40</td>
<td>43</td>
<td>42</td>
<td>30</td>
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<tr>
<td>TOTAL TEACHING ASSIST. BUDGET</td>
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<td>$288,620</td>
<td>$503,468</td>
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<td>$585,725</td>
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<td>RESEARCH GAR - FALL</td>
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<td>21</td>
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<tr>
<td>RESEARCH GAR - SPRING</td>
<td>19</td>
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<td>22</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>RESEARCH GAR - SUMMER</td>
<td>4</td>
<td>15</td>
<td>12</td>
<td>17</td>
<td>15</td>
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<tr>
<td>TOTAL GRAD ASSISTANTS</td>
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<td>176</td>
<td>151</td>
<td>151</td>
<td>157</td>
</tr>
</tbody>
</table>

*Guillemette retired in February
### Table 1.3. TAMU Peer Institutions as determined by Vision 2020

<table>
<thead>
<tr>
<th>PEER INSTITUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIVERSITY OF TEXAS</td>
</tr>
<tr>
<td>UC BERKELEY</td>
</tr>
<tr>
<td>UNIVERSITY OF MICHIGAN</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
</tr>
<tr>
<td>UCLA</td>
</tr>
<tr>
<td>UC SAN DIEGO</td>
</tr>
<tr>
<td>UNIVERSITY OF WISCONSIN</td>
</tr>
<tr>
<td>UNIVERSITY OF FLORIDA</td>
</tr>
<tr>
<td>GEORGIA TECH</td>
</tr>
<tr>
<td>UNIVERSITY OF ILLINOIS</td>
</tr>
<tr>
<td>UNIVERSITY OF MINNESOTA</td>
</tr>
<tr>
<td>OHIO STATE</td>
</tr>
<tr>
<td>PENN STATE</td>
</tr>
<tr>
<td>PURDUE UNIVERSITY</td>
</tr>
<tr>
<td>UC DAVIS</td>
</tr>
</tbody>
</table>

### Table 1.4. Faculty Salaries TAMU Geology and Geophysics Compared with Peer University Departments 2016-17

<table>
<thead>
<tr>
<th></th>
<th>MEAN MONTHLY SALARIES</th>
<th>G&amp;G - PEER GEOSCI.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TAMU OVERALL</td>
<td>TAMU GEPL</td>
</tr>
<tr>
<td>PROFESSOR</td>
<td>$16,289</td>
<td>$13,567</td>
</tr>
<tr>
<td>ASSOCIATE PROFESSOR</td>
<td>$11,247</td>
<td>$10,092</td>
</tr>
<tr>
<td>ASSISTANT PROFESSOR</td>
<td>$10,387</td>
<td>$8,969</td>
</tr>
</tbody>
</table>
1.6 LAST APR EXTERNAL REVIEW

The 2010 External Review initiated significant faculty discussion and debate, leading to a faculty retreat and the preparation of a Strategic Plan, which was submitted to the College of Geosciences in 2010 (Appendix A). Additional, informal research seminars were held in order to focus on our research strengths and explore our research opportunities. While the challenge of identifying a single scientific theme for the diverse faculty of the department was not met, several interdisciplinary research areas were identified. These included petroleum geosciences, environmental geosciences, and tectonophysics, all of which were recognized as existing strengths of the department. In addition, we concluded that paleoclimate and continental margins research could flourish, given our affiliations and common research interests with faculty and scientists of Oceanography, Atmospheric Sciences, and the International Ocean Discovery Program. Societal impact was recognized in all of these areas, with applications for energy, environment, and hazards.

The 2010 External Review made nine specific recommendations that are listed below with our subsequent actions.

1. Identify where geosciences research will be directed and move as aggressively as possible to take advantage of the external funding opportunities that will evolve in response to state and national priorities. We identified research themes and made some progress in pursuing external funding but we could do this better.
2. Seek the best balance between academic geoscience (traditionally based on a strong PhD program) and the traditionally strong applied geosciences centered around petroleum geology, environmental sciences, and hydrogeology. We have attempted to balance these two themes as we have AAU aspirations in research, but we also know industries demand some of our best students. We think we are recruiting better graduate students, but we are struggling to see the benefits (e.g., increased scholarly output, increased grantsmanship) from this transition.
3. Continue attempts to re-balance the MS and PhD programs so that the PhD students form a greater proportion of the total graduate student population. We have done this but are struggling to see continuous improved results.
4. Focus on high-priority faculty hires in key areas such as biogeochemistry, field-based physical hydrogeology, reflection seismology and probably two more hires in Deep Crust
and Mantle Dynamics to help tie this diverse group together. We hired a field-based hydrogeologist (Dr. Knappett), two reflection seismologists (Dr. Bobby Reece and Dr. Tominaga), and two faculty in tectonics and mantle dynamics (Drs. Kitajima and Fulton). Additionally, we hired a siliciclastic sedimentologist (Dr. Ewing), a shale sedimentologist/stratigrapher (Dr. Julia Reece), a carbonate sedimentologist (Dr. Laya), a basin analyst (Dr. Perez) and a micropaleontologist (Dr. Belanger). Although we did not hire a biogeochemist this will likely be a priority in our cluster hire proposal we expect to put forth in Spring 2018.

5. Bolster the advising for both undergraduate and graduate students. We hired Suzanne Rosser in 2012 as undergraduate and graduate advisor and she immediately stabilized our advising office. We hired Patricia Fike as graduate advisor in 2016 and she has stabilized that role. We now think our advising office is a strength of our department.

6. Faculty should foster a culture of timely publications of research results by both MS and PhD students in high-visibility national and international journals. We have had some individual success with this, but on the whole we still fall short on this front.

7. Take advantage of synergies within the College of Geosciences with IODP and the Berg-Hughes Center (BHC). We have done some research projects through BHC and Crisman Institute in Petroleum Engineering, that fund research in unconventional resources for graduate students. We also have a number of faculty members that are involved with IODP cruises and data.

8. The department should re-design its undergraduate curriculum to meet the needs of the 21st century. We did this in 2015-2016 and are implementing it fully in the fall of 2017. We think this will become a strength of our department.

9. The department should provide research support (post-doctoral researcher?) for Department Head Andreas Kronenberg so his personal research does not unduly suffer while he remains as head. This was not acted upon directly, but Andreas’s post-doc (Dr. Caleb Holyoke) was supported by Halbouty Visiting Professor funds.

The challenge posed by the 2010 External Review of balancing a M.S. program for professional geology students and a Ph.D. program for research-oriented students was discussed at length. While choosing to focus on one or the other program would have been a simple solution, the faculty concluded that publishable research papers should result from both M.S. and Ph.D. programs. Workshops held with the Department’s advisory council confirmed that communication skills, and the capability to solve challenging new problems are highly valued in industry, just as they are in academia.
The 2010 Review Committee was troubled by the caliber of our graduate students. In response, the faculty resolved to increase its entrance requirements and improve its graduate student recruiting efforts. In addition, the decision was made to attract postdoctoral geoscientists to the Department, making use of earnings from the department’s endowments, with the goal of improving the research environment and providing mentors to our Ph.D. (and M.S.) students. Although we have attracted some excellent post-doctoral researchers we still have not established a vibrant “post-doctoral” culture of increased scholarly research.

The 2010 review concluded that research funding and state-of-the-art analytical facilities were insufficient to reach the objective of Vision 2020 of becoming a top-ten geoscience department. Examination of research funding throughout the Department revealed that funding opportunities are inhomogeneous and that some faculty have more opportunities than others to support their research efforts. Faculty resolved to seek new sources of funding, and to consider funding potential in new faculty hires. Needed improvements to existing laboratory facilities were reviewed and new analytical laboratories in environmental and isotope geochemistry were identified along with needs for technical support.

The Department plays a major role in providing core science courses at TAMU and is attempting to increase the population of underrepresented students in geology and geophysics majors. The Department has worked to build a culture of shared governance, through open discussion, consensus-building, sharing responsibilities on faculty committees, and calling for votes on important matters. Our petroleum, hydrology, and environmental geosciences are intended to meet needs of the state of Texas. Our initial foray into online graduate education is in support of the Department of Geography’s Geographic Information Systems Technology in Petroleum Geosciences Degree. We are teaching two online graduate courses and contributing to another course in this program. By the summer of 2018 we hope to begin rolling out courses in a M.S. of Petroleum Geosciences that will be taught by tenure-track faculty and professors of practice.

A draft of a Departmental strategic plan was presented to faculty by Department Head Rick Giardino (Appendix A) in 2014. This strategic plan included an analysis that outlined many of our strengths, weaknesses, opportunities and threats. A number of critical issues related to Vision 2020 goals in enhancing our faculty and students, diversifying our department,
attaining financial parity, and increasing our commitment to Texas were discussed. An action plan to address some of these issues was put forth, but the faculty never voted on this strategic plan, nor was it widely implemented. However, when possible, Dr. Giardino began to implement specific action items, and Dr. Pope has continued this course.
1.7 ANALYSIS OF DEGREE PROGRAM

As you initiate your review, please know that we wish to benefit from your insights, some of which may confirm our own self-evaluation, and some that we may not have recognized. We think that the Department of Geology and Geophysics balances its commitments to education, research, and service fairly well. We are interested in knowing whether you think that balance has been achieved, and whether we can achieve greater excellence by our continued approach. Ultimately, we seek your independent evaluation and your impressions of our opportunities.

We provide a simple Strength, Weakness, Opportunity, and Threats (SWOT) Analysis here of the most important elements in each category.

Strengths:
1. Outstanding faculty, many of them at early career stages.
2. Outstanding undergraduate curriculum, undergraduate, and graduate students.
3. Broad research portfolio that values and tries to balance our AAU aspirations for fundamental research with our applied research.

Weaknesses:
1. Culture of research publications and post-doctoral fellows not fully established and implemented.
2. Culture of haves versus have-nots produces unresolved friction

Opportunities:
1. Hiring more post-doctoral researchers and Halbouty Visiting Scholars should lift our research productivity and help grow our culture of increased scholarship.
2. Undergraduate research through new capstone course or other research programs may lead to increased opportunities for research funding, publications, and increased opportunities for mentoring between graduate students and undergraduate students, and faculty and undergraduate students.
3. Increasing demands for collaborations with institutions outside the United States (China and Mexico).
Threats:
1. Losing/retaining young faculty members through lower salaries, retention or other issues.
2. Losing our balance of applied and fundamental research.
3. Less Teaching Assistant support due to core curriculum changes.

These are exciting times for our department, with the realization of many new faculty hires in our department. Over a time period in which faculty hiring has been limited at many institutions, we have interviewed and hired some of the finest Earth scientists available in new areas of research, in addition to replacing key faculty in our traditional areas of strength. We are proud of our new faculty and their early career accomplishments. We have also augmented these tenure-track faculty hires by hiring a number of Professors of Practice, instructors with real-life experiences, especially in the petroleum geosciences. These faculty members provide a wealth of knowledge that we think is extremely beneficial to our undergraduate and graduate students. However, the growth in our tenure-track faculty numbers was recently checked somewhat by faculty losses, and a hiring freeze in effect in 2017.

More than ever, we recognize new opportunities to solve problems related to energy, environment, and climate as concerns about peak global oil production, water resources, contaminants, and sustainability of modern life are heightened. In the last four years we have hired faculty members in siliciclastic sedimentology, carbonate sedimentology, shale sedimentology and stratigraphy, basin analysis, field hydrology, tectonics, earthquake physics, seismology, and micropaleontology. We have excellent faculty and students engaged in environmental geosciences, and we are committed to building this program in the context of the university's interdisciplinary water program and the college's emphasis on environmental geosciences. We have outstanding geoscientists examining the geologic history of climate change and its biotic response, and we have established new geochemistry laboratories for stable and radiogenic isotope studies. Texas A&M has a long standing strength in tectonophysics and rock mechanics, and recent studies of deep crust and mantle processes have involved interdisciplinary approaches in geochemistry, mineral physics, and geophysics. In addition to basic science questions of these fields, application of these learnings include reservoir rock characterization and earthquake source mechanisms.
We are proud of our students, and we expect a great deal of them. Our undergraduate B.S. programs in geology and geophysics emphasize fundamental geological disciplines, rigorous math and science backgrounds, hands-on learning in field, laboratory and problem-solving courses, and undergraduate research opportunities. Over a two-year period from 2015-2016 we totally revamped our undergraduate curriculum and it is being implemented fully in Fall 2017. Our graduate M.S. and Ph.D. programs emphasize independent research, underpinned by advanced coursework and faculty advising. Students in the Department benefit from significant numbers of scholarships and fellowships generated by industry contributions and alumni endowments. In addition, the Department supports many graduate students as teaching assistants, through our commitment to core courses that fulfill broadening requirements of non-science majors. Assessments of our programs reveal that placement of our undergraduate students in graduate programs is excellent, and many of our students, graduate and undergraduate, benefit from summer internships. Placement of graduate and undergraduate students in geoscience careers, both in the energy and environmental industries, is good.

The Department of Geology and Geophysics also faces a number of challenges. While many faculty members have an excellent record of publication, we are not satisfied by the publication record of our graduate students. For those students beginning industry careers, this is not a serious limitation; for students wishing to pursue careers as college or university faculty, this is a problem we must continue to address. We have improved our recruitment of outstanding Ph.D. students capable of, and interested in, careers as faculty and research scientists. With greater numbers of students who publish their research and entertain academic careers, we expect the intellectual experience of all students in our department will be elevated. In addition, increased participation by students in publication should contribute to increased research productivity of our faculty. We actively recruit graduate students at all levels, but over the last eight years our percentage of Ph.D. students has risen from ~ 33% to > 50%, and this brings its own challenges such as funding students for longer periods of time.

The Department has a number of faculty members whose research is well funded. However, averaged over the entire department, we have not achieved the level of extramural funding we would like. Research funding is important, not only for the work itself, but to increase the number of graduate student research assistantships we are
able to offer. We think that increased availability of research funding would increase the number of excellent Ph.D. students we can attract to our department, and would give students, currently funded as teaching assistants, more time to dedicate to research and publication.

With the Department’s reputation in petroleum geosciences, its connections with the energy industry, and fluctuating energy costs, the student numbers in our department have fluctuated dramatically, particularly in our undergraduate programs. Our increasing student numbers challenge us to maintain the quality and rigor of our program. We have doubled the number of lecture sections and labs for key required courses so that the core undergraduate courses (historical geology, introduction to mineralogy, petrology, paleontology, sedimentology and stratigraphy, structural geology, etc.) are now taught every semester to make sure our undergraduate students don’t spend too long getting their degrees. Enrollment in some of those sections grew to over 100, and we gave faculty extra teaching credit for those, in order to encourage maintaining the high standards and faculty engagement we have had in smaller courses. We have worked hard to improve our undergraduate curriculum to address cutting-edge scientific questions, and to coordinate our courses better, and provide a better learning experience for the students.

The Berg-Hughes Center for Petroleum and Sedimentary Systems has increased our stature in applied petroleum geosciences. However, the low cost of petroleum has hampered our efforts to fully fund the center at the level we expected, and build its interdisciplinary capabilities. We also wish to build our environmental geosciences program, and our Life, Climate, and Earth history program while maintaining current strengths in geophysics, geochemistry, and tectonophysics.

We think the Department’s 2010 Strategic Plan and many of the action items in the 2014 Draft Strategic Plan align well with the strategic goals and priorities of both the College of Geosciences and Texas A&M University. We strive to be an upper tier Geology and Geophysics program that molds outstanding student scholars, and produces cutting-edge research that addresses persistent problems in the state of Texas (e.g. energy, water, environment). One of our greatest challenges is to balance the needs of increased rankings (i.e., international recognition, increased external funding) with the needs of the state (e.g. increasingly interdiscipline students, increasingly technologically adept students, increasing demands on energy and water resources).
Our 2010 Strategic Plans outlined specific action items to keep us on a path toward reaching our goal of becoming a top tier Geology and Geophysics program: hire new faculty (at many levels) in relevant, high-priority interdisciplinary fields; increase the quantity and quality of PhD students; bolster our advising; publish our (faculty and student) research in a more timely manner; take advantage of synergies within the College and across the campus; and re-design the curriculum. Similarly, the Draft 2014 Strategic Plan action items included: create a more flexible teaching schedule; hire multiple professors of practice; increase mentoring of faculty; make more high-impact learning experiences available for our undergraduate students; fully fund all teaching positions for field camp and provide field camp scholarships; diversify and globalize the department; attain resource parity with top tier Programs; establish distance learning offerings; and ensure continued funding for G-camp.

Three examples of improvements made since the last external review are outlined below:

1. increase the quantity and quality of PhD students
2. bolster our advising
3. Chevron sponsorship of field camp.

Since 2010 our percentage of PhD students has almost doubled, rising from ~33% to >50%. This has been very good for our department as our classes are typically more involved. These students have bought into a publishing mindset, commonly completing 3-4 papers for their PhD, some publishing in Nature and Science. However, the increased departmental support for PhD students is turning out to be a double-edged sword: with total funding for graduate students flat or decreasing, the longer tenure of PhD students means we may need to decrease the input rate of new students. Additionally, we are trying to balance the need for more PhD’s with industry needs in applied Geosciences that preferentially seek M.S. or undergraduate students. So this “experiment” in increasing PhD students has definitely brought us some great new students, but we are still striving for the optimal balance between research and training in our graduate program.

In 2010-2012 our student numbers (both undergraduate and graduate) were increasing but were much smaller than currently, however, our advising office was in a shambles because we had lost a long-term undergraduate advisor and we went through a series of short-lived replacements. In 2012 we hired Suzanne Rosser who stabilized our advising office and immediately times to degree decreased, our course offerings were streamlined,
prerequisites were enforced, and she made transfer students and freshman a priority in recruiting and retention. So while our enrollments are currently dropping we think the students we have now are better prepared and progressing better because of Suzanne's care for the students. Suzanne was recently rewarded for her success by earning the College advising award, and the TAMU Presidential Service Award, the highest staff award on campus. We hired Patricia Fike in 2016 to advise our graduate students and she is also beginning to see some similar successes. So we think our advising office is currently in a good place, but we are constantly on the look out for ways to retain both of our advisors.

We pride ourselves in providing a comprehensive field camp experience for our undergraduate students. This course is 4-6 weeks in duration and allows our students to map and study igneous, metamorphic, and sedimentary units. Beginning in 2010 the funding for Teaching Assistants for the field camp courses was transferred from the College to the Department. About this same time Chevron was in negotiations with the Department to determine ways they could support us, and they decided to provide funds to support the field camp. Their support not only pays for the teaching assistants but provides scholarships for the field camp students. This type of private sector support was critical to keeping the field camp running and has continued to this day, even as we taught nearly 120 students this past summer. The undergraduate students began paying a modest increase in differential tuition (an enhancement over University tuition) in 2017 that should help cover the costs of field camp.

We think these three examples provide success stories where we were able to follow the recommendations of the external review that help us make our program better.
ACADEMIC PROGRAMS AND CURRICULA

2.1 PROGRAMS OFFERED

Undergraduate Programs
The Geology and Geophysics Department (GEPL) offers three undergraduate degrees: the B.S. in Geology, the B.S. in Geophysics, and the B.A. in Geology. An Engineering Geology Option (EGO) to the B.S. in Geology was recently phased out, with the last handful of EGO students graduating in 2013. Our philosophy for the B.S. degrees is to require a sufficiently broad grounding in both fundamental geology and geophysics, along with rigorous mathematics and physics requirements, so that our graduates can enter a graduate program with the background to be strongly competitive.

The curriculum provides a pathway for students to develop skills to ensure their success as potential leaders of the next-generation geoscience workforce. A well-designed curriculum is built around learning outcomes. The learning goals for our graduates are divided into five technical competencies and six professional skills.

The five technical competencies are:
1. Evaluate how Earth materials control and interact with Earth system processes (*Earth Materials*)
2. Infer the state and evolution of the global Earth system from observations and modeling of fundamental physiochemical and biological processes (*Earth Dynamics*)
3. Recognize the variability and interdependence of Earth's geosystems through time and space across multiple scales (*Space & Time*)
4. Analyze data and develop conceptual and quantitative models to better understand geological systems (*Models and Data*)
5. Interpret how Earth's surface is shaped by its interactions with the atmosphere, biosphere, hydrosphere and geosphere (*Earth System Processes*)

The six professional skills are:
1. Demonstrate *Critical Thinking* through their analyses of data
2. *Communicate* effectively the results of analyses in multiple formats
3. Practice personal and social *Responsibility*
4. Demonstrate social, cultural and global *Competence*
5. Engage in *Lifelong Learning* to constantly refresh and revitalize their knowledge base
6. *Collaborate* effectively in group settings
The Department also does significant amounts of instruction to non-science majors for University Core science credit, but also to students majoring in related programs such as Civil Engineering, Environmental Science, and Petroleum Engineering.

**Graduate Program**

The Department of Geology and Geophysics offers several graduate degrees including the MS in Geology, MS in Geophysics, PhD in Geology, and PhD in Geophysics. The MS is a 32-hour program, which includes a thesis requirement. The PhD is either a 64-hour program for students with a masters or a 96-hour program for students entering directly from the baccalaureate. Faculty can also advise graduate students enrolled in MS or PhD degrees in Water Management and Hydrologic Sciences. The MS programs prepare students for careers in industry and public practice, mostly in fields related to energy, water, and the environment. The PhD programs are intended to provide students with expertise to teach and to lead original research in academia, government and industry.

The Department’s graduate programs require students to demonstrate both depth and breadth: deep disciplinary expertise coupled with broad knowledge of geology and/or geophysics. Expertise is developed through the student’s thesis or dissertation project, while breadth is developed through courses, seminars, field trips, informal “hallway” discussions, and social activities. Some programs within our degrees, such Geophysics, Tectonophysics, and the Petroleum Certificate, facilitate the breadth requirement via required or strongly recommended classes.

Students focus much of their attention on developing core technical competence within their specialty, but also apply their knowledge and skills to new and emerging scientific questions and socioeconomic concerns. Our graduates approach new challenges with flexibility, as lifelong learners with strong problem-solving and critical thinking skills.
2.2 PROGRAM CURRICULA

Undergraduate Program Curriculum

In the summer of 2014 the Curriculum Study Group, comprised of GEPL faculty and graduate students and curriculum development experts at TAMU’s Center for Teaching Excellence was formed to revise the curricula of the two B.S. degrees. The pre-2017 curriculum was adopted in 1997. This committee gathered data from faculty, current and former students, employers, and grad schools to determine the skills needed and the strengths and weakness of the current program. A detailed set of course-level learning objectives was developed and a new outline of courses was approved at a faculty retreat in October 2015. The revised curricula first appear in the 2017-18 catalog; however, 2016 freshmen are also following this revision, so we expect the first graduates of this curriculum in Spring 2020.

The new curriculum addresses several deficiencies, in addition to modernizing courses and eliminating redundancies. Our surveys identified written and oral communication as the skills that needed the most improvement in our curriculum. The most prominent additions to the curriculum involve: 1) standardized and re-imagined instruction in written and oral scientific communication; 2) a better distribution of field experiences throughout the degree with enhanced opportunities to gain experience with modern geologic mapping tools such as GPS and GIS; 3) participation in a group research experience. New required courses include a first-semester seminar (based on a successful seminar for transfer students developed by our academic advisor) that introduces students to faculty and University life and resources; majors-only versions of the first-year sequence; a second-year writing-intensive course; a writing- and speaking-intensive group research course with rotating topics; and modernization of the upper-division geophysics curriculum.

The outlines of all degree’s (pre- and post-2017) are listed in Appendix D, along with a brief description of all undergraduate courses.

Our degree with the highest enrollment is the B.S. in Geology. Of the 120 credit hours, 45 are in required Geology and Geophysics courses, and 30 are in supporting science and math courses. We believe that the mathematics (through differential equations), chemistry, and physics requirements make our Geology program amongst the more rigorous in the US. Seven credit hours of the curriculum are devoted to field technique, including a week-long field trip in GEOL 250 and a 3-4 week summer mapping course taught by TAMU faculty.
The B.S. in Geophysics supplements most of the fundamentals of the B.S. in Geology with expanded mathematics and physics requirements and specialist geophysics courses. Of the 120 credit hours, 38 are in Geology courses, 20 are in Geophysics courses, while supporting science and mathematics courses comprise 36 hours. The two B.S. degrees are nearly identical in the first two years, so that students can discover which discipline best suits their aptitude and career interest.

The B.A. in Geology was designed to be a flexible degree program for students who are seeking to apply fundamentals of geology toward a career in a non-science field, such as science journalism or environmental law. Of the 120 credit hours, required Geology and Geophysics courses comprise 46, supporting science and mathematics courses comprise 22 hours, and 15 hours are used for a concentration that is designed by the student in conjunction with the academic advisor. We have been discussing new models for reinventing the B.A. so that it becomes compatible with the 2017 curriculum and the needs of the next-generation geoscience workforce.

All three of our undergraduate degrees can be taken as part of a 5-year program in conjunction with the Department of Oceanography’s Master in Ocean Science and Technology (a non-thesis degree). The undergraduate requirements for the 5-year degree are identical to the standalone programs, except that elective classes are filled with Oceanography courses in preparation for the graduate specialization. These degrees are relatively new, and none of our students have yet matriculated.
Other Undergraduate Teaching

Two of our undergraduate courses, GEOL 101 Foundations of Geology and GEOL 106 Historical Geology, can be taken for University core science credit. From the late 1990’s to 2014, these courses were very popular and made up a large fraction of GEPL teaching. Due in large part to changes in the structure of the state-mandated Core Curriculum the demand for these classes has dropped dramatically. Prior to the 2014 academic year, all TAMU students were required to a 4-hour (lecture + laboratory) course, from a restricted list of 11 courses (most of them various versions of introductory Physics, Chemistry or Biology). A large fraction of non-science and non-engineering majors (primarily from the Mays Business School and the colleges of Architecture, Education and Liberal Arts) used GEOL 101 for their science credit. In 2010, 1966 students took GEOL 101, while there were a total of 2125 freshmen in the four target colleges). Exactly 50% of all GEPL Student Credit Hours (SCH) during that year came from GEOL 101.

Since 2014, the University no longer requires lab courses. Therefore most non-science students now take three 3-hour courses. While the pool of students needing a Core science course doubled from 2010 to 2016, now five different colleges offer 57 Core science courses. Predictably, the enrollment in GEOL 101 has dropped by about a factor of two, to 894 in 2016-17. GEOL 101 and GEOL 102 produced less than 19% of the GEPL SCH total in 2016-17. In addition, GEOL 106 was once one of a larger set of secondary Core science courses, and was once taken by 250-300 non-GEPL students each year, and has dwindled to less than 100.

In 2016, following the lead of other Core science courses in the College of Geoscience, GEOL 101 was split into a 3-hour lecture course and a new 1-hour lab course (GEOL 102). In Spring 2017, we also introduced an online section of GEOL 101. Enrollment in the lecture sections has continued to drop, although these measures may have slowed the decrease. The enrollment in introductory lab sections, an important source of graduate student funding for our department, has plummeted. Because this decrease occurred while the number of GEPL majors was growing (Figure 2.1), total lab sections remained relatively stable up to 2016-17. However, as the number of majors begins to decrease, overall TA support is expected to decrease.

The Department is considering options for new course offerings for the core curriculum that might be more attractive, focusing on socially relevant or interesting topics like energy, hazards or evolution. Getting new courses approved into the Core Curriculum and building an enrollment base for them will be a several year process.
The other pool of students seeking credits in Geology and Geophysics are Engineers, in particular Civil Engineering and Petroleum Engineering (PETE) majors, who frequently minor in Geology. The PETE curriculum currently requires GEOL 104 and GEOL 404 (Petroleum Geology), while Geol 312 and Geol 306 are commonly chosen as technical electives. The 2017 curriculum moves GEPL majors out of GEOL 104, so that that course can be modified to better serve the needs of the enrolled engineers.

![Figure 2.1. Teaching Assistants](image)

Recent and projected number of graduate students supported as Teaching Assistants, broken down by type of course. “Geol 101/102” includes only TA’s for the Core-approved introductory science course. “Other non-GEPL majors” includes courses that have a significant enrollment from non-GEPL majors (Geol 104, Petroleum Geology (404), Environmental Geology (420) and Hydrogeology (410)). “GEPL majors” includes courses designed for majors. Between 2014 and 2016, section sizes were increased and number of sections per TA increased for some classes, which prevented the number of required TA’s from growing far beyond the money allocated for them.
Graduate Degree requirements

Graduate students develop a degree plan in consultation with their research advisor and committee. Courses on the degree plan are commensurate with the student’s career goals and provide essential breadth. Graduate course descriptions are listed in Appendix E along with theses and dissertations published between 2010-2017.

Master of Science

By university requirement, our MS Programs help students develop new understanding through research and creativity. A total of 32 credit hours of approved coursework and research are required, with 21-23 hours of formal graded coursework, two credit hours of seminars, and a nine hour residency requirement. Each student engages in research under a faculty advisor, who is also a member of the graduate faculty, and an advisory committee of two or more other graduate faculty members. One of these members must be from outside the department. Persons outside the university with relevant expertise may serve on a graduate committee by special appointment.

Students file a degree plan and thesis proposal with the Office of Graduate and Professional Studies (OGAPS), defend their thesis in a public oral examination conducted before the advisory committee, and then submit their final, corrected thesis to the Thesis Clerk for final approval.

Doctor of Philosophy

By university requirement, our PhD Programs give students thorough and comprehensive knowledge in an academic discipline. The successful doctoral student demonstrates ability to perform independent research and express thoughts clearly and forcefully, both verbally and in writing. The university requires 64 credit hours (96 hours if the student does not have an MS degree) on an approved degree plan that includes formal coursework, seminars, and nine residency credit hours. The Department strongly recommends that Geophysics PhD candidates take four core courses, GEOP 611, 652, 660, and 666. The student’s graduate committee must include four members of the graduate faculty, one of whom is from another department. Outside persons with relevant expertise may serve on a committee by special appointment. Doctoral candidates must pass a preliminary examination, which consists of written and oral components. Students file a research proposal and complete their degree by passing a public Dissertation Defense examination, and filing an approved PhD Dissertation with the Thesis Clerk.
Petroleum Certificate
To expand their competitiveness in petroleum geosciences, students may pursue the Petroleum Certificate, which can be applied to a MS or PhD diploma in either Geology or Geophysics. The Graduate Certificate in Petroleum Geosciences does not substitute for a MS or PhD degree, nor partially satisfy the thesis or dissertation requirement. Rather, it indicates preparation for careers in the energy industry through core courses, seminars, internship presentations, and enrichment activities. The certificate is awarded on completion of the MS or PhD degree.
2.3 ADMISSIONS CRITERIA

Undergraduate
The Department does not have much control over undergraduate enrollment, since freshmen are admitted by TAMU Admissions, and transfers are admitted by the College of Geosciences (although we now have direct input into the latter decisions). Students graduating in the top 10% of a Texas high school class are guaranteed admission into TAMU. Between 64 and 73% of applicants are admitted, and about half of admitted students choose to enroll. Applications, and therefore enrollment, strongly tracks employment prospects in the oil and gas industry. Standardized test scores for our enrolled freshmen have stayed consistent over the last seven years, with average SAT scores in the 76th percentile, while average ACT score are around the 88th percentile.

Undergraduate recruitment efforts are mostly done through the College of Geosciences, along with Department participation in on-campus recruitment events. Each year, GEPL offers $80,000 to $100,000 in endowed scholarships to prospective freshmen. These scholarships are openly competitive, with awards based on a combination of academic merit and financial need. Typically, about half of those offers are turned down, with the retained funds going toward scholarships for continuing students.

Graduate Recruitment and Admissions
The graduate admissions committee is chaired by the Associate Department Head for Graduate Affairs (currently Dr. Mark E. Everett) and comprises 6-7 faculty members drawn from across academic disciplines and ranks. At the present time, junior faculty hold the majority voting bloc which we view as appropriate since our junior faculty shape the long-term future of the department and should have a strong voice regarding the makeup of incoming graduate cohorts. The admissions committee has established, since the last program review, a set of policies and procedures that are annually revised and ratified by the faculty. The current policies and procedures documents can be found in Appendices F and G, respectively.

There are two qualifying criteria that the graduate admission committee determines through their normal meetings and discussions: (a) a positive vote from the graduate admissions committee and; (b) a faculty advisor has been identified, as evidenced by a written statement of advocacy. Details about the voting procedure and faculty advocacy statements appear in the policies document. Additionally, details about a source of support must be identified prior to making an admissions offer to qualified applicants. No qualifying PhD-64 (PhD-96) students are admitted without 8 (10)
semesters of guaranteed support. The normal level of support is 4 semesters for qualifying MS students, although a limited number of unsupported qualifying MS students are admitted.

The university has initiated the Applicant Information System (AIS), which has streamlined the application process and enabled the admissions committee to automatically generate a spreadsheet of the current applicants along with their key information. The spreadsheet is distributed to faculty members who then review it, follow up with application materials in AIS, and hold discussions with prospective students via phone or Skype. The faculty members demonstrate their advocacy with a written statement. The admissions committee reviews the qualifications of the advocated applicants and ranks the qualified applicants, keeping in mind both academic record and the goal of an equable distribution of graduate students amongst the faculty. The department head then determines who can be offered admission according to the capacity of department resources.

To achieve and maintain excellence in the graduate program it is essential that the department attract the best and brightest young scholars, both domestic and international, who have outstanding potential as evidenced by test scores and letters of reference, and also already have demonstrated achievement in research areas that align well with one or more aspects of the wide range of scientific expertise collectively professed by the faculty.

The primary vehicles for recruiting graduate students include: (1) establishing a high-visibility presence at national meetings such as GSA, AAPG, AGU and SEG; (2) hosting an annual recruitment weekend each late February/early March in which the top domestic admitted students are invited to campus; (3) timely awarding our most prestigious fellowships to the top incoming prospects.
Figure 2.2 Graduate Student Admissions
Percentages of graduate student applicants admitted (open circles) and graduate students who accepted our offer and enrolled (star symbols).

Graduate admissions statistics are shown in Figure 2.2 covering 2012-2017. For each semester intake (sp=Spring; fa=Fall) the total number N of applicants is indicated, as well as the numbers of admitted applicants and the number of applicants who eventually enrolled. The latter two are expressed as a percentage of the total number of applicants. We have a much larger applicant pool for the Fall intakes (avg. N=262) than the Spring intakes (avg. N=47). The admission rate has remained between 2012-2017 at 8-10% for the Fall intake whereas the Spring-intake admission rate has fallen from 30-40% to about 15% since 2016. The Spring intake rate generally runs higher than the Fall intake rate in part because Spring applicants tend to be more focused in areas of faculty research interest. A larger fraction of the Fall applicants do not explicitly mention a specific research interest that aligns with a faculty area of expertise. Thus, proportionately more qualified Spring applicants receive faculty advocacy statements than qualified Fall applicants. A proportionately higher number of admitted Fall-intake applicants elect to go elsewhere, although we are still enrolling 67% of all Fall-admitted students. In terms of total numbers of applicants, a peak value of N=344 occurred for the Fall 2014 intake. At this point in time, oil prices were running at record high levels, the "shale-gas" revolution was in full swing, and the popular expectation was that well-paying, long-lasting jobs were abundant for petroleum geoscience degree holders.
The GRE scores (verbal plus quantitative scores on the “new” scale) for incoming graduate students over 2012-2017 is shown in Figure 2.3. The data are sub-divided by degree type and discipline. In all categories, the total GRE scores of incoming students has remained roughly constant, with mean values ranging from 301-318. There is not a discernible relationship between GRE score and degree type or discipline. The quantitative scores of incoming students tend to run a few points higher than the verbal scores.
2.4 NUMBER OF DEGREES AWARDED PER YEAR

The number of B.S. and B.A. degrees awarded have climbed steadily in recent years, while M.S. and Ph.D. degrees are relatively stable at about 20 and 9, respectively. Degrees awarded is discussed further along with enrollment in Chapter 4.

Table 2.1 Degrees Awarded

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<tr>
<th>DEGREE OFFERED</th>
<th>DEGREES AWARDED ANNUALLY</th>
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</thead>
<tbody>
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<td>B.S.</td>
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<tr>
<td>M.S.</td>
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<tr>
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<td>PH.D.</td>
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<td>TOTALS</td>
<td>62</td>
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</table>
2.5 AVERAGE TIME TO DEGREE

Undergraduate Students

The time undergraduate students take to get a degree has been steadily dropping in recent years. Graduates during the 2015-16 academic year who entered as freshmen GEPL majors took an average of 4.01 years (Figure 2.4), with many students finishing in seven semesters. Transfer students take an average of a little over 3 years to graduate after entering TAMU, and this number has also decreased over time. GEPL graduates who changed from another major in TAMU take just under 5 years from the date of entering TAMU.

Figure 2.4 Time-to-degree, Freshmen

Time-to-degree for First-Time-in-College freshmen who enter and finish in GEPL
Graduate Program
We maintain a robust M.S. program that welcomes both industry-focused and academic-focused applicants. The department has deep connections to the petroleum industry with its base in nearby Houston. Industry has indicated they favor M.S. students as entry-level technical hires. Many of our industry-focused masters applicants are cognizant of this, and consequently the department aims to provide industry with a well-trained and adequate geoscience workforce and to provide aspirant petroleum geoscientists with the necessary preparation to embark on a successful career in industry. In this scenario, the M.S. thesis remains a highly important document. It provides evidence to industry that the potential masters hiree is able to team with an advisor to plan, execute, complete and successfully defend a significant research endeavor.

![Graph of Years to Complete MS Degree](image)

**Figure 2.5 Years to complete MS degree.**

The average number of years to complete the MS degree over 2011-2016, as shown in Figure 2.5, is 2.8-3.2 years, with some year-to-year variance. On balance, particularly in Geology, the time-to-M.S.-degree is coming down toward the aspirational level of 2.0 years. There are several reasons the M.S. degree might take longer than 2.0 years to complete. First, many students accept internships with petroleum companies over the summer, which provides excellent career preparation, but takes away valuable summer research time.
Second, masters students fresh from undergraduate study must complete a rigorous thesis that contains sufficient results to warrant a top-rated peer-reviewed publication. Third, the time requirement for students to do a teaching assistantship is substantial. These reasons make it difficult to complete the program in 2.0 years, even for an exceptionally qualified academic-focused masters student. The most straightforward approach to lower the time to M.S. degree, while preserving both the rigorous thesis and the summer industry internship opportunity, is to secure more fellowships and research assistantships. Other methods could include requiring incoming M.S. students to have a demonstrated record of undergraduate research achievement, and to initiate the thesis research during the first semester of graduate study to build early momentum.

Figure 2.6 Years to complete PhD degree.

The average number of years to complete the PhD degree is shown in Figure 2.6. The data show, for both Geology and Geophysics, a roughly steady value of 5.5-6.5 years, with some year-to-year variance. These numbers, which are based on small samples (typically 3-6 graduates in each degree program per year), are skewed upward by a couple of factors. First, a number of PhD students have left campus for employment or other reason but register in absentia for many semesters, albeit with honest intention to complete the degree. Second,
the numbers do not distinguish between the 64-hour and 96-hour PhD programs. Clearly, a 96-hour PhD program takes longer to complete. A straightforward approach to reducing time to PhD degree would be to secure more fellowships and research assistantships, especially for PhD students in their later most-productive years, so that these students are not required to spend excessive time teaching a laboratory class they have taught several times before. A second option would be to find ways to improve the research environment in the department over the summer months. This is a period of time during which most faculty depart hot and humid College Station and very few top scientists from elsewhere visit the department. Consequently, our PhD students do not experience the highly motivational buzz of activity during the summer that they would see at institutions, which are located in more favorable geographical locations.

Time to degree should decrease due to recent changes in our academic advising. First, we used to accept graduate students without advisors, but we found that many of our M.S. students floundered without early direct supervision, so we now only accept graduate students with a primary advisor/advocate identified prior to admission. Additionally, we hired Ms. Trisha Fike to regularly advise students on departmental and university regulations.
2.6 ACADEMIC ENHANCEMENTS/HIGH-IMPACT OPPORTUNITIES FOR STUDENTS

It is a Texas A&M University goal for students to participate in several types of transformative activities during their undergraduate degree, designated High Impact Learning Experiences (HILE). All of our students participate in course-based HILE, which include field courses and writing-intensive courses. Also our First Semester seminar course establishes each cohort of students into a Learning Community in their first semester in the department. In the new curriculum, all seniors will participate in a small-group research project course.

Most students also will take the opportunity to do at least one other high-impact option. In recent years, a few students each semester will do a semester abroad: we have a formal exchange program with the University of Leicester, and other students have arranged semesters in Australia, New Zealand and Ireland. We have taught short courses for undergraduates in Costa Rica and. About a dozen undergraduates each summer do an internship at a petroleum or environmental consulting company.

A large proportion of majors participate in undergraduate research, through an independent project with a professor or a research class. In the 2016-17 academic year (including summer) 81, 79 and 55 students registered for credit hours in Research. The largest single program is Dr. Laya and Dr. Pope’s summer research course supported by a generous grant from Clayton Williams. Forty undergraduates participated in the two sections of this course in Summer 2017.

A significant number of our graduate students take summer internships with petroleum companies, and a smaller number with environmental companies. The Department of Geology and Geophysics encourages this form of career preparation. Representatives of many petroleum companies view internships as an excellent opportunity for students to gain industry experience and an internship facilitates mutual evaluation between the student and the company. Summer interns may be involved in a variety of projects, from subsurface mapping, to production geology and reservoir characterization, preparation for drilling or leasing, or working with computer applications. Major oil and gas companies increasingly make offers of full time professional employment preferentially to their top-ranked interns.
2.7 ASSESSMENT OF STUDENT LEARNING OUTCOMES

The mechanisms of program assessment have evolved in order to strike a balance between a desire to better assess learning outcomes as recommended in the 2010 Academic Review Report and the need to maintain a level of consistency through the upcoming university accreditation renewal. Our degree program assessment now includes a broader array of both summative and formative measures resulting in differing styles of action plans enacted at the program level.

Data on summative undergraduate program measures have been drawn primarily from undergraduate “exit interview” questionnaires. During undergraduate progression through the program, formative assessment is done with evidence primarily drawn from instructor evaluations on key points of course content (e.g., exam questions, data evaluation, course projects, writing or speaking exercises, group projects, capstone experiences, etc.). The findings feed back into more immediate course-level changes, as well as into program design. Deficiencies brought to light by these measures were addressed in a series of faculty workshops and retreats ultimately resulting in a complete reformation and modernization of the Geology undergraduate curriculum.

As part of the curriculum redesign, we are working with the Center for Teaching Excellence to improve our assessment and integrate it better with the courses. During the course development stage, we held meetings with faculty responsible for teaching each required course, and identified the type of instrument or data to be collected for assessment of every course-level learning outcome. These artifacts include test questions, problem sets and laboratory reports, projects or papers and, in some instances, student reflections. In some cases, students will upload their work or reflections to their ePortfolio page (all students are introduced to this tool in their first semester GEOL 180 course). Beginning in Spring 2018, the GEPL Curriculum Committee will pull samples of each of these artifacts and review data for the highest level course-level. If a problem is indicated in any of the courses we will fix it as soon as it is apparent. After two to three years we expect to do an overall assessment of how the new curriculum is working and make small changes as needed.
The graduate programs are assessed through a combination of end-of-program evaluation at the thesis/dissertation defense, annual progress reports, and measures of engagement in graduate students’ target communities (e.g., publications, conferences, internships, etc.). Broad programmatic changes resulting, in part, from graduate-level assessment were addressed at a recent faculty retreat aimed at renovating our graduate programs.
2.8 ANALYSIS

Our primary response to assessment of the academic programs is through our redesign of the undergraduate degree. As a first step in the development of our new undergraduate curricula, we surveyed former students about which types of skills they used most in their current job, and which ones they were best prepared for by their TAMU degree (Figure 2.7). Our surveys identified written and oral communication and facility with software as the skills that are both most important and needed the most improvement within our curriculum.

All of the above concerns (as well as others) were addressed by new and modified courses in the curriculum, including two new writing-intensive courses, the addition of a half-semester of GIS labs to our new field methods course, and new programming-intense course in geophysics.

![Figure 2.7. 2014 Alumni Skill Survey](image)

GEPL alumni were surveyed about the importance of 13 technical skills to their current position (in a job or in graduate school), and how well their undergraduate experience prepared them for that.
The Department of Geology and Geophysics has a long-standing reputation in applied petroleum geoscience; in earlier years, the department was known for the education it provided and in later years, graduate geology and geophysics programs became known for directed research in petroleum geology and geophysics. More recently, the Department has invested in developing a strong program in environmental geosciences, which together with University initiatives in water resources and management, represents an emerging research strength. Tectonophysics was introduced as a research focus soon after the Agricultural College of Texas was renamed, and the new University emphasized research. Tectonophysics continues to be an active area of graduate research with funding available from a number of sources. Studies of life and Earth history have long been a focus of the department, with obvious applications of biostratigraphy to petroleum geosciences, but in recent years, investigations of the geologic record have increasingly focused on the geologic history of climate change.

Research strengths of the Department in 1) petroleum geosciences, 2) water resources and environmental geosciences, 3) tectonophysics, deep crust and mantle dynamics, and 4) life, climate and Earth history align well with research funding of NSF, DOE, and the energy industry. The level of our activity in each of these areas is described below, documented by records of publication and funding. Recognition of faculty expertise in these research areas is indicated by invited talks, editorships, memberships on review panels, and other professional activities. Curriculum vitae for all core faculty members is given in Appendix H.

Petroleum Geosciences
Research initiatives in petroleum geosciences at Texas A&M began in 1965, when Dr. Robert R. Berg, a well-known and respected consultant in the petroleum industry, was named Head of the Geology Department. Dr. Berg hired research-oriented faculty from industry, including Shell Development geologists, Drs. John Handin (and his structural geology research team), Robert Stanton, and Wayne Ahr, and a Shell Development oceanographer, Dr. Richard Rezak. In 1967, Dr. Terry W. Spencer was recruited from his applied seismology position in industry, to build the new Geophysics Department. Over the years, faculty and students of Geology and Geophysics Departments (and later, as members of the merged department) made
significant contributions in a number of petroleum geoscience applications, including basin analysis, sequence stratigraphy, geochronology, petrophysics and reservoir characterization, capillary forces and sealing capacity, structural trapping, seismic imaging and analysis of reservoirs. Graduate students have made use of a variety of tools to investigate reservoirs.

In the last eight years, with the addition of new faculty, we have regained much of the strength we lost in sedimentology, stratigraphy, with new directions in sediment provenance studies, carbonate reservoirs, fine siliciclastic reservoirs, active-source geophysics and seismic interpretation. We are confident in the new members of the department, and expect that publication and funding rates in sedimentary geology and petroleum geosciences will increase.

Most recently, the Berg-Hughes Center for Petroleum and Sedimentary Systems has been facilitating integrated, multi-disciplinary studies of reservoirs and sedimentary basins, bringing together sedimentologists, stratigraphers, structural geologists, geophysicists, and petroleum engineers under the guise of the Crisman Institute. With our industry contacts, we are confident that we can gain access to state-of-the-art datasets. The growth of the Chevron sponsored CORE also is integrating geologic and engineering data to better understand fluid flow in basins. Graduate students have access to computational and imaging facilities in our department to analyze and interpret 3D seismic datasets. High-resolution imaging facilities are available to study core, including CT-scanning, SEM, EDS, XRF, CL, NMR. Between the Tectonophysics Laboratory and labs of Petroleum Engineering, petrophysical properties of rocks can be measured, such as elastic P- and S-wave velocities, inelastic compaction behavior, permeabilities, and capillary pressures.

Water Resources and Environmental Geosciences
The Department has strengths in theoretical modeling of groundwater flow and solute transport in subsurface aquifers, in environmental geochemistry and biogeochemistry focused on fate, transport, and biogeochemical behavior of contaminants, in near-surface geophysics adapted to image the upper 30-100 m beneath Earth's surface, and in engineering geology.
Many of our students who perform water-related research are part of the college’s Water Management and Hydrological Sciences Program, and they benefit from the perspectives of geoscientists, agricultural scientists, and engineers.

The near-surface geophysical research performed in our department can be applied to study effects of human activities, such as building, excavating, tunneling and storing or monitoring accidentally released hazardous materials. EM induction and ground penetrating radar are used to image the top 30-100 m beneath Earth’s surface. Near-surface geophysics research at Texas A&M University has also found increasing applications in archeological prospecting. Current research includes the development of finite element analysis and inversion techniques for controlled-source electromagnetics, AVO analysis and vector migration of ground-penetrating radar data, archaeological geophysics at historic sites, electromagnetic characterization of fractured rocks, resistivity imaging of unknown bridge foundations, and electromagnetic mapping of deformation structures for meteorite impact hazard assessment.

A number of environmental geoscience problems draw on geomorphology and engineering geology. Geomorphology and geology research performed in our department addresses problems associated with geological processes that affect man-made structures as well as natural geohazards in the critical zone as defined by the NRC and NSF.

**Tectonophysics, Deep Crust and Mantle Dynamics**

The Department has research strengths in the study of tectonic processes, both through mechanical analysis and approaches taken by faculty and student associates of the Center for Tectonophysics, and through interdisciplinary geochemical/geophysical approaches taken by a focus group interested in Deep Crust and Mantle Dynamics. Studies of faulting in the upper crust, transitional brittle-ductile deformation at mid-crustal depths and high temperature plastic flow in the lower crust and mantle are investigated at all scales, from atomistic flaws to mesoscale structures to rifts, trenches and mountains formed at plate boundaries. Members of the Center for Tectonophysics and Deep Crust and Mantle Dynamics group have wide ranging expertise including structural geology, mechanics of materials, mineral physics, geochemistry and petrology, and geophysics. Numerical mechanical analyses and geophysical modeling benefit from state-of-the-art computational facilities. A wide range of mechanical properties measurements can be made in the John Handin Rock Deformation Laboratory, and deformation microstructures and textures can be investigated.
by optical and electron microscopy. Analytical facilities available to study petrological relations, geochemistry, and defect chemistry include the department’s electron microprobe, IR spectrometer, TIMS and ICP-MS mass spectrometers of the Ken Williams Radiogenic Isotope Laboratory, and microanalytical TEM instruments of the university’s Microscopy and Imaging Center. With the broad-ranging interests of faculty in tectonic processes, and variety of theoretical, experimental, and analytical capabilities, students may pursue research questions by multiple approaches. Ongoing research includes modeling of dynamic fault rupture, experimental studies of rock friction at high velocities, microstructural studies of San Andreas Fault materials recovered by the SAFOD project, experimental studies of carbonate deformation under conditions of subduction zones, deformation of ultramafics under mantle conditions, geochemical studies of crustal evolution, and petrologic determinations of water fugacity in mantle-derived rocks.

*Life, Climate and Earth History*

Recent hires in the fields of sedimentology, geobiology, paleontology, and geochemistry have supplemented an established faculty to build a program with potential for international prominence in the study of the interaction of the biosphere, ocean, and atmosphere throughout Earth history. This program further benefits from the participation of many faculty, staff scientists and students of the Departments of Atmospheric Sciences, Biology, Oceanography, and Geography, and the Integrated Ocean Discovery Program.

Our studies of ancient environments are complemented and enriched by ongoing research into the physical, geochemical, and faunal record of historic environmental change. We have an important focus on using the fossil record to understand how biological systems responded to ancient environmental and climate changes. Ongoing studies include Late Paleozoic ice ages and Paleogene climate shifts. For example, a recently-completed NSF project involved six faculty members in the department integrating biogeography, stratigraphy, and isotopic methods to explore circulation changes in the North American epeiric sea during the onset of the late Paleozoic glaciation.
Studies of climate deterioration and global change in the Cenozoic take advantage of samples from ocean drilling and terrestrial sections from the Gulf States both of which have excellent age control. The work centers on benthic, nektobenthic, and planktic organisms of shelf environments and the open ocean, providing a bridge between continental and pelagic ocean records. This research is aided by the ongoing biostratigraphic research on calcareous plankton by faculty and graduate students in our department.

Climate change studies at the most recent end of the geological timescale in the Quaternary and Holocene are also being researched by faculty in collaboration with faculty in the Departments of Geography and Oceanography, and the Integrated Ocean Discovery Program. The geochemistry of the most recent geologic record provides the greatest resolution and is the least affected by alteration and diagenesis. Because the ocean plays such an important role in the global carbon cycle, an understanding of these high-resolution and recent marine sediment records will illuminate the impact of large-scale anthropogenic release of greenhouse gases into the atmosphere.
3.2 CORE FACULTY

Faculty
Core Faculty is defined as full-time tenured or tenure-track, and administratively locked (adloc) in this department. In the time since the last External Review, the Department has experienced significant changes in its faculty, with large numbers of losses and gains in FTE faculty (Figure 3.1) as well as appointments of joint and adjunct faculty.

Over the years 2010 to 2013, we lost one senior faculty member to death (Wiltschko) and six more to retirement (Fox, Hajash, Mathewson, Popp, Spang, and Ahr, who died shortly after becoming emeritus) while gaining no new tenure-track faculty. Additionally, the Department lost two active young faculty members to other institutions (Wade in 2010, Weiss in 2011) and two senior faculty members (Ikelle in 2013, Olszewski 2016) to the private sector. Dr. Bruce Herbert left the Department in 2013 for a full-time term position with the TAMU Libraries, where he was transferred permanently in 2016. In 2017, Dr. Rick Carlson retired, and Dr. Tice and Dr. Tominaga are transitioning to a research scientist positions, giving up tenure for personal reasons.

Offsetting these losses we have hired eleven tenure-track faculty members in Siliciclastic Sedimentology (Ewing), Geophysics (B. Reece and Tominaga), Hydrogeology (Knappett), Carbonate Sedimentology (Laya-Pereira), experimental Rock Physics (Kitajima), Shale Sedimentology and Deformation (J. Reece), Basin Analysis (Perez), Earthquake Dynamics (Fulton) and Micropaleontology (Belanger).

University Priorities: Faculty Investment Programs
A new initiative of the university contributed to the Department’s ability to build on the strengths we identified in our 2010 Strategic Plan. A cluster hire associated with the Integrated Ocean Discovery Program (IODP) in 2014 led us to successfully recruit Dr. Masako Tominaga and Dr. Patrick Fulton to our department. Dr. Masako Tominaga was a successful recruit that we will miss in the future.
Figure 3.1. Department of Geology and Geophysics Faculty, 2009-17

Colored bars denote the title of each faculty member. Periods of emeritus status are not shown. White areas denote unfilled positions. Faculty are arranged by when they left or joined the Department; two faculty on the same line does not denote that the second was designed as a replacement for the first. This figure includes two non-tenure-track faculty in primarily-teaching positions (Heaney and Balta).
Rebuilding Sedimentary Geology and Petroleum Geoscience Programs
Texas A&M’s Board of Regents, with support of the department’s advisory council and college ($2.9M), established the Berg-Hughes Center (BHC) for Petroleum and Sedimentary Systems. In January 2010 Dr. Mancini arrived as its first director and served until 2013. Dr. Mancini initiated interdisciplinary studies involving geologists, geophysicists, and petroleum engineers at TAMU and research scientists in the energy industry. Dr. Pope served as the interim Director of BHC for the 2014 academic year and successfully recruited Dr. Carlos Dengo, a retired Vice President from ExxonMobil, who was instrumental in establishing the long-term viability of BHC, as its second Director. Dr. Dengo initiated more integration with Petroleum Engineering and hired two faculty members that are still in the department (Laya-Pereira and Perez). In the spring of 2017 Dr. Dengo retired from the BHC and we hired Dr. Mukul Bhatia, a previous VP at BHP Billiton as the third Director of the BHC. Dr. Art Donovan (retired BP), a Professor of Practice in Unconventional Resources, and Dr. Mamdouh Shebl, a Professor of Practice in Petrophysics, joined the BHC in September 2017. The Chevron sponsored Center of Research Excellence (CORE) in BHC began advising students working on fluid flow in sedimentary basins in the Fall of 2013. Dr. Mauro Becker became the Director of CORE in the spring of 2017, and he is assisted in advising the CORE students by Dr. Andrea Miceli-Romero, a research scientist. The BHC provides a stable home for Petroleum Geoscience Programs and has increased our collaborations with Petroleum Engineering, especially through the Crisman Institute.

Current Faculty
Gains in faculty replacement since 2010 were generally moderated by faculty losses and the Department has stabilized at 28 FTE faculty at the time of this review (see Appendix H for Figure documenting chronology of faculty losses and gains over the last 8 years), of which 15 are full Professors, five are Associate Professors, and eight are Assistant Professors (Table 3.1). The Department of Geology and Geophysics serves as the academic home of the Department Head, but this position adlocates with the College of Geosciences. Brief curricula vitae of all current faculty appear in Appendix H.
The four research strengths of our faculty are areas emphasized by our graduate curricula and thesis and dissertation topics (Appendix E), and funded by research grants. Our research interests in petroleum geosciences have potential for funding by the energy industry and the U.S. Department of Energy (DOE). Our research interests in water, environment, tectonophysics, deep Earth processes, and the history of life and climate align well with challenges identified in an NSF report of the priorities for its future funding of Earth Sciences-related fields entitled “Dynamic Earth: GEO Imperatives & Frontiers 2015-2020” (https://www.nsf.gov/geo/acgeo/geovision/nsf_acgeo_dynamic-earth-2015-20.pdf). This report outlines the continuance of support for the basic research traditionally funded by the GEO directorate’s core programs. Importantly, our four areas of departmental strength align with the report’s newly-identified avenues of NSF funding which include improving our understanding of and reliance to hazards and disasters, and establishing a collaborative effort to understand the water cycle. In addition to these imperatives, the NSF report identifies emerging research frontiers that it will likely support. The frontiers which align best with our faculty research areas include Earth systems processes that cross the land-ocean interface; high-latitude ocean-atmosphere-ice- ecosystem interactions and processes; and research on early Earth.”

**Post-doctoral Fellows and Research Scientists**

Over the last seven years the Department has successfully recruited post-doctoral fellows and research scientists (Table 3.3) who work with faculty and students, funded by endowments and extramural funding (from NSF and USGS) in geophysics and tectonophysics, paleobiology, environmental biogeochemistry, and geoscience education. We are proud of our post-doctoral scientists, for their research productivity, contributions to student mentoring, and participation in life of the department. However, we recognize that to be a top-tier department we need to do a better job recruiting, mentoring, and advocating for our post-doctoral fellows.
3.3 CORE FACULTY/STUDENT RATIO

The ratio of undergraduate students to Core faculty (tenured and tenure-track) nearly tripled between 2009 and 2014 (to a peak of 19, Figure 3.2) due to the dip in faculty numbers beginning in 2012, which coincided with a surge in enrollment. Reversal of both of those trends has brought that ratio down to 14.5 for Fall 2017. The number of graduate students per faculty have ranged between 4 and 6, with the changes mostly driven by departures of faculty who left students behind and additions of new faculty in the process of building a graduate program.

Figure 3.2 Students per tenured or tenure-track faculty, Fall semester.
3.4 PUBLICATIONS (MOST RECENT 5 YEARS)

With 28 faculty in the Department of Geology & Geophysics, research interests are broad and varied. However, there are a number of research themes and strengths (as identified above) that bring us together into research collaborations. Drawing on publications over the period 2010-2017, we determined the level of research activity in each of the department's strengths: 1) petroleum geosciences, 2) environmental geosciences, 3) tectonophysics and deep crust and mantle dynamics, and 4) life, climate, and Earth history.

The total number of peer-reviewed publications of the department is 526 over the eight-year period, with 100 in petroleum-related fields including sedimentology/stratigraphic studies, 162 in the environmental geosciences and water-related fields, 175 in the tectonophysics and deep-crust and mantle dynamics field, and 89 in the life, climate and Earth history field (Appendix J). No publication were double-counted even though several of them do overlap fields (e.g., sed/strat studies and life, climate and Earth history studies). On the basis of these research publications, three of the four areas we identify as research strengths are highly productive, with 100 or more publications in each area. Part of the reason for the lower number of publications in the fourth research area is the fewer number of faculty identified in this area. A detailed breakdown of publications by faculty member is given in their vitae (Appendix H).

One way in which the research productivity and external federal funding of departments across the university can be determined is through the university’s subscription to a commercial academic data base, Academic Analytics. The most recent data available for 2016 is shown as a “rose-type” diagram in Figure 3.3. This data compares productivity output according to four criteria: publications, awards, citations, and grants. Using these criteria and comparing our faculty’s metrics to those for scholars in the disciplines of Geology and Geophysics across the US, we remain generally above the median expectation in regards to several criteria. Yet, a targeted area of improvement for our current trajectory is external funding and increased publication/citation per faculty member. Recent hires of superb early career faculty, and an overall improvement in the research culture of the department will likely ameliorate both metrics.
Figure 3.3 Academic Analytics Research Analysis for Department of Geology and Geophysics for 2016.
3.5 EXTERNAL GRANTS (MOST RECENT 5 YEARS)

Sources of Research Funding

Research activity in the department can also be evaluated by looking at the level of research funding through grants and contracts. While the sources and levels of funding differ among the different research themes of the department, we anticipate increases in funding, in coming years, in each of the four areas of departmental strength. The total amount of research expenditures varies from year to year with a low of just near $1.0 M (2012 – coinciding with our fewest number of faculty), to just over $13 M in 2015.

![Figure 3.4. Research Expenditures](image-url)
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<td>RETURNED IDC PER FACULTY FTE</td>
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<td>$3,725</td>
<td>$5,489</td>
<td>$3,205</td>
<td>$6,505</td>
<td>$3,096</td>
<td>$2,606</td>
<td>DON'T HAVE</td>
<td>$3,999</td>
</tr>
<tr>
<td>TOTAL IDC RETURN ALLOCATED TO DEPARTMENT AND PI'S</td>
<td>$71,355</td>
<td>$90,419</td>
<td>$97,734</td>
<td>$144,047</td>
<td>$157,058</td>
<td>$146,126</td>
<td>$124,528</td>
<td>DON'T HAVE</td>
<td>$118,752</td>
</tr>
</tbody>
</table>
Petroleum geosciences have largely been supported by U.S. DOE grants and contracts, industry contributions to individual faculty and industrial associates programs such as the Consortium for Automated Seismic Processing (CASP), with some funds coming from PRF and international funds such as Sinopac (China Petroleum and Chemical Corporation) and Qatar Petroleum Research Program. Funding is expected to rise substantially with the initiation of the Berg-Hughes Center for Petroleum and Sedimentary Systems, corresponding to the development of new industrial research consortia, and new DOE and PRF research initiatives.

NSF funding is important to all other areas of departmental research. In addition to NSF grants, environmental research in the department has been supported by DOE, TTI, and USDA projects. Tectonophysics research has been supported through grants from the USGS, DOE, DOD, with significant NSF funding coming from dedicated Margins, SCEC, and SAFOD initiatives. Life, Climate, and Earth History research of department faculty of Geology and Geophysics (adloc and joint) has been supported by both EAR and OCE panels of NSF and by the NSF CHRONOS project. The department has also attracted funding through an NSF-CAREER grant awarded to Dr. Benchun Duan.

Twenty-one faculty members of the Department of Geology and Geophysics were first PIs on active, externally-funded projects, representing 66% of the faculty as a whole (using the current number of FTE faculty, 28 in FY 2017). Research expenditures have increased in recent years from $1,530K in fiscal year 2009-2010 (FY09), to $7,030 K in 2016-2017 including TAMRF, TEES, and TAMU-RS accounts. One of the reasons for this increase is the number of proposals our active young faculty typically are preparing and submitting each year. 85% of the department’s Assistant and Associate Professors were as PIs. Fewer (47%) full Professors had research expenditures as first PIs during FY16; however, in a number of cases, full Professors served as secondary PIs to projects with junior faculty as first PIs. Department of Geology and Geophysics faculty also were instrumental in acquiring in building the College of Geosciences facilities in stable and radiogenic isotope geochemistry with multiple successful NSF MRI proposals during the review period.
3.6 FACULTY RECOGNITION AND SERVICE

Faculty of the Department of Geology and Geophysics have been recognized for their research and educational contributions. Leadership and stature of the faculty in the broader scientific community are indicated by invitations to give keynote lectures, and positions of responsibility held.

Geology and geophysics faculty and staff have received college or university level awards in teaching, research or service over the last 8 years. Members of the Department received multiple awards from professional societies over 2010-2017. Notably, high honors were awarded to junior faculty: Dr. Duan received a NSF Career Award in 2015, and three faculty received fellowship in professional societies over the last five years, one to the Geological Society of America (Dr. Marcantonio) and one to the Paleontological Society (Dr. Raymond).

Geology and geophysics faculty presented over 250 invited talks during the period 2010-2017, many as keynote speakers. Seventeen department members have served as editors or associate editors of scientific journals over this time period and five are on editorial boards.

Many faculty members also have served on review panels of funding agencies, including:

<table>
<thead>
<tr>
<th>NSF</th>
<th>NASA</th>
<th>DOD</th>
<th>NSERC (CANADA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOE</td>
<td>EPA</td>
<td>AAAS</td>
<td>PETROLEUM INSTITUTE</td>
</tr>
<tr>
<td>USGS</td>
<td>SCEC</td>
<td></td>
<td>PETROLEUM RESEARCH FUND</td>
</tr>
</tbody>
</table>
3.7 FACULTY ENDOWMENTS

The Department of Geology and Geophysics has strong support from its former students, with a number of generous donations made in support of named faculty endowments in the department and college. A number of current faculty members enjoy the benefits of holding a named chair or professorship (Table 3.6). Endowed chairs provide annual earnings of ~ $50,000 and endowed professorships provide yearly earnings of ~ $10,000, which can be used for a variety of scholarly purposes, including support of research, students, and post-doctoral researchers. Faculty Chairs may also use earnings for one month of summer salary each year.

Table 3.2. Endowed Chairs and Professorships held by Geology and Geophysics Faculty in 2017

<table>
<thead>
<tr>
<th>FACULTY NAME</th>
<th>NAMED CHAIR OR PROFESSORSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>RICHARD GIBSON</td>
<td>DUDLEY J. HUGHES CHAIR IN GEOLOGY AND GEOPHYSICS</td>
</tr>
<tr>
<td>FRED CHESTER</td>
<td>DAVID BULLOCK HARRIS CHAIR IN GEOLOGY</td>
</tr>
<tr>
<td>ETHAN GROSSMAN</td>
<td>MICHEL T. HALBOUTY CHAIR IN GEOLOGY</td>
</tr>
<tr>
<td>ANDREAS KRONENBERG</td>
<td>MICHEL T. HALBOUTY CHAIR IN GEOLOGY</td>
</tr>
<tr>
<td>MUKUL BHATIA</td>
<td>DAN A. HUGHES CHAIR IN GEOSCIENCES</td>
</tr>
<tr>
<td>MARK EVERETT</td>
<td>HOWARD KARREN PROFESSORSHIP IN GEOLOGY &amp; GEOPHYSICS</td>
</tr>
<tr>
<td>BENCHUN DUAN</td>
<td>FRANCESCO PAOLO DI GANGI/HEEP PROFESSOR THEORET. GEOPHYSICS</td>
</tr>
<tr>
<td>FRANCO MARCANTONIO</td>
<td>JANE AND KEN WILLIAMS CHAIR IN GEOSCIENCES</td>
</tr>
<tr>
<td>HONBIN ZHAN</td>
<td>RAY C. FISH PROFESSORSHIP IN GEOLOGY</td>
</tr>
<tr>
<td>YUEFENG SUN</td>
<td>WILLIFORD PROFESSORSHIP IN PETROLEUM GEOLOGY</td>
</tr>
</tbody>
</table>

Chairs and professorships may be awarded to new, incoming faculty with the purpose of recruiting outstanding individuals to the department. Alternatively, faculty of the department with outstanding research and teaching records may be honored through the award of an endowed chair or professorship. Nominations of candidates for chairs and professors are submitted to the College of Geosciences, which appoints a selection committee made up of Distinguished Professors of the College, and a faculty representative from each department of the College of Geosciences. The Chairs and Professorships Selection Committee is chaired by the dean of another college at TAMU. Chairs are awarded for a five-year period and professorships are awarded for a three-
year period, with possible renewals for an additional term. Depending on the donor’s letter of intent, any given chair or professorship may be restricted to individuals from a specific department or faculty with scholarly achievements in a specific research area. Faculty from the Department of Geology and Geophysics are eligible for a number of college chairs and professorships. In addition they are eligible for departmental chairs and professorships.
3.8 TEACHING LOAD

The nominal teaching load for most tenured/tenure-track faculty in the Department is three courses (3 credit hours per course) per year, with some deference given to class size (discussed below). Tenured faculty can apply for Faculty Development Leave; we have had an average of one to two faculty per year on a semester long FDL from teaching. We offer new hires one semester off from teaching in their first three years, and also attempt to give an occasional course-free semester to those with heavier-than-average teaching loads or a large external research commitment. As a result, in recent years, we have typically had two to four faculty not teaching in any given semester.

The rapid growth of undergraduate enrollment relative to faculty from 2012-15 have caused a significant restructuring of our teaching. Lecture sections grew, with all required courses in the Geology degree being taught to over 90 students (with some reaching our lecture hall capacity of 170). In order to maintain the rigor that is needed in the core courses of our curriculum, instructors in these large sections are credited with teaching two courses. In addition, the number of sections offered had to grow: almost all required courses and popular electives need to be taught in each semester, sometimes with multiple lecture sections.

The number of undergraduate courses taught each semester (including the large sections as two courses) increased by 50% from 2012 to 2014, reaching 33 per semester (Figure 3.5). While we have added several new faculty, the number of tenure-track faculty that have been available to teach each semester (i.e., not on some form of teaching release) has only gone up by 10-15% since 2012. Because of the resources committed to the undergraduate program, we have almost never had to exclude our own majors from required classes, including field camp, and time-to-degree has actually been dropping steadily during this period. However, fewer elective courses were taught at both the undergraduate and graduate level.
Figure 3.5. Undergraduate Teaching

Increase in undergraduate course equivalents, and in tenure-track faculty available to teach in each semester (not on Faculty Development Leave or other teaching release). Teaching here does not include graduate courses (stable at about 12 per semester) or summer teaching (which has doubled from 5 to 10 sections) over the last 10 years. The sum of sections over 90 and summer field instructors is termed “course equivalents”, and is meant to show the teaching effort expended in undergraduate courses.
3.9 FACULTY OTHER THAN CORE

In 2010, the Department was beginning to re-build its sedimentary and petroleum systems with the addition of Dr. Ernie Mancini and Dr. Mike Pope to lead the Berg-Hughes Center. We also benefited from our contacts in the energy industry and affiliations with IODP. Dr. Art Donovan and other colleagues in the petroleum industry provided inspiring courses to our students that revealed current exploration and development strategies, and provided in-class exercises using rich, unpublished industry data sets. Some of these courses were so successful we have formalized Art’s position, hiring him as a Professor of Practice to augment our faculty capabilities in this area. This is a strategy we have used in the Petroleum Geosciences hiring a number of non-tenure track Professors that provide the department a wealth of practical experience, and they bring extensive teaching and mentoring experience. The Department has six joint faculty members with adlocs in other departments, and ten adjunct faculty members, including four Professors of Practice (Kabir, Donovan, DeGraff, and Markello).

Coordination of introductory Geol 102, 104 and Geol 106 laboratories are provided by the department’s Technical Laboratory Coordinator, Dr. Michael Heaney. In addition to these duties, Dr. Heaney teaches two of the department’s important field courses, Summer Field Geology (GEOL 300; GEOL 350 in new curriculum) and Introduction to Geologic Field Methods (GEOL 309; GEOL 250 in new curriculum). A Visiting Lecturer, Dr. Brian Balta, teaches mineralogy, petrology and planetary geology from 2016 - 2019. Additionally Dr. Alfonso Benavides-Iglesias teaches geophysics and writing classes and Dr. David Bapst teaches writing courses.

The Department has a unique resource, the Halbouty Visiting Professorship, which is used to bring outstanding scientists to Texas A&M for extended visits or a sabbatical visit. Halbouty Visiting Professors are expected to give an invited talk, and they may give an extended series of seminars, or workshops, or teach courses. We also encourage Halbouty Visiting Professors to collaborate with faculty and students of the department. The most recent recipient of the Halbouty Visiting Professorship, Dr. Ursula (Uschi) Hammes of the Texas Bureau of Economic Geology, taught a short course in the Fall of 2016, then co-taught a course on Unconventional Resources in the Spring 2017 semester, now serves on a number of our graduate student’s committees, and is submitting proposals for research with Julia Reece.
Dr. Saugata Datta, a low-temperature geochemist from Kansas State University, is a Halbouty Visiting Chair for the 2017-2018 academic year. In fall 2017, Dr. Datta is teaching a graduate course in “Chemistry of Natural Waters” and he is working closely with Drs. Zhan and Knappett on a number of research projects.
3.10 FACULTY DIVERSITY

Since our 2010 review, the diversity of our faculty has increased in several ways. White males at the rank of Professor, the dominant demographic category in 2010, have shrunk from 50% of our faculty to 34%. The primary changes have occurred through the phase of new hiring that occurred from 2014-2017. Our Core faculty breakdown is currently 34% Assistant Professor, 14% Associate Professor and 51% Professor (the overall University distribution is 22% Assistant, 30% Associate and 48% Full).

The representation of women on our faculty increased considerably through our recent hiring. Seven (24%) of our Core faculty are women, and three of those are at the rank of Professor (20%). These percentages are up from 9% and 12%, respectively, in Spring 2010. These compare favorably with national averages at PhD-granting geoscience departments (12% overall and 8% of Professors).

International cultures are well-represented, with seven of our faculty originally from countries outside of North America, including China, Japan or Venezuela. However, of domestic faculty, only one is from an underrepresented ethnicity, so our faculty still lags well behind our own student body in approaching the demographic profile of Texas. Faculty search committees receive training in recruiting from underrepresented groups, and both the recruitment process and the applicant pools must be certified for inclusivity before any short list of candidates can be made.
3.11 FACULTY QUALIFICATIONS

All tenure-track faculty members hired into the Department of Geology and Geophysics are required to possess an earned Ph.D. at the beginning of their employment at Texas A&M University. Though not required, most of our tenure-track hires have one or more experiences as post-doctoral researchers prior to joining our faculty.

All current lecturers in our department also were required to have earned Ph.D.s prior to teaching at Texas A&M.
3.12 ANALYSIS

While we have done relatively well in re-building from our low of 21 FTE in 2012-2013 to our current 28 FTE, we were recently at 30 (2016), and we need to continue to hire quality replacements as faculty leave if we are to succeed in reaching our goal of becoming a top-tier department of Geology and Geophysics.

The department is heavily invested now in the success of the recently-hired faculty. A decade ago we went through a long period where our assistant professors routinely left the University for other jobs before being tenured. The top priority over the next 3-4 years has to be to retain the young faculty and help them to be successful and earn tenure.
Undergraduate Enrollment
Undergraduate enrollment doubled between 2005 and 2009 to reach 200 students. Enrollment doubled again between 2012 and 2015 resulting in a peak of 530 majors (Figure 4.1). The growth was particularly strong in Geophysics, which went from fewer than 50 majors to over 150. From 2013 to 2015 between 200 and 230 new students entered the program each year.

Since the drop in oil prices in 2015, incoming students have dropped sharply, to just below 100. With graduation now outpacing new additions, total enrollment has dropped to 393 in Fall 2017. The 2017 curriculum was designed to accommodate a total enrollment as high as 500, but we feel an ideal number would be between 350 and 400. A stable input of 130-150 new students each year would reach this target. In the last year we added about 100 new students. A small increase in oil prices should put us close to our ideal case. However, the oil and gas industry is remarkably volatile and past experience has taught us how to be responsive to fluctuations in enrollment numbers.

Approximately 50% of our current undergraduates entered as freshmen Geology or Geophysics majors. About 30% are transfers from other schools, with most of those from community colleges or junior colleges (Blinn College in Bryan, TX being the major local feeder school). The rest have switched from other majors within TAMU; about half transferred from the College of Engineering, while most of the rest are from Science or General Studies. All but 1 or 2 of our undergraduate majors are enrolled full-time in any given semester.
Figure 4.1. Undergraduate Enrollment, 2010-17

GEPL undergraduate enrollment on 20th day of Fall semester from 2010 to 2016. Also included are projected enrollments for Fall 2017 (probably accurate to within 10 students). The top line is total GEOL + GEOP students, the bottom number is GEOP students only.
Graduate Enrollments
The graduate enrollment between 2011-2016 is holding steady at 124-137 students. The enrollment numbers, or “graduate student headcount,” is shown in Figure 4.2. The percentage of PhD students has steadily increased from about 44% to 51%. A large factor that has influenced the recent proportional rise in the number of doctoral students includes action on a recognition that doctoral students better help to raise the research profile of the faculty since they publish more papers than M.S. students. Consequently, in recent years proportionately more faculty advocacy statements are received for doctoral applicants. The aspiration of the department is that a doctoral student will graduate in 4 years and publish 3 papers whereas a M.S. student will graduate in 2 years and publish 1 paper, all in top international peer-reviewed journals. This implies 0.75 such papers/year for a doctoral student as opposed to 0.5 such papers/year for a M.S. student. Furthermore, the papers produced by doctoral students, especially their latter ones, are more likely to be high-impact contributions to the scientific literature. Also, a large percentage of graduating masters students have not met the publication aspiration of the department.

Figure 4.2. Graduate student enrollments by degree.
4.2 STUDENT DIVERSITY/DEMOGRAPHICS

The majority of our undergraduate majors are Texas residents, with the Houston metropolitan area being the most common region of origin. Almost all of our students are enrolled full-time, and about one third of our graduates have student debt at the time of graduation.

Women are underrepresented in our undergraduate programs compared to other sciences at TAMU and geosciences nationwide. Since 2003, the proportion of women has averaged around one-third (Figure 4.3). This low proportion is probably due to the nature of our department as a feeder into the petroleum industry, which is still predominantly male. The evolution of total female enrollment has followed the same pattern as male enrollment, but lagging by about one year. The Geology degrees typically have a slightly higher proportion of women than Geophysics.

The GEPL undergraduate population has been growing increasingly ethnically diverse. The fraction of minority students increased slowly in the early 2000’s, but has risen rapidly since 2012 to 36% in 2016 (Figure 4.4). Most of this growth has occurred among the Hispanic student population, which tripled in size between 2010 and 2016. The increase in diversity has been even stronger in the growing Geophysics program, which was 42% minority and 6% international students in Fall 2016. In concert with this rise in diversity, the percentage of freshmen that are first-generation college students has risen steadily in recent years, to 28% in 2016.

International students are not a large component of the undergraduate program. The number of international majors has remained consistent (at 20-25) throughout the big enrollment changes. Most international undergraduate students are sponsored by a company or the government of their home country. We have been actively exploring programs with universities in other countries that would bring more international students into our undergraduate and graduate programs, either as transfers or in a joint-degree program. An increase in sponsored international students would give us some buffer against the strong variations in domestic demand for our program.
Figure 4.3. Undergraduate Enrollment by Gender
Fall semester enrollment of GEPL undergraduate men and women (note different scales).

Figure 4.4. Undergraduate Diversity
Percentage of undergraduate GEPL majors classified as ethnic minority or non-US citizens (Fall semester).
Graduate

The number of international graduate students, expressed as a percentage of the headcount, is indicated in Figure 4.5. The percentage of international graduate students has remained steady at 34-36% over 2011-2016. Some of the international graduate students are sponsored by their national governments or petroleum companies. These countries include Thailand, Indonesia, Saudi Arabia, Turkey, South Korea and others. The unsponsored international students are from a wide range of countries, but especially India and China.

Figure 4.5. International and domestic graduate enrollment
Of the Department’s domestic graduate students, ~10-15% come from under-represented groups (Figure 4.6), which falls well short of our aspirations, given the much greater diversity of the Texas population (~34% Hispanic, 12% Black, 4% Asian). Our percentage of graduate students of Hispanic origin has steadily increased over 2011-2016 to 10%. Nationwide, about 11% of MS and PhD degrees in geosciences were conferred to Asians and under-represented minorities (2016 AGI Geoscience Workforce Program). With ~35-36% female graduate students in the Department (Figure 4.7), we also recognize challenges to achieve our aspiration of gender parity. Nationwide, 41% and 47% of Masters and PhD degrees in geosciences were conferred to women (2016 AGI Geoscience Workforce Program).

Figure 4.6. Diversity in graduate enrollment
Percentage of student headcount, shown by year.
Figure 4.7. Graduate enrollment by gender
4.3 RETENTION AND GRADUATION

Undergraduate
About 60% of freshmen GEPL majors are retained within department after their first year (Figure 4.8a), with most of the transferring students switching to non-science majors. This retention rate is slightly higher than the average of other science majors at TAMU, which retain only 40-50% of freshmen. In the last two years, there was a small but noticeable drop in GEPL retention. One possible cause is that we have noticed an increase in the students who were unable to get into an enrollment-restricted program (such as Engineering) and chose a GEPL major as a second choice, hoping to then switch majors after a year. Of those retained after one year, about 80% go on to graduate with a GEPL degree.

For students transferring into GEPL from outside of TAMU, 80-100% are retained after one year (Figure 4.8b); almost all of those retained go on to finish their degree. Because we expect transfers to be an increasingly important part of our student body, we have taken steps to ensure their success. When our current academic advisor, Ms. Suzanne Rosser, joined the Department in 2012, she put a special emphasis on working with transfer students to become acclimatized to the University and Department, and to develop the habits to succeed. She designed a first-semester seminar exclusively for transfer students that emphasized forming a cohort, meeting faculty, building study habits, and finding University resources. This course (which has since been formalized as GEOL 180 in the curriculum, now with both Freshmen and Transfer sections) was presented as a transfer retention tool in posters at AGU, GSA and the Earth Educator’s Rendezvous, and was instrumental in Ms. Rosser winning a Presidential Medal for Excellence (the highest TAMU staff award) in 2017.
Figure 4.8. Undergraduate Retention

1-year retention of cohorts of GEPL undergraduate majors: (a) First-Time-in-College Freshmen, with all majors from TAMU College of Science for comparison. (b) Transfer students who entered TAMU as GEPL majors during. The size of each cohort is shown in black.
TAMU holds three graduation ceremonies per year (May, August and December) and GEPL undergraduate degrees are typically distributed throughout the year. The large increase in incoming students is just beginning to affect undergraduate degrees, with 122 awarded in academic year 2016-2017 (Figure 4.9). We project these numbers to peak in 2017-2018, as our large freshmen and transfer class of 2015 matriculates.

![Undergraduate Degrees Awarded](image)

**Figure 4.9. Undergraduate Degrees Awarded**

Undergraduate GEPL degrees awarded in each fiscal year (consecutive Fall, Spring and Summer graduations). Projections for 2016/17 and 2017/18 have an uncertainty of ~5 and ~25, respectively.

Graduation rates among freshmen who enter our program have mostly varied between 50% and 60% (Figure 4.10). Most of those students finish in four years (see also time-to-degree, Figure 2.4). The fraction of students needing five years to finish has been decreasing steadily. Over this period, no one took longer than five years to graduate. The department has made a major effort to keep graduation rates at this level as enrollment has surged.
Graduate Retention after one-year is nearly 100% in both the MS and PhD programs. Only about 20% of M.S. students graduate in 2 years, and about 60% in 3 years, though there is an upward trend to both of those numbers (Figure 4.11). The MS time-to-degree is discussed in more detail in Chapter 2. After 4 years about 85% of MS students have either graduated or are still in the program. About 50% of PhD students graduate within five years (Figure 4.12). After 7 years about 70% of Ph.D. students have either graduated or are still in the program.
Figure 4.11. M.S. Graduation Rate
Percentage of each cohort of entering MS students in GEPL degrees that finished with a degree in GEPL in 2, 3 and 4 years, along with the size of each cohort.

Figure 4.12. Ph.D. Graduation Rate
Percentage of each cohort of entering MS students in GEPL degrees that finished with a degree in GEPL in 3, 5 and 7 years, along with the size of each cohort.
4.4 INSTITUTIONAL FINANCIAL SUPPORT

Our Department supports graduate students through fellowships and assistantships. We typically have more teaching assistantships available in the Fall semester, so more students are supported on research grants in the spring. On average (Figure 4.13), about 45 graduate students are supported at teaching assistants (GAT’s) each semester, and about 24 are supported as research assistants (GAR’s). The number of GARs is steadily increasing, but we expect the number of GATs to decrease in the next few years (see Figure 2.1).

Eighty percent of our full-time Ph.D. students received some financial support in 2016, with the average amount just under $21,500 (not including tuition and benefits). Most GAR positions come with a remission for tuition and fees and full student benefits. GAT positions currently include tuition and benefits for Ph.D. students, but do not include these for M.S. students.
The Department of Geology and Geophysics is blessed to have a giving alumni base and industry partners that provide fellowships (mostly graduate students) and scholarships (mostly undergraduates) for undergraduate and graduate students. The amounts of scholarships and fellowships from 2013-2017 are provided in Table 4.1 and the names of the scholarships are provided in Table 4.2. We have averaged almost $370K in Fellowships, and nearly $140K in scholarships during this time. These funds are awarded competitively based on the criteria established by the donor. The decrease in the funding for fellowships is directly tied to the decrease in the price of oil as a number of companies have cut back on their giving with long-term slump in oil prices, we expect this will increase as energy prices increase. We are privileged to be able to commonly provide so much fellowship and scholarship funding. Overall, we provide 80% of our Ph.D. students (the only statistics we have) institutional support at a rate of ~ $20,500/year.

### Table 4.1 Scholarships and Fellowship Amounts Awarded

<table>
<thead>
<tr>
<th>Year</th>
<th>Fellowships Awarded</th>
<th>Scholarships Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$330,000</td>
<td>$131,000</td>
</tr>
<tr>
<td>2014</td>
<td>$435,500</td>
<td>$140,000</td>
</tr>
<tr>
<td>2015</td>
<td>$570,000</td>
<td>$153,000</td>
</tr>
<tr>
<td>2016</td>
<td>$350,800</td>
<td>$102,000</td>
</tr>
<tr>
<td>2017</td>
<td>$156,000</td>
<td>$170,100</td>
</tr>
</tbody>
</table>

The amounts of scholarships and fellowships from 2013-2017 are provided in Table 4.1 and the names of the scholarships are provided in Table 4.2.
### Table 4.2. Geology and Geophysics Named Scholarships and Fellowships

<table>
<thead>
<tr>
<th>UNDERGRADUATE SCHOLARSHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERG, ROBERT &amp; JOSEPHINE SCHOLARSHIP</td>
</tr>
<tr>
<td>BLACKWELL, MARY &amp; MICHAEL ‘73 GRAD SCHOLARSHIP</td>
</tr>
<tr>
<td>BP FIRST GENERATION SCHOLARSHIP</td>
</tr>
<tr>
<td>CHEVRON - FIELD CAMP SCHOLARSHIPS</td>
</tr>
<tr>
<td>COASTAL BEND SOCIETY SCHOLARSHIP</td>
</tr>
<tr>
<td>COLQUITT, EMILY &amp; KELLAM SCHOLARSHIP</td>
</tr>
<tr>
<td>COLUMBINE LOGGING SCHOLARSHIP</td>
</tr>
<tr>
<td>CONOCOPHILLIPS FIELD CAMP SCHOLARSHIP</td>
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<tr>
<td>CROCKER, GEORGE E. MERIT SCHOLARSHIP</td>
</tr>
<tr>
<td>DAVIS, CHARLIE ‘60 ENDOWED SCHOLARSHIP</td>
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<tr>
<td>FARMER, JOE S. ‘53 MEMORIAL SCHOLARSHIP</td>
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<tr>
<td>GOLDING, ROBERT JR. ‘88 SCHOLARSHIP</td>
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<tr>
<td>HESS LEADERSHIP SCHOLARSHIP</td>
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<tr>
<td>HINCHHEY, STUART ‘82 SCHOLARSHIP</td>
</tr>
<tr>
<td>HOUSTON OIL &amp; MINERALS SCHOLARSHIP - GEOLOGY STUDENT</td>
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<tr>
<td>HOUSTON OIL &amp; MINERALS SCHOLARSHIP - GEOPHYSICS STUDENT</td>
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<tr>
<td>JACKSON, JR. &amp; NORINE ENDOWED SCHOLARSHIP</td>
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<td>KNEBEL, ROBERT SCHOLARSHIP</td>
</tr>
<tr>
<td>MARATHON SCHOLARSHIPS</td>
</tr>
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<td>PAGE, ROSIE M. &amp; MURRAY D. SCHOLARSHIP</td>
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<td>PARKER, TRAVIS ENDOWED SCHOLARSHIP</td>
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<tr>
<td>QEP SCHOLARSHIP</td>
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<tr>
<td>RUFFER, THOMAS ‘81 &amp; CAROL ‘81 SCHOLARSHIP</td>
</tr>
<tr>
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</tr>
<tr>
<td>SPEED, CARLTON D. JR. ‘26 SCHOLARSHIP</td>
</tr>
<tr>
<td>STEWART, JENNY ‘81 AND BOB ‘80</td>
</tr>
<tr>
<td>VON GONTEN, DR. DOUG ‘56 SCHOLARSHIP</td>
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<tr>
<td>WILTSCHKO SCHOLARSHIP</td>
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</table>
Graduate Scholarships and Fellowships

**BERG-HUGHES CENTER SCHOLARSHIPS**
- GREEN, MARIANNE & WILLARD ‘53
- HASTINGS, SARAH N. & JOHN O. JR.

**GEOLOGY & GEOPHYSICS GRADUATE FELLOWSHIPS**
- HALBOUTY, M.T. GRAD FELLOWSHIP
- LEONARD GAGE LARSEN FELLOWSHIP
- CONOCOPHILLIP SCHOLARSHIP/FELLOWSHIP
- THE C AND M WILLIAMS JR. SCHOLARSHIP
- CHEVRON FELLOWSHIP - GEOLOGY & GEOPHYSICS
- FRIEDMAN, MEL & DEBBY GRAD FELLOWSHIP
- HESS CORP GRAD FELLOWSHIP
- TIEH, DR. TOM ENDOWED FELLOWSHIP
- BHP BILLITON - GRAD FELLOWSHIP
- BP FELLOWSHIPS
- TALISMAN FELLOWSHIP
- BLACKWELL, MARY & MICHAEL ‘73 GRAD SCHOLARSHIP

**BERG-HUGHES CENTER GRADUATE FELLOWSHIPS**
- CONOCOPHILLIPS/HEEP ENDOWED GRAD FELLOWSHIP
- DARK, WILLIAMS E. ‘54 FELLOWSHIP
- MARSHALL, M/M DUSTIN W. ‘75 FELLOWSHIP
- KELLY, PRISCILLA & THOMAS ‘53 FELLOWSHIP
- PEDROTTI, CAROLYN & DAN ‘53 FELLOWSHIP
- AHR, WAYNE M. ‘65 FELLOWSHIP
- BERG, ROBERT ENDOWED FELLOWSHIP
- BHC - CHEVRON FELLOWSHIP

**TECTONOPHYSICS GRADUATE FELLOWSHIP**
- HANDIN FELLOWSHIP (TECTONOPHYSICS)
4.5 STUDENT PUBLICATIONS/PRESENTATIONS

We typically have several undergraduate students present their research results at regional or national scientific meetings each year (e.g. Geological Society of America, American Geophysical Union, AAPG). Most of our undergraduate scholars present their research results at our departmental research symposium each spring. This symposium commonly has 50-100 talk and poster presentations that are judged by faculty, scientists from across campus and representatives from private industry. The Department provides small monetary awards for the research deemed outstanding. We are hopeful that as our undergraduate research expands it will produce more publications.

Similarly, we encourage all graduate students present at a scientific meeting or conference. Many of our students present at regional or national meetings of GSA, AAPG, GCGA, AGU, or SEG. However, some of the students present at more specialized conferences. For the last three years, our graduate students have averaged 38 first-authored papers or presentations per year. Since only a few of our graduate students do not present the results of their research we are disappointed that less than half of our graduate students publish in peer-reviewed journals. We are trying to improve these publishing results by providing financial rewards for our best student publications.
4.6 EMPLOYMENT PROFILE

We began mandating exit surveys of graduating seniors in 2014. This has produced the first data set (207 completed surveys) we have collected that has a response rate high enough to be significant. At the time of graduation, 20% of our students had at least one job offer, and 22% were accepted into a graduate program. About 44% of these graduates had applied to at least one graduate school, and many of these were waiting to hear (Note that over half of our students graduate in August or September, and so plan to have a gap before starting graduate school).
4.7 ANALYSIS

Students
Since the 2010 Program Review, the population of GEPL undergraduate students has varied from just over to 200 to over 530, and is now dropping steadily to the current number of 393. We know that freshmen applications to our undergraduate program follow the price of oil at the time that students are considering college (Fig. 4.16). While our program will always be tied to the volatility of the oil and gas market, we are currently seeking ways to mitigate these effects by adding a steady base population of students, through enhanced nation-wide domestic recruiting and international partnerships.

Figure 4.14 Price of oil and Application to GEPL
Correlation of the 1st Quarter average price of oil (West Texas Intermediates, source: US Energy Information Administration) with the number of GEPL freshmen applications for the following year.
Graduate student numbers show a slow steady increase from 2010 to 2015, and then a leveling off of graduate student number. We currently have ~125 graduate students, which is near our historical average, however, the majority of these students are now Ph.D. candidates (Figure 4.3).

The Department has continued to maintain a strong commitment to introductory core science courses at Texas A&M University, with undergraduate student credit hours of over 4,000 per year. However, these numbers fell significantly following re-classification of many courses to meet the “Core science” requirement. To remedy this situation we are emphasizing GEOL 104 to the growing engineering population, teaching a GEOL 101 course online, resurrecting GEOL 307 DinoWorld as a CORE elective and we are beginning to plan a Geologic Hazards course that should be very apropos for the state of Texas and our undergraduate students. Student credit hours in required courses of the geology and geophysics majors have grown, corresponding to our increasing student numbers, whereas graduate student credit hours have changed little.

A major strength of our graduate program includes the development of admission policies and procedures documents. These documents, annually ratified by the faculty, describe the admission decisions criteria and support awarding processes and provide timelines for each step. The availability of the documentation renders transparent all decisioning processes. These are living documents on which faculty are invited to suggest improvements. The received suggestions are discussed annually at a faculty meeting, and changes voted in favor upon by the faculty are incorporated.

Another strength is the recent requirement of a faculty advocate statement for graduate student admission. This requirement ensures that incoming graduate students have an advisor identified prior to arrival, ensuring that the student has research interests in alignment with our existing research expertise. We strongly recommend that a faculty member has direct contact with a putative student prior to submitting the advocacy statement. The prior contact ensures that the graduate student meets English language and other expectations of the faculty member.
We have also taken steps to ensure that the graduate admissions process is progressive and fair. For example, the junior faculty comprise the majority voting bloc in admission decisions. The opportunity of selecting top-rated graduate students provides a strong lift to the current research activities of the junior faculty, promoting a long-term foundation for the future of the department and supporting their career advancement toward tenure and promotion. At the same time, we also promote a policy of equable distribution of TA and fellowship awards to the faculty, ensuring that each faculty member will receive his or her fair share of departmental support.

In the past year we have also developed a Graduate Handbook that provides a wealth of information to incoming and continuing graduate students. The handbook was largely the effort of the department graduate advisor, Trisha Fike. We are pleased to say that Ms. Fike has been a great addition to our department and, through one-on-one meetings with each graduate student each semester, she is able to determine whether the student is on-track to timely degree completion and to early identify any potential problems.

In the past couple of years we have also reinstated the annual graduate recruitment weekend, held in early March. This event allows 8-12 of our top-rated admitted domestic students to visit campus and meet their putative advisor, as well as our faculty, staff and students. The recruitment weekend is popular and many of the invitees enroll at Texas A&M University.

There remain significant challenges to the graduate program. Foremost amongst these are to find ways to secure additional resources such as teaching and research assistantships, and industry-supported fellowships. We also need to reduce time-to-degree, especially for the MS students, while preserving the rigorous thesis and the summer internship. Another challenge to the graduate program is to get offers out to our top-rated students earlier in the semester; this involves more efficient admissions decisions. Finally, we need to implement active strategies that will achieve gender parity in our graduate student population and attain diversity amongst our domestic students that reflects that of the population of the state of Texas.
CONCLUDING OBSERVATIONS/SUMMARY

5.1 NEW INITIATIVES AND PLANNING

Looking ahead, we seek input into our perceived needs to:

• Maintain our undergraduate program standards, as student numbers stabilize or fall, while integrating the increased undergraduate student research of the new curriculum into our portfolio of research products and provide opportunities to present and publish this research in a timely manner.

• Revisit and modernize our graduate curricula, while continuing to balance our graduate program with outstanding research-oriented Ph.D. students and dedicated, hard-working, motivated M.S. students; foster a culture of graduate student publication through competitive research awards.

• Create more opportunities for post-doctoral researcher for cutting-edge research and encourage their publishing and grantsmanship.

• Increase the level of research funding by taking advantage of the opportunities through the TAMU Foundation and industry connections, this will allow us to maintain and enhance needed laboratories and infrastructure for faculty and students, and provide organic mechanisms to grow our centers and focus our research in our areas of faculty research strengths.

• Build a world-class online curriculum in Petroleum Geosciences that will be sought after across the globe.

The most important factor in recruiting and retaining faculty and students is the community of colleagues and scholars that makes the department its academic home. Excellent colleagues engaged in collaborations that are exciting and productive are also essential to our successes in teaching and research. We have made attempts to build a geoscience community of students, staff, and faculty who excel through collaborative pursuit in teaching and research. Our “community of geoscientists” includes members of our department,
its adjunct and joint appointments, and members of the College of Geosciences, its departments and centers. By “students” we include undergraduate, graduate, and former students. We include staff and faculty of all ranks as we depend on all department members to administer and run our programs.

Undergraduate Programs

In the last seven years, we have made two major goals in the undergraduate program: 1) maintain the rigor of the program in face of fluctuating faculty numbers and rapid growth of enrollments while improving time-to-degree; 2) revise the program to streamline course offerings, improve integration of courses, and enhance the competitiveness of our graduates in the job and grad school marketplace. We think the improvements we have made have put our undergraduate program on track to be one of the very best in the country.

In order for the improvements of our program to pay dividends in more and higher quality students we have several more initiatives in planning for the next seven years:

1.) revise the B.A. in Geology to a degree provide a foundation in geology but tied directly to a pre-law, teacher-preparation, or public policy program.

2.) institute a 5-year BS/MS (thesis-based) program in both Geology and Geophysics designed to accelerate exceptional and motivated students on their way to PhD programs.

3.) modernize our pedagogy to enhance student engagement in the classroom, through pedagogy workshops and a faculty learning community.

4.) modernize our teaching facilities, including at least one technologically-equipped studio classroom that is friendly to group work and other non-lecture-style pedagogy.

5.) grow a more stable base of undergraduate students. We can do this through developing partnerships for student-sharing with foreign universities and through enhanced national recruiting.
Graduate Programs
Assessments of our graduate programs are mixed by comparison with our assessments of undergraduate programs. Our graduate students readily find employment in the energy industry, and they benefit from summer internships with oil and gas companies. In recent years, we have also placed some of our Ph.D. students in faculty positions. However, the increase in the number of Ph.D. students in our program has not coincided with the increase in research productivity we expected, so we continue to search for effective ways to establish this culture of research publishing. Competition from other graduate programs has also increased, and we have lost top-ranked candidates to graduate programs that made 1) early offers, 2) offers with larger graduate stipends, and 3) offers of guaranteed, multi-year fellowships. So we continue to search out opportunities that will allow us to make more competitive offers to graduate students towards growing our graduate student population into one of the premiere graduate programs in the world.

Faculty
One-third of our faculty will be going through the tenure process within the next six years. The future success of the Department is heavily reliant on the success of that process and those faculty. Therefore, supporting those faculty as they develop into leaders in their research and excellent teachers must be one of the primary tasks of the department. To do this we will:

1.) continue to support them through occasional teaching release to give them time to focus on research, and be mindful of their share of the teaching and service load of the department

2.) work to increase support for graduate students, both in number and amount of offers, so that these faculty will have high quality students to work with

3.) lobby for competitive faculty salaries

Research Funding and Support
We recognize the need to increase our research funding. Gaining research funding should be facilitated by greater contributions of Ph.D. students to our research
productivity. Our research funding has increased in recent years, owing largely to the efforts of the excellent young faculty who have joined the Department.

However, we may also need to re-evaluate our balance of funding sources and faculty time dedicated to teaching and research. Traditionally science units have relied on external federal support for their research programs, however, with the decline in this type of funding we will search for new funding sources through foundations, industry, and non-governmental agencies. This search for additional funding could be facilitated by more support from the TAMU Foundation and the College of Geosciences. The Department of Geology and Geophysics at Texas A&M University makes a large investment in science education for non-majors to meet our commitment to producing a well-educated populace for the state of Texas. While we remain committed to the university’s core courses, young faculty need to dedicate significant time to initiate their research and obtain funding, especially as federal funding decreases. One means to decrease faculty teaching is to hire more lecturers. Greater support of graduate students through research grants would facilitate student dedication and effort to bring their research to publication.

With the number of recent faculty hires in our department in the last five years we have dedicated significant funds to new faculty start-up, and we have made competitive start-up offers for new faculty. Start-up funds are critical to make competitive offers to the best faculty candidates, and they are essential to initiate the research of new faculty and their students. However, we need to make sure that we can continue to support our new faculty to increase their productivity by making outstanding offers to graduate students, encouraging the faculty to pursue funding from numerous sources, and providing much needed time through Faculty Development Leaves or internal leaves to write up the results of their last research and prepare grants and proposals for future research.

*Building on Strengths*

The Department and College of Geosciences recently invested significant resources to rebuild our strength in petroleum geosciences, who contribute to sedimentary geology, and petroleum geology and geophysics. The Berg-Hughes Center facilitates interdisciplinary research between members of our department, faculty and students of Oceanography and Petroleum Engineering, and colleagues in the energy
industry. However, the BHC has not grown as we expected due to the downturn in the petroleum industry and a lack of corporate backing. We suggest that a full-time fund raiser from the Foundation be assigned to the Department and the BHC to better build on the potential growth of this center and the department. We initiated a Petroleum Geoscience Certificate with the advent of the BHC, but we need to make this a more prominent aspect of our graduate program, especially for the M.S. students, since recruiters know this is an easy means to know that the students received a broad geosciences background.

The Department has also made investments and plans to build our program in environmental geosciences. We hired a field hydrogeologist (Peter Knappett) to complement our current strengths in hydrogeology theory and modeling. However, we hope to hire a biogeochemist or low-temperature aqueous geochemist that would contribute to the college's Water Management and Hydrological Sciences Program and to the College of Geoscience's undergraduate Environmental Geosciences Program. Funding opportunities for this prospective new faculty can be identified from NSF, EPA, and DOE. If graduate education and research in water resources and environmental geosciences are to thrive in our department, we will need to succeed in attracting active young scientists and make start-up offers that build on the laboratories that our current faculty have established.

The Department has attempted to enhance our strength in tectonophysics with the addition of Hiroko Kitajima and Patrick Fulton. The John Handin Rock Deformation Laboratory is still an internationally recognized laboratory, but replacement or upgrading of aging equipment in this facility is necessary to maintain its reputation. However, real investments would be required, comparable to those made in state-of-the-art radiogenic and stable isotope geochemistry laboratories, and we look forward to addressing this challenge in the near future.

We have established a department strength in life, climate, and Earth history research and education. We wish to maintain and strengthen this area of graduate research and contribute to College of Geosciences interdisciplinary climate initiatives. There are multiple opportunities to collaborate in geobiology, paleobiology, paleoclimatology, and paleoceanography, with faculty and students of our department, and members of
Departments of Oceanography, Atmospheric Sciences, and Geography, and research scientists of IODP.

The Department of Geology and Geophysics has a proven record of hiring outstanding young faculty. We also have good records of providing excellent programs for undergraduate and M.S. students with practical professional career goals. We have yet to demonstrate that we can retain outstanding faculty and attract a larger population of outstanding research-oriented Ph.D. students. We recognize that performing well in both applied and fundamental geosciences research is a challenge; it would be easier to focus our efforts in either the applied energy and environmental geosciences or the academic world of fundamental geosciences. However, we are committed to this challenge. We have confidence that unforeseen applications come from curiosity and fundamental understanding in the sciences.
Appendix A. Strategic Plans
2010 Strategic Plan

As a large geoscience department at one of the two largest state universities of Texas, and with affiliations in the College of Geosciences and university, we believe that we have opportunities to build our reputation in four areas:

1. Petroleum Geosciences
2. Water Resources and Environmental Geosciences
3. Tectonophysics, Deep Crust and Mantle Dynamics
4. Life, Climate and Earth History

We have attempted to establish these as our traditional and emerging strengths. We believe that we can develop these programs further to meet the university's challenges of Vision 2020 with current faculty, with new faculty hired to complement current strengths, and with allocation of resources that will allow our educational and research programs to flourish.

Core Values

While open debate and scrutiny are daily staples of our academic culture, we have been convinced by the department's advisory council (GEODAC) that our academic and professional goals can be reached if we develop a common understanding of core values and live by them. Our core values include:

1. The clear articulation of our vision and goals.
2. Our priorities and expectations reflect our goals.
3. As individuals and as a community, we take responsibility for accomplishing our goals.
4. Openness, honesty and listening lead to mutual trust and effective communication.
5. We value all members of our community for their contributions, and we respect their opinions and diverse perspectives regardless of position or background.
6. We have a life-long commitment to learning and teaching.
7. Sustained productivity and creativity require balance and perspective.
8. A culture of intellectual curiosity, scientific rigor, and collaboration will inspire excellence.
9. Striving for improvement will lead to success.

Accomplishments and Shortfalls

In our 2005 Strategic Plan, we established academic goals for our graduate and undergraduate programs, faculty research productivity and extramural funding, and building our faculty and technical staff hiring.
We have improved our undergraduate program by 1) establishing new, writing-intensive courses, 2) providing students with in-house tutoring in math and physics to improve their backgrounds and performance in math and background science courses, 3) involving more undergraduate students in research, 4) maintaining our summer field course (Geol 300) as the capstone course of the Geology B.S. program, and providing additional field exercises in other geology and geophysics courses. Our undergraduate program assessments are encouraging (Appendix B), and we are pleased by the number of our majors who go on to graduate geology and geophysics programs, or take geoscience jobs. We are pleased by the number of undergraduate students who are offered summer internships and by the number of undergraduates who are introduced to research, either through individual projects with faculty or as participants in funded research projects.

We have attempted to improve our graduate program by 1) elevating our admissions standards, 2) improving our graduate student stipends, at the same time that the University has released graduate students from tuition and benefits costs, 3) establishing and communicating clear expectations to our graduate students and reinforcing these with fellowship and scholarship guidelines that emphasize scholarship and research accomplishment. Our students benefit from active on-campus recruiting and from summer internships. Placement of our students in applied geoscience careers is excellent (Appendix C). We are also proud of those students who have brought their M.S. theses and Ph.D. dissertations into print in peer-reviewed journals (Appendix C) and have initiated their own academic careers as faculty at universities and colleges. However, our graduate program assessment indicates that we are not meeting our goals in student-authored publications. Many M.S. Thesis research projects are never published and a number of our Ph.D. students publish fewer peer-reviewed papers than will make them competitive for faculty or government lab research openings.

We are proud of the active, young faculty we have hired in recent years. Their ambitions, scholarly backgrounds, and ability to address important scientific questions have largely been responsible for recent increases in research funding of the department. We have also attempted to improve the research environment of the department by hiring postdoctoral researchers, who are able to invest their full time to research, collaborate with faculty and students, and provide outstanding mentoring to our Ph.D. (and M.S.) students. All five postdoctoral fellows of the department are outstanding young scientists. Dr. J. Moore has co-authored a 2008 paper in Science, Dr. Holyoke has been invited to give a keynote lecture at a Gordon Research Conference this coming summer, 2010, and all five have contributed to the development of new research proposals.

After extended efforts (and some setbacks) to rebuild our traditional strength in petroleum geosciences, collaborations with faculty of TAMU’s Petroleum Engineering Department, and ties
with the energy industry, we are on the threshold of rebuilding our strength in petroleum geosciences. We have successfully hired outstanding sedimentary geologists, we have established the Berg-Hughes Center for Petroleum and Sedimentary Systems, and we have attracted an experienced leader to direct this center. With Dr. Hopper's loss from the Department, we are working to rehire a reflection seismologist who will rebuild our geophysics program and collaborate with geologists, geophysicists, and petroleum engineers of the Berg-Hughes Center.

The Department has new research strengths in radiogenic and isotope geochemistry, supplementing our environmental geochemistry capabilities. The Department has invested in outstanding new geochemistry faculty and the College of Geosciences has invested in state-of-the-art analytical facilities. Our geochemistry faculty have developed ties with Oceanography and Geography, and with the Integrated Ocean Drilling Program (IODP) and they have strengthened our developing Deep Crust and Mantle Dynamics focus. The department and college have succeeded in hiring outstanding ODASES faculty to build on research collaborations with scientists of the IODP. However, we have failed to build the environmental geosciences with a critical faculty hire in hydrogeology and we have lost a biogeochemist. Our environmental geosciences program needs an applied hydrogeologist who can collaborate with our current faculty, with strengths in hydrogeology theory and modeling and environmental geochemistry and biogeochemistry, and with faculty across campus in the university's Water Management and Hydrological Sciences Program. We recently lost an important faculty member, Dr. J. McGuire, whose biogeochemical research was well funded and attracted excellent students to our graduate program. We need to build our environmental geosciences in this area as well, supplementing the research of Drs. Herbert and Tice.

Tectonophysics was identified as a strength of the Department in our 2002 review, but without significant investments in faculty replacements and facilities, it will be difficult to re-establish this strength of the department. We attempted but failed to hire faculty with specialties in rock mechanics, geodynamics, and tectonic geodesy, who would have strengthened this research area. As the John Handin Laboratory ages, it will also be important to rebuild this laboratory if we wish to continue to lead in this area. Funding in tectonophysics has continued to be strong, and we have the opportunity to rebuild a unique strength that will be competitive, nationally and internationally.

Through Reinvestment and ODASES faculty hires and the development of state-of-the-art stable and radiogenic isotope geochemical laboratories, we have invested in developing a strong program in Life, Climate, and Earth History. This group is particularly well positioned to make research and educational contributions with opportunities to collaborate with colleagues throughout the College of Geosciences and the IODP.
The Department has managed to maintain a small staff of technicians and a research professor to facilitate research by operating and maintaining the John Handin tectonophysics lab, the electron microprobe lab, and geochemistry laboratories. All of these individuals contribute to educational objectives, in support of teaching laboratories, as well as facilitating our research. However, we are still challenged to maintain our facilities, and we could use more technical support.

**Summary of 2010 External Program Review**

The Department of Geology and Geophysics received an external review of its comprehensive program in 2010. In their January 27, 2010 report (*Appendix I*), the External Review Committee, chaired by Dr. Robert Tracy (Virginia Tech), also included a more general review of the department. This section briefly reviews the state of the department at that time and the principal conclusions of the review.

*Faculty and Research Staff*

In 2010, the Department of Geology and Geophysics had 26 full time faculty members, with six additional faculty who held joint appointments in Oceanography, Geography, and Petroleum Engineering (*Table 2.1*), as well as one lecturer, a research scientist who taught some courses, and one post-doctoral researcher. This represented a significant reduction from 37 full time equivalent (FTE) faculty members when the two separate Departments of Geology and Geophysics were merged, eight years earlier. Of the full time faculty members, 18 were full Professors, five were Associate Professors, and three were Assistant Professors.

Of the full-time tenure-track and tenured members in the department in 2010, 20 are still in the department, our Lecturer was promoted to Assistant Professor, and our Associate Research Scientist was promoted to Associate Research Professor. Of the Joint Faculty appointments in 2010, four are currently with TAMU and of these, two are administratively part of the department. Two full time faculty members left TAMU for other career opportunities and four were awarded Emeritus upon their retirement. The Curricula Vitae of continuing faculty, along with those of all current faculty members, are provided in *Appendix A*.

*Students*

In 2010, just over 200 students were enrolled in academic programs offered by the department. At the undergraduate level, there were about 100 geology majors and a dozen geophysics majors. At the graduate level, 40 students were pursuing a M.S. in geology, 16 were working on a M.S. in geophysics, and a little over 40 students were working towards doctoral degrees, almost evenly split between geology and geophysics.
Staff

In 2010, the Geology and Geophysics office staff consisted of four administrative assistants, who took care of appointments, administrative records, financial matters, accounting, and support of undergraduate and graduate programs. Two IT staff members assisted faculty and students with network and computer needs, as well as maintenance of a departmental website and preparation of an annual alumni newsletter. Introductory laboratories were organized and teaching assistants were supervised by a Technical Lab Coordinator. The department supported one Laboratory Research Specialist.

Salient Points of the 2010 Review

At the time of the 2010 Program Review, Texas A&M University had recently completed a long-range planning effort, Vision 2020, formulated with the goal of elevating Texas A&M to a top-ten public university in national rankings by the year 2020. Much of Vision 2020 was being fully implemented in 2010. The Vision 2020 plan established twelve imperatives for the university:

1. Elevate our faculty and their teaching, research and scholarship
2. Strengthen our graduate programs
3. Enhance the undergraduate academic experience
4. Build the letters, arts, and sciences core
5. Build on the tradition of professional education
6. Diversify and globalize the A&M community
7. Increase access to knowledge resources
8. Enrich our campus
9. Build community and metropolitan connections
10. Demand enlightened governance and leadership
11. Attain resource parity with the best public universities
12. Meet our commitment to Texas

The Charge of the 2010 Geology and Geophysics External Review was focused on the entire program and on meeting the challenge of Vision 2020 to gain recognition as one of the top ten academic programs. In their evaluation of the Department, the External Review Committee addressed: 1) faculty stature and academic performance, 2) strength of the Ph.D. (and M.S.) programs, and 11) research funding and facilities. Their report included a number of perceived strengths and weaknesses, along with recommendations to build on strengths and resolve weaknesses.
Strengths:

I. The department had visibility in the petroleum industry as a major educational and research unit, with internship and career opportunities for students.

II. The department enjoyed a unique relationship with its former students, many of whom were involved in the energy industry and provided significant contributions to the department and students.

III. Facilities and equipment were abundant and teaching facilities were excellent. State-of-the-art capabilities were recognized in rock deformation.

IV. Students had access to state-of-the-art computational facilities, common space, and financial support through fellowships and teaching assistant positions.

V. Faculty had across-the-board strengths in a wide range of research areas, with notable strengths in petroleum geosciences and tectonophysics, and potential in environmental geosciences.

VI. Excellent new faculty had been hired with significant potential in teaching and research.

VII. Unusual potential for synergism was recognized with other departments in a College of Geosciences, and with the Ocean Drilling (Discovery) Program.

Weaknesses:

i. The department appeared to lack a clear focus with a unified, inclusive vision for the future and high-impact research objectives.

ii. Graduate student capabilities and interests were not commensurate with those of a top-tier research university.

iii. The graduate student applicant pool was inadequate in terms of quality and quantity.

iv. Long residence times and failure of graduate students to focus on research were attributed to the structure of the graduate program, teaching assistant duties and summer internships.

v. The overall level of research funding was not competitive with nationally ranked research universities.

vi. The department did not have a critical mass of senior faculty who were leading collaborative, interdisciplinary research efforts.

vii. The department did not have sufficient state-of-the-art analytical equipment to compete with research efforts of top-tier departments.

Recommendations:

a. Identify where geosciences research will be directed for the next decade, and move as aggressively as resources will allow to position the department to take maximum advantage of the external funding opportunities that will evolve in response to national and state priorities.
b. Seek the best balance between academic geoscience (traditionally based upon a strong PhD program) and the strong geosciences centered around petroleum geosciences, environmental geosciences, and hydrogeology.

c. Continue to rebalance the MS and PhD programs so that PhD programs form a greater proportion of the total graduate student population.

d. Focus on high-priority faculty hires in key areas such as Biogeochemistry, field-based Physical Hydrology, Reflection Seismology, and probably two or more hires in Deep Crust and Mantle Dynamics to help tie this diverse group together.

e. Bolster the support staff for educational programs, particularly for both undergraduate and graduate technical advising.

f. Faculty should foster a culture of timely publication of research results by both MS and PhD students in high-visibility national and international journals.

g. Maximum advantage should be taken of opportunities for synergies within the College of Geosciences, particularly to leverage opportunities provided by the Berg-Hughes Center, providing an essential connection between basic and applied research.

h. The department should enhance its assessment tools for undergraduate educational outcomes to better identify problem areas and to provide the best information for necessary re-design and streamlining of the curriculum to meet the needs of the 21st century.

i. Provide research support (post-doc position?) for Department Head Andreas Kronenberg so that his personal research program does not suffer unduly while he remains as Head.
Preamble

The strategic plan for the Department of Geology and Geophysics was generally guided by Vision 2020 and the following specific imperatives of Vision 2020:

- Elevate our faculty, teaching and research;
- Strengthen our graduate programs;
- Enhance the undergraduate academic experience;
- Diversify and globalization the department;
- Commit to Texas;
- Build community and metropolitan connections; and
- Increase access to knowledge.

Vision

The Department of Geology and Geophysics is engaged in cutting-edge scholarship related to Earth and its complex systems and processes: the interactions among solid Earth, hydrosphere, biosphere, as they impact society. The department is committed to excellence in discovery and creation of new knowledge about Earth, enabling life-long learning by all students about Earth processes and the impacts and engagement of faculty, students and the public addressing and solving the challenges associated with stewardship of Earth.

With this vision, the Department of Geology and Geophysics seeks to lead in the discovery, dissemination, and application of knowledge about Earth (including its physical, chemical, and biological components and their interactions). By lead, we mean:

- Educate students of diverse backgrounds who rise to leadership positions in industry, government, and education.
- Conduct interdisciplinary, innovative, technologically advanced research that is widely translated and communicated for the benefit of a global society.
- Prepare all students for thoughtful, life-long participation in public issues related to science, technology, and society.
Mission

The primary mission of the Department of Geology and Geophysics is framed by being created as a Land Grant University and serving as a Sea Grant University and a Space Grant University. Through these strong foundations our mission is to:

- Provide quality education;
- Provide cutting-edge research;
- Provide outreach to the citizens of Texas extending to the national and international arena;
- Advance new understanding of the Earth System and apply these to the needs of society;
- Prepare the next generation of geoscientists to conduct research, to find and develop natural resources, and to measure and respond to environmental change.

Values/Goals

As faculty we value the creation of knowledge, and the imparting of knowledge, skills, values, and ethics to our students that reflect a strong geoscience experience. We value a collegial environment and the atmosphere and resources to facilitate and promote cutting-edge research by our students and faculty. We value a diverse faculty and geoscience student body. We also value excellence, integrity, leadership, and service. We value providing our students with a sense of working on teams and possessing quantitative skills. We value our responsibility to the citizens of Texas to provide research outcomes that will help lead the state in providing a sound economic, sustainable base for the future.

We value Earth science that is:
- Rigorous;
- Quantitative;
- Driven by deep, broadly significant questions;
- Grounded in implications for society at large; and
- Interdisciplinary and supported by multiple modes of inquiry (historical observation and inference, modeling, experimentation).

We value education in Earth science that:
- Is focused on knowledge, skills, and values reflecting geoscience expertise;
- Meets the needs of the diverse range of students coming to Texas A&M;
- Benefits from and reflects the research distinctiveness of the faculty; and
- Is rigorously supported by research and assessment.
## SWOT Analysis

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>Research-active faculty</td>
<td>Compensation and recruitment packages not competitive w/peer aspirant</td>
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<tr>
<td>Research facilities</td>
<td>departments</td>
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<tr>
<td>Quantitative skills</td>
<td>Faculty/students not representative of state</td>
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<tr>
<td>Scientific community leadership</td>
<td>Low technical/facility support (maintenance, upkeep)</td>
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<tr>
<td>Community outreach (G-Camp, NASA)</td>
<td>Underfunded research programs relative to peer &amp; aspirant departments and</td>
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<tr>
<td>Demand for degrees and graduates resulting in high applications and</td>
<td>research ambitions</td>
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<tr>
<td>enrollment</td>
<td>Low endowment relative to our peer institutions</td>
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<tr>
<td>Well-connected to industry (Berg-Hughes)</td>
<td>Education model scales poorly to large student numbers</td>
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<table>
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<tr>
<th>Opportunities</th>
<th>Threats</th>
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<tr>
<td>Interdisciplinary multi-institution funding opportunities growing from</td>
<td>Changing university CORE curriculum makes demand for service courses</td>
</tr>
<tr>
<td>Federal sources</td>
<td>uncertain</td>
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<tr>
<td>Projected increasing demands for Earth</td>
<td>Decreasing funding for disciplinary, single-</td>
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<tr>
<td>Scientists/Earth Science degrees</td>
<td>investigation projects (Federal &amp; State)</td>
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<tr>
<td>Access to HPC facilities</td>
<td>Changing models of industrial funding (focus on existing large centers)</td>
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<tr>
<td>Opportunities for collaboration in research, education and outreach w/IODP</td>
<td>Growing student numbers not matched by funding needed for existing high impact experiences (field, lab, etc.)</td>
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<tr>
<td>Access to growing college programs in diversity</td>
<td>University-level IT infrastructure a hindrance to efficient function (TAMUDOCS, CONCUR, MAESTRO)</td>
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<tr>
<td>Growing demand for collaboration w/our department from Central/South America &amp; Asia</td>
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### Critical Issues Related to Vision 2020 Goals

A. Elevate our Faculty, Teaching and Research

1) Growing institutional assessment and instructional demands are restricting faculty time for the creative tasks of proposing new research directions and creating new learning opportunities. Resolving this while maintaining or enhancing existing standards is a critical issue for faculty productivity and retention.

2) Rapidly increasing demand for our courses are straining teaching staff. We need additional teaching staff to cover some teaching to meet additional demand while maintaining instructional standards.

3) Department lacks parity with other departments (including partnering departments within TAMU and external peer and aspirant departments) in support for technical staff.

4) Lack mentoring program for junior faculty and graduate students.

B. Strengthen our Graduate Programs and Enhance the Undergraduate Academic Experience

1) Lack named dedicated funds for critical issues/needs, such as tuition, field work, lab analysis.

2) Need increased High Impact Learning Experiences (HILE) to address increasing undergraduate population.

3) Maintain capstone-quality summer field course.
C. Diversify and Globalize the Department
   1) The Department (and University) does not represent the diversity of Texas and so our ability to recruit and retain the best students and faculty from across Texas and the US is reduced.
   2) Limited international research and study abroad programs, including undergraduate and graduate exchange opportunities.

D. Attain Resource Parity
   1) Need resources to upgrade, maintain, replace and buy new cutting-edge equipment.
   2) Need to develop high-performance computing (HPC) capabilities.
   3) Infrastructure is in need of major repairs—classrooms, teaching labs, specimen collections, field equipment, and computers look like third-world University.

E. Increase Access to Knowledge by Building Community and Metropolitan Connections as Part of Our Commitment to Texas
   1) We offer no distance learning courses, certificates or degrees.
   2) Missing opportunities to take advantage of locations in Houston to offer face-to-face programs similar to the Mays Business School programs.
   3) Poor or limited connections with teachers in underserved schools.

Critical Issues Related to Provost’s Departmental Report Card and Academic Analytics

A. Publication and Citation Record
   1) Citations per faculty member
   2) Citations per publication
   3) Articles per faculty member
   4) Total Citations

B. Funding Record
   1) Grant dollars per faculty member
   2) Number of grants per faculty member
   3) Percent of faculty with grants
   4) Average award per faculty member
Action Plan Related to Vision 2020 Goals

A. Elevate our Faculty, Teaching and Research
   1) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research and publication.
   2) Create three professors of instruction positions with 3-5 year contracts to help cover large number of student numbers. This will also provide more time for faculty to dedicate to proposal writing and publication.
   3) Develop a fund for salary continuity between grants for technical support staff.
   4) The department will partner with the College to create a mentoring and training program for junior faculty and graduate students. The faculty mentoring program will be run by the department head and T&P committee chair and will pair senior faculty with junior faculty to help mentor with career growth. The student mentoring program will be run by the department head and the graduate director and will emphasize career planning.

B. Strengthen our Graduate Programs and Enhance the Undergraduate Academic Experience
   1) Use the upcoming capital campaign to raise named dedicated funds for critical issues/needs, such as tuition, field work, data analysis.
   2) Align the curriculum to educate students to be leaders of the future.
   3) Ensure the stability of our capstone-quality summer field course.

C. Diversify and Globalize the Department
   1) Develop a strategy to recruit underrepresented students and faculty from around Texas and the US, so that we better represent the diversity of Texas and the US.
   2) Expand our international research and study abroad programs, including undergraduate and graduate exchange opportunities with Costa Rica, Mexico and China.

D. Attain Resource Parity
   1) Use the upcoming capital campaign to raise dedicated funds to upgrade, maintain, replace and buy new cutting-edge equipment.
   2) Develop world-class High Performance Computing facilities.
   3) Create a plan of action to seek University help to address infrastructure problems, specifically, size-appropriate classrooms, collaborative learning environments, internet connectivity, etc.

E. Increase Access to knowledge by Building Community and Metropolitan Connections as part of our Commitment to Texas
   1) Create distance learning courses, certificates and Master of Geoscience degree. This proposed solution will help address our commitment to Texas and build our community and metropolitan connections.
2) Take advantage of existing locations in Houston to offer face-to-face programs similar to the Mays Business School programs.

3) Use G-camp connections to build a network with teachers in underserved schools to expand our connections with students and teachers of Texas for recruiting.
Action Plan Related Provost’s Report Card and Academic Analytics

A. Publication and Citation Record
1) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research and publication.
2) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research and publication.
3) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research and publication.
4) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research and publication.

B. Funding Record
1) Work with Academic Analytics to have grants from industry counted as part of our total grant number and use flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research.
2) Work with Academic Analytics to have grants from industry counted as part of our total grant number and use flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research.
3) Create flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research.
4) Work with Academic Analytics to have grants from industry counted as part of our total grant number and use flexible teaching schedule distributions for faculty to spend dedicated time developing proposals for cutting edge research.
A. Elevate our Faculty, Teaching and Research

1) Flexible teaching schedule distribution (no cost for implementation)
2) Three professors of practice ($158,760)
3) Continuity fund ($60,000)
4) Mentoring plans ($7,000 for mentoring training programs for senior faculty and trips to workshops for junior faculty)

B. Strengthen our Graduate Programs and Enhance the Undergraduate Academic Experience

1) Capital campaign to help raise funds for graduate student tuition ($240,000), fieldwork ($90,000), and lab analysis ($40,000).
2) High-impact learning through undergraduate research project ($60,000 for 60 peer-reviewed undergraduate research proposals per, year 30 in fall and 30 in spring), funds to
enhance undergraduate first-year seminars ($10,000 per year; $1,000 per course, 5 courses per semester)

3) TAs for field camp ($18,360), professor salary for field camp ($60,000), field camp scholarships ($30,000, 15 scholarships at $2,000 each)

C. Diversify and Globalize the Department

1) Travel and recruiting materials ($15,000)

2) International study abroad scholarships ($30,000, $1,000 per student)

D. Attain Resource Parity

1) $1,000,000 to several million dollars for updating, maintaining, buying cutting-edge equipment.

2) Interior facelift (including new computer labs) ($500,000)

3) Maintenance cost for high-performance computing research ($250,000 per year)

E. Increase Access to knowledge by Building Community and Metropolitan Connections as part of our Commitment to Texas

1) Distance learning (no cost if outsourced)

2) Off-campus face to face teaching (underwritten by distance education fees assessed to classes)

3) Ensure funding for G-camp and workshops throughout the year ($120,000 for summer G-camp and 3 workshops per year)
Appendix B. Facilities
Centers, Laboratories, Programs and Departments Within and Associated with the Department of Geology and Geophysics

The Department of Geology and Geophysics at Texas A&M University benefits from faculty and student affiliation with research centers and departments in the College of Geosciences. The Department currently has three joint professors and ten adjunct professors who occasionally teach courses in our department, offer related courses in other departments, and serve on graduate student research committees.

The Interim Dean of Geosciences, Professor Debbie Thomas, has a joint appointment with our department, as does the Director of the IODP, Professor Brad Clement. A significant number of faculty members are associates of the Center for Tectonophysics and many faculty are affiliated with the Berg-Hughes Center for Petroleum and Sedimentary Systems. Some faculty in our department teach courses of the College’s Environmental Studies Program, and others serve as advisors and graduate research committee members of students in the university's Water Management and Hydrological Sciences Program.

The Department of Geology and Geophysics has traditional strengths in petroleum geosciences, and we have benefited from an active and supportive advisory council. Texas A&M geology and geophysics students are in high demand in the energy industry, and recruiters come to our department each year from major oil and gas companies and many smaller producers involved in geological and geophysical exploration.

Berg-Hughes Center for Petroleum & Sedimentary Systems

The Berg-Hughes Center (BHC) for Petroleum & Sedimentary Systems, integrate faculty from our department, and the Departments of Oceanography and Petroleum Engineering to address fundamental and applied problems in the Earth Sciences. The Berg-Hughes Center is part of the Department of Geology and Geophysics, with the purpose of hosting multidisciplinary research that addresses fundamental scientific questions and makes applications to petroleum systems that will benefit Texas and address the nation's energy needs. The Berg-Hughes Center owes its name to 1) Dr. Robert R. Berg, who was an admired faculty member of the department and member of the National Academy of Engineering, and 2) the Hughes family, three of whom are graduates of Texas A&M University and successful, independent oil and gas entrepreneurs. Earnings from the Dan A. Hughes ’51 Chair in Geosciences support the academic activities of the Director of the Berg-Hughes Center, and funds from remaining endowments largely go to students through scholarships, graduate fellowships, and undergraduate summer internships. In addition to its research goals, the center is intended to provide an innovative multidisciplinary education in petroleum and sedimentary geoscience, and contribute to the career development of geoscience and engineering students who work together in joint research projects, and exchange ideas in seminars.
Industry colleagues have shown their enthusiasm for the BHC by providing data sets for student research, and funds to support student research and fellowships. Earnings from endowments will go to student scholarships, fellowships, and undergraduate summer internships. Funding of research will come primarily through external contracts and grants, from the Department of Energy and from industry.

Dr. Ernest Mancini was the initial Director of the Berg-Hughes Center and joined the Department of Geology and Geophysics, in the spring semester, 2010. Dr. Mancini left his position in 2013 and Dr. Carlos Dengo took over the BHC Director in 2013. Carlos also served for three years as Director and instituted a more business-like approach that led to more collaborative research with Petroleum Engineering (PETE). Dr. Mukul Bhatia assumed the position of BHC Director in Spring 2017.

<table>
<thead>
<tr>
<th>Berg-Hughes Center Faculty Associates in Geology and Geophysics</th>
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<tr>
<td>Blasingame</td>
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<tr>
<td>Fred Chester</td>
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<tr>
<td>Judith Chester</td>
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<tr>
<td>Duan</td>
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<td>Ewing</td>
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<td>Everett</td>
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**Water Resources and Environmental Geosciences**

The Department invested in environmental geosciences over the last 12 years, and it now represents one of our strengths. Water resources research and environmental geosciences benefit from colleagues in the College of Geosciences, Engineering and Agriculture with interests in hydrology and environmental studies. The Department has faculty with expertise in theoretical groundwater modeling, environmental geochemistry, geophysical methods, geomorphology, and engineering geology. Numerical models of Dr. H. Zhan are relevant to groundwater flow and solute transport. We think that the department's strength in hydrogeology and the strength of the university's Water Program has benefitted greatly by hiring Dr. Peter Knappett, an applied, field-based hydrogeologist. Drs. Grossman, Marcantonio, and Tice investigate natural systems by geochemical (and biogeochemical) approaches. The Department has strength in this area of research, but could use replacement of a recent faculty loss (Dr. J. McGuire) by a new faculty member who works on biogeochemical processes in natural systems. This research area benefits
greatly from Dr. Giardino's geomorphology and Dr. Everett's near-surface geophysics contributions.

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<thead>
<tr>
<th>Water Resources and Environmental Geosciences Faculty</th>
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<tr>
<td>Everett</td>
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<td>Giardino</td>
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**Center for Tectonophysics**

Faculty, postdoctoral research and student associates of the Center for Tectonophysics evaluate tectonic events and rock deformation by a combination of theoretical analysis, experimentation, and observation that bears on the mechanics that govern faulting, plate tectonics, and mantle flow. Experimental determinations and mathematical modeling of the mechanical behavior and associated deformational processes are employed to understand the structures of mountain belts, plate boundaries, and deformed sedimentary, igneous and metamorphic rocks at all scales of observation. Applications include the development of fractured reservoirs, the transport and storage of fluids in petroleum and hydrological systems, and such fundamental processes as plate rifting, subduction, mantle convection, transform faulting, slow episodic creep, and seismogenesis. Tectonophysics research is also applied to problems in geomechanical engineering.

Center faculty maintain a healthy level of external funding in support of basic and applied tectonophysics research. Collaboration between faculty within the Center, as well as with researchers elsewhere on campus and from other institutions is common. Recent funding sources include the NSF, USGS, DOD, and DOE, as well as industrial sources including Shell, BP, ExxonMobil, and Hess. Center researchers are involved in a number of national and international research programs and initiatives, including NSF MARGINS, SCEC, IODP-NanTroSEIZE, and EarthScope-SAFOD. Seventeen students are Associates of the Center and two postdoctoral fellows, Drs. Holyoke and Zhong.
Deep Crust and Mantle Dynamics

Studies of tectonic and geodynamic processes in the department also draw on interdisciplinary approaches involving geochemistry, petrology, and geophysics. Current projects include EM Imaging of the Earth's deep interior, geochronology of plate collisions, chemical evolution of the crust and mantle, natural deformation microstructures of ultramafic assemblages and inferences of rheology, and planetary dynamics. The group runs a semester-long weekly seminar series on topics in Deep Crust and Mantle Dynamics each year. Members of the Deep Crust and Mantle Dynamics group include members of the Department of Geology and Geophysics as well as faculty in Oceanography and research scientists at IODP:

Deep Crust and Mantle Dynamics Faculty and Post-docs

<table>
<thead>
<tr>
<th>Everett</th>
<th>Kronenberg</th>
<th>Newman</th>
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<tbody>
<tr>
<td>Fulton</td>
<td>Lamb</td>
<td>Sparks</td>
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<td>Gibson</td>
<td>Miller</td>
<td>Tominaga</td>
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Life, Climate, and Earth History

Much of the Department's strength in Life, Climate, and Earth History draws on faculty members with specialties in geobiology, geochemistry, sedimentology, and paleontology. Geobiology is the study of how living things interact with geological systems at present and in the past. Two of its major subdivisions are geomicrobiology and astrobiology. Paleontology, the study of ancient life, takes many of the topics of geobiology and extends them through geological time, addressing how organisms have responded to changes in environment and climate.

We offer rigorous cross-disciplinary education in all these areas to our graduate students. Students can customize their coursework to advance their particular research interests as well as get a broad background in the current issues facing scientists at the frontier between the Earth and life sciences.
Climate change research in our department involves geobiology and paleontology as well as isotope geochemistry and paleoceanography. One specific research focus is how isotope and trace element tracers can be used to understand the relationship between past climate change and past oceanic biological productivity, deep-ocean circulation, and patterns of continental aridity. Another research focus is measuring the geochemistry of microfossils to investigate past sea surface and bottom water temperatures and gain insights into vertical and latitudinal temperature gradients. Climate change research is a collaborative effort throughout the College of Geosciences, drawing on members of our department, members of Departments of Atmospheric Sciences, Oceanography, and Geography and the Integrated Ocean Discovery Program (IODP).

<table>
<thead>
<tr>
<th>Life, Climate, and Earth History Faculty in Geology and Geophysics</th>
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<tbody>
<tr>
<td>Ewing</td>
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<tr>
<td>Grossman</td>
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<td>Heaney</td>
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Laboratories

The Department has a wide array of laboratories and facilities in support of research, many within the department, and a number that are available to faculty and students as College and University facilities.

**Department Laboratories and Instrumentation**

Some laboratories within the Department are maintained by individual faculty, but many are shared facilities. Many of the research laboratories are also used for instructional purposes and graduate laboratories. Further details of the laboratories and facilities described here can be found on the Department's website (http://geoweb.tamu.edu/research-facilities).

**Computational Resources.** All faculty and most students use desktop and/or laptop personal computers for much of their work, access to the internet and e-mail. In addition, several faculty and faculty groups maintain rack-mounted servers and clusters. Shared computing facilities of the department include several UNIX servers and a cluster of 153 nodes of high performance computing. The nodes consist of Appro 1124i AMD Athlon dual processors operating at 1.5
GHz with 2 GB of memory. The cluster operates under the Rock Clusters Operating System. There are two classrooms populated with individual computers and data analysis software for instructional use. There is also a common computing area on the third floor with computers configured for open access by graduate students, along with a printer and two large-format plotters.

**Earthquake Simulation Lab.** The Earthquake Simulation Lab conducts numerical simulations of past earthquakes and future scenario earthquakes. The lab facilities include a Sun Fire X4600 server with 8 processors, 48 GB memory and 450 GB hard disk, a Sun Ultra 40 workstation with 2 processors, 8 GB memory and 5 TB hard disk, and several high-level PC systems. The lab has access to a 52-node 832-processor IBM Cluster 1600 system - Hydra of the Texas A&M Supercomputing Facility.

**Computing and GIS Remote Sensing.** The Geology and Geophysics Department provides Geographic Information System (GIS), Trimble Global Positioning System (GPS) receivers, remote sensing, and 3D modeling resources for faculty and students. ArcInfo, ArcView, ERDAS, ENVI/IDL, and WMS are installed and used for research and teaching. The computer lab (Halb 308) is used for compiling and digitizing spatial and attribute data, interpreting geologic and geophysical data to produce publication-quality maps and diagrams. Eight PC’s are equipped with GIS and remote sensing software and field laptops are available with the GPS receivers. 3D visualization and modeling are available in the Immersive Visualization Center, which is a university facility located in the Halbouty Geosciences building. GPS receivers are used to teach Geol 352.

**Near-Surface Geophysics Instrumentation.** A Near-Surface Applied Geophysics Laboratory is maintained in the department by Dr. M. Everett. Geophysical equipment includes electromagnetic induction instruments (Geonics PROTEM 47, EM34—3, EM31 and EM63), ground-penetrating radar (Sensors and Software PulseEkko 25, 100 and 200 MHz systems), an 8-channel 56-electrode resistivity and 28-electrode induced polarization system (Advanced Geosciences Inc. SuperSting R8/IP), a cesium vapor magnetic gradiometer (Geometrics G - 858), gravimeter (LaCoste & Romberg), and reflection/refraction seismic equipment (Geometrics StrataView 48-channel seismograph with 14/40 Hz geophones and GeoStuff roll - along capability). Trimble GPS units are available for field geophysics experiments as is a traditional Topcon/Sokkia total-station navigation system and commercial software (seismic/GPR interpretation includes Kingdom Suite and ProMax). A fully ruggedized Panasonic Toughbook and 30 laptops are also available. This equipment is used to teach Geop 413 and Geop 435.

**Environmental Geochemistry Lab.** The environmental geochemistry lab includes instrumentation to characterize metals, nutrients, and trace organics in water, soils, sediments and consolidated rock. Specific instruments include a SpectrAA.200 Varian UltrAA with flame or Graphite furnace, Coy Anaerobic Chamber, Varian 4000 Ion Trap GC/MS/MS, Dionex Ion Chromatograph with a CD 25 conductivity detector, GP50 Gradient Pump and AS40 Automated Sampler, Agilent 6890 Series Gas Chromatograph with autosampler and flame ionization
detector, Vario EL III (Elemental Analyzer), Agilent Capillary Electrophoresis, Sartorius CP2P Microbalance, Jenway 6200 Fluorimeter, Metrohm 746 VA Trace Analyzer Ion Analysis (voltametry), and Hitachi V-3010 UV/VIS Spectrophotometer. Faculty and students also have access to the IR Spectroscopy Laboratory.

**John Handin Rock Deformation Lab.** The Handin Laboratory provides facilities to investigate the deformation of rocks and minerals under controlled conditions appropriate to the environments of the upper crust to the lithospheric mantle ([http://geoweb.tamu.edu/tectono/facilities/john-w-handin-laboratory](http://geoweb.tamu.edu/tectono/facilities/john-w-handin-laboratory)). The laboratory is equipped with groups of different rock deformation apparatus, devices for measuring physical properties, controlled environment chambers, a rock repository, sample preparation equipment, and a machine shop. Graduate students, visiting scientists, research scientists, and faculty use the laboratory for research and teaching activities. The Handin Laboratory plays a key role in the laboratory component of the graduate core-curriculum courses of the Center for Tectonophysics (Geop 615, Experimental Rock Deformation) and of the Geophysics Ph.D. program (Geop 660, Physics of the Earth's Interior). It is available for research by all qualified faculty and student users of the Center for Tectonophysics.

**Electrohydraulic Loading Facility.** Three loading frames are available for testing rock at elevated temperature and pressure appropriate to upper and lower crust conditions, and at displacement rates up to 1 m/s. The servo-controlled machines are particularly well suited for investigating complex load paths. The facility is currently being upgraded with a new hydraulic pressure generating pump, cooling system, and low-pressure hydraulic, water and air plumbing. In addition, new safety enclosures, high pressure plumbing, electronics for control and data acquisition, and other ancillary equipment will be installed. This facility houses:

- A 500-ton servo-controlled, electrohydraulic testing machine (MTS load frame) capable of deforming 2.5 by 6 cm cylindrical specimens in triaxial compression under controlled loading/deformation histories. Originally designed with an argon gas pressure vessel to reach confining pressures and liquid pore fluid pressures of 1200 MPa and temperatures to 1200 C this apparatus may be used with other pressure vessels to deform larger samples at lower pressures and temperatures.
- A 150-ton servo-controlled, electrohydraulic testing machine (MTS load frame) capable of deforming samples up to 2.5 cm diameter under confining pressures to 300 MPa, pore fluid pressures to 200 MPa, and temperatures to 300 C. The pore-fluid pressure system may be used in a flow-through or single-ended oscillating pressure mode to determine fluid flow and storage properties during deformation, and is ideal for the investigation of the mechanical behavior of both crystalline and sedimentary rocks in geothermal and petroleum-gas reservoirs.
Bi-axial load frame, with 150-ton servo-controlled load capability on each axis, that is capable of achieving medium strain rates (7 cm displacement at a rate of 1 m/s). This apparatus is being constructed from two load frames that were earlier designated as the MSR and HTR. This apparatus will be used for high speed friction studies; it also may be fitted with other pressure vessels or sample grips to permit true-triaxial tests and high-speed fracture tests.

High Pressure and Temperature Deformation Facility. Five rock deformation machines are available for testing ductile deformation of rocks and minerals at pressures of the middle crust to upper mantle. These apparatus deform cylindrical samples at constant strain rate and are capable of constant stress loading with some modification. The facility includes the following apparatus:

- Two Heard-type, triaxial argon gas apparatus for deformation of 1 by 2 cm cylindrical specimens at confining pressures to 500 and 1000 MPa (and pore pressures to 200 MPa), temperatures to 1000 C and strain rates from $10^{-3}$ to $10^{-8}$ sec$^{-1}$. One of these apparatus is in current use and the other requires installation. Pressure and temperature are servo-controlled and stresses are determined from internal load cell readings.
- Two Griggs-Blacic triaxial piston-cylinder apparatus capable of employing weak solid or molten salt confining media for deformation of 6 by 15 mm specimens at confining pressures to 2000 MPa, temperatures to 1300 C, and strain rates from $10^{-3}$ to $10^{-8}$ sec$^{-1}$.
- Griggs, solid-pressure-medium, multiple anvil "cubic" apparatus capable of confining pressures to 7000 MPa and temperatures to 1000 C. This apparatus has been used in Geop 660 to measure P- and S-wave velocities at high pressure and room temperature.

Sediment and Sedimentary Rock Testing Facility. This facility contains several gear driven, triaxial apparatus designed to test mechanical properties of uncemented, granular aggregates and weak rocks at upper crustal conditions. These deformation machines are capable of constant strain rate loading to low rates, and can accommodate large samples.

- Two 10-ton, Heard-type variable strain-rate, triaxial systems (VSR) for deformation of 2 by 4 cm specimens at confining and pore pressures to 300 MPa, externally heated to 300 C and strain rates from $10^{-3}$ to $10^{-8}$ sec$^{-1}$. These apparatus employ internal load cells for sensitive and accurate measurement of force. One system retains the original metal packings for higher pressure work; the other system is fitted with a large-diameter piston and o-ring packings for experiments on weak rocks, sands, and marine sediments at confining pressures less than 120 MPa. This apparatus is ideal for long-term tests of creep consolidation and fluid flow properties.
- Two 100-ton, variable strain-rate, triaxial compression systems (Handin-Logan LSR-type) for deforming 10 by 20 cm cylindrical specimens at confining and pore pressure to 70 MPa, temperatures to 150 C, and strain rates from $10^{-3}$ to $10^{-9}$ sec$^{-1}$. These machines
have been used for investigating creep of rock salt. An additional pressure vessel is available for tests on 5 by 10 cm cylindrical specimens in these load frames.

- A 200-ton, variable strain-rate, triaxial-compression apparatus (Handin-Logan LSR) for tests on specimens up to 5 cm diameter and 20 cm length at strain rates from $10^{-3}$ to $10^{-8}$ sec$^{-1}$ at confining and pore-fluid pressures to 300 MPa at room temperature. The apparatus has accommodated studies of acoustic emission, permeability using the transient-pulse technique, fracture under mixed tensile and compressive stress states, rock and simulated gouge friction, failure in thick-walled hollow cylinders, and fracture and folding in rock models. After over 6500 experiments, the pressure vessel of this apparatus failed; it was decommissioned was replaced.

Petrophysics Facility. This facility contains two machines to test petrophysical properties under isotropic loading conditions.

- An Autoclave apparatus designed to measure elastic P- and S-wave velocities using piezoelectric transducers with pulse or other signal generators at confining pressures and pore-fluid pressures to 300 MPa.
- An apparatus designed by T. Shimamoto to measure porosity and permeability to pressures of 200 MPa using displaced gas, gas and liquid flow-through capability, and double-ended pressure-decay testing system.

Additional facilities available in the Handin Laboratory

- Digital data acquisition and Computer Equipment: Several mobile, networked PCs each having a Data Translation high-speed, high resolution A/D acquisition board, HP VEE with DT VPI or LabView acquisition software, and a large UPS.
- Acoustic emission recording and counting system.
- Laser profilometer to measure surface geometry.
- Controlled humidity chamber and several furnaces.
- Multiple vacuum and pressure epoxy impregnation systems, curing ovens, and fume hood.
- Diamond coring, diamond cut-off saws, surface grinder for preparation of specimens.
- A machine shop and electronics laboratory containing an assortment of machining equipment (e.g., lathes, mills, drill press, band saw), and electronic fabrication and testing supplies and equipment.

Friedman Microscopy Lab. The Mel Friedman Petrofabrics Laboratory is dedicated to the study of deformation textures of naturally and experimentally deformed rocks. The laboratory includes a Zeiss Axioimager A1 Advanced upright research microscope that is equipped with an Axiocam HR and AxioVision4 software for high resolution digital imaging. The laboratory houses five additional research-quality microscopes, and three older Leitz microscopes dedicated to
universal stage applications. Equipment for sample cutting, preparation, and polishing is available in a neighboring laboratory. In addition, a photoelastic load frame and heated deformation stage are available to investigate the nature of stress concentrations associated with flaws and geometric irregularities, and to study intracrystalline plastic deformation and recovery processes. The facilities in the Mel Friedman laboratory support teaching and research activities in the Center for Tectonophysics. It is routinely used in the laboratory component of Geol 665 (Structural Petrology), which is one of the core courses of the Center for Tectonophysics and the Petroleum Certificate Program.

**Hydrothermal Geochemistry Lab.** This laboratory includes five large-volume, flow-through hydrothermal systems capable of controlled long-term (12+ month) experiments at $T = 200\,^\circ C$, confining and pore-fluid pressures $P = 100\, MPa$ and constant fluid flow rates. All wetted parts subjected to elevated temperatures are constructed of materials (including titanium, Hastelloy C-276, Inconel, gold, or teflon) that are inert to most dissolved species. Volumetric strain can be measured while simultaneously monitoring changes in fluid chemistry. The laboratory is also equipped with eight standard, cold-seal pressure vessels and four rapid-quench vessels, and supporting equipment capable of temperatures to $800\,^\circ C$ and pressures to $200\, MPa$.

**Fluid Inclusion Lab.** The Fluid Inclusion Laboratory at Texas A&M University is equipped with a modified USGS heating and freezing stage, designed by Fluid Inc. USA. This equipment is designed to pass heated air or nitrogen over the sample, permits heating of inclusions to $700\,^\circ C$. By passing nitrogen gas through liquid nitrogen and then over the sample, inclusions (3-50 $\mu m$) can be cooled to $-190\,^\circ C$.

**IR Spectroscopy Lab.** The IR Spectroscopy Laboratory is a shared facility of the department with faculty and student users who are engaged in environmental geosciences, tectonophysics and studies of deep crust and mantle processes. This lab houses a Nicolet Magna 560 FTIR with two room-temperature detectors spanning wavenumbers from IR to the near-IR, a high contrast IR polarizer, a NicPlan IR Microscope with polarizer and a high sensitivity, low temperature detector. Transmission and reflection spectra are gathered for large single crystal and powder samples with room temperature and cryogenic specimen holders, a Gemini dual attenuated total reflectance and diffuse reflectance accessory on the main spectrometer bench. Transmission and reflection spectra can be collected for small samples using the IR microscope. The laboratory includes a press to prepare powder samples, diluted by KBr or other salt, and polishing facilities to prepare single crystals for transmission measurements. While the Nicolet spectrometer is an aging instrument, it continues to provide quality IR spectra and serves our multiple purposes well. Reflection spectra have been collected for contaminated soils, polarized transmission spectra have been measured for hydrous minerals, and trace hydrogen defects (from ppm down to 40 ppb) have been detected and quantified in nominally anhydrous minerals.

**Sedimentary Geology Lab.** This laboratory was rebuilt, to accommodate new faculty and student research in sedimentary and petroleum geology, as part of the Berg-Hughes Center. A sample preparation lab contains multiple rock saws (oil and water-based), standard and Isomet
wafer-blade saws, and two polishing wheels. Four laboratories are available for wet chemistry. Microscopy facilities include two research-grade microscopes with Image Analysis Software, and a Technosyn 8200 MKII Cathodoluminescence Stage with epifluorescence capabilities attached to a Digital Camera and Image Analysis Software. The sedimentary geology lab also houses the Berg Sedimentary Core Teaching Collection. We also have a state-of-the-art Subsurface Computer Laboratory supported by the petroleum industry that includes 16 state-of-the-art PC workstations. Software includes Paradigm, Geoframes, Geographix, Landmark unix-based software (OpenWorks, Promax, etc.), Kingdom, and Petrel.

The equipment in the Carbonate Petrology Lab:

1) The Phenom XL Scanning Electron Microscope (SEM) from Phenom-World
2) Olympus BX53MTRF petrographic microscope using software Olympus Stream Essentials 2.1
3) Rigaku MiniFlex 600 Benchtop X-ray Diffraction System (in process to be purchased)

Paleobiology Lab and Collections. The paleobiology lab facilities include equipment for processing, preparation and microscopic imaging of samples for research in the fields of biostratigraphy, paloeclimate and systematics. Separate rooms are available for microfossil and macrofossil processing, from unconsolidated and indurated sediments. Equipment is available for trimming rocks, size screening and acid preparation, and room is available to organize and work with sedimentary rocks. A dedicated micropaleontology room houses several research-grade optical microscopes. Electron microscopy is done at the University's centralized Microscopy and Imaging Center. A large collections room is maintained with macrofossil samples and continental outcrop samples. These collections complement deep-sea cores stored in the on-campus IODP core repository.

Evolutionary Geobiology Lab. This new laboratory supports the research of Dr. Tice and co-workers. It is equipped with standard equipment for culturing and working with microbes, including incubators, freezers, walk-in cold storage, a PCR thermal cycler and gel imaging system, centrifuges, a fluorescence/petrographic microscope, a laminar flow hood and two fume hoods, an anaerobic glovebox, and two large phototroph incubators. This lab houses a Horiba XGT-7000 X-ray fluorescence microanalyzer, capable of semiquantitative and quantitative imaging of the distributions of elements from Na to U on samples up to 10 cm x 10 cm with a spot size of 10 or 100 µm and detection limits to a few ppm.
College Shared Facilities

In addition to departmental laboratories and facilities, faculty and students have access to several state-of-the-art facilities that have recently been established in the College of Geosciences. These include a new Stable Isotopes Laboratory that combines instruments from laboratories that used to function separately in the Departments of Geology and Geophysics, Oceanography, and Geography. Combining resources of faculty start-up, a successful NSF MRI proposal, and the generous donation of Mr. R. Ken Williams ’45, the College has established a state-of-the-art radiogenic isotope geosciences laboratory in support of faculty and students of our department and others. The College obtained a new XRF core scanner, which is housed in the on-campus IODP facility, which is available to our geology faculty and students. These facilities go a long way to address inadequacies in analytical laboratories identified in our 2002 External Review.

Stable Isotope Lab. The Stable Isotope Geosciences Facility (SIGF) is a multi-investigator, college-wide facility for light stable isotope analyses and science (http://stableisotope.tamu.edu/). The laboratory is managed by an Executive Committee consisting of Dr. Ethan Grossman (Co-Director, GEPL), Dr. Brendan Roark (Co-Director, GEOG), Dr. Niall Slowey (OCNG), and Dr. Yige Zhang (OCNG). Dr. Christopher Maupin serves as Facility Manager. SIGF houses five isotope ratio mass spectrometers and seven peripheral devices for automated H, C, N, O, S, and clumped (13C-18O) isotopic analyses of minerals, waters, and organic matter. The facility also houses a Picarro Cavity Ring-Down Spectrometer for O and H analyses of water. Recent funding through the TAMU Research Development Fund and the start-up package of Dr. Zhang resulted in the addition of three mass spectrometers in 2017. SIGF is located in two laboratories in the Eller O&M Building. There are currently four faculty members, 11 graduate students, and four undergraduate students working in SIGF. The user base includes 40 faculty members and staff scientists from around the globe, including nine departments, five colleges, Sea Grant, and the Integrated Ocean Discovery Program (IODP) at TAMU. SIGF is proactive in promoting the educational mission of TAMU. Nearly 100 students have received training or analyses from SIGF. The facility hosts laboratories for graduate courses including GEOL 648 (Stable Isotope Geology) and GEOL 681 (Seminar in Stable Isotope Methods and Research), and provides analyses for inquiry-based learning experiences (i.e., student projects) in GEOS 405, GEOG 491 ([Undergraduate] Research), GEOL 491, and GEOL 648.

Ken Williams Radiogenic Isotope Geosciences Lab. The R. Ken Williams ’45 Radiogenic Isotope Geosciences Laboratory at Texas A&M is a 1550 ft² laboratory complex, completed in September, 2008, which consists of a designated perchloric acid fume hood room, gown-up room, dilution and weighing room, clean general chemistry room an ultra-clean chemistry room, and an instrument room (http://geosciences.tamu.edu/research/research-facilities/radiogenics). The general chemistry laboratory is designed to class 10,000 clean-room standards. This laboratory includes five clean-air workstations, each testing to better than 100 particles >0.3 μm
per ft³ air, and one recirculating laminar-flow workstation (no particle detected). The ultra-clean laboratory is designed to Class 100 specifications. The instrument room houses a Triton thermal-ionization mass spectrometer, an Element XR high-resolution inductively-coupled plasma mass spectrometer, an iCAP-RQ quadrupole mass spectrometer and a NWR 193 nm excimer laser-ablation system. A Neptune multicollector inductively-coupled plasma mass spectrometer is scheduled to be installed Fall 2017. The radiogenic isotope geochemistry facilities also include separate rooms for dirty/wet sample preparation, rock crushing, and mineral separation.

The general chemistry lab is used primarily for sample digestion, chemical separation, and elemental purification for Nd-Sm, Sr, and common Pb isotopes from whole-rock powders, microfossils, macrofossil fragments, and rock glass. Common Pb separation is done on anion resin using HBr-HCl chemistry. Bulk REE are separated using EiChrom REE-specific resin and Nd-Sm purification is conducted using reverse-phase chromatography on anion resin and α-HIBA chemistry. Separation and purification of Sr uses EiChrom Sr-specific resin. All clean sample preparation and separation chemistry for U-Pb dating is conducted in the Class 100 ultra-clean laboratory. Our U-Pb zircon geochronology protocol largely follows the annealing, chemical abrasion, and thermal-ionization mass spectrometry (CA-TIMS) methods described by Mattinson (2005). This method has proven highly successful in minimizing U-Pb discordance caused by Pb-loss from radiation damaged zones within the zircon crystal (e.g., Mundil et al., 2004). Total procedural blanks for U-Pb analyses are consistently about 1 picogram or less Pb per sample.

The ThermoFisher Triton thermal-ionization mass spectrometer (TIMS) was commissioned in October, 2008. This instrument is equipped with a retarding-potential-quadrupole (RPQ) energy filter and a modified (14-dynode) MassCom secondary electron multiplier (SEM). Abundance sensitivity and Faraday/SEM ion yield with the RPQ disengaged are 3.9 ppm and 94.5%, respectively and with the RPQ active are 0.006 ppm and 93.3%, respectively. The response of the SEM is linear up to 900,000 counts/sec. The Triton met installation specifications with 2 ppm (1σ) external reproducibility on ¹⁴₃Nd/¹⁴⁴Nd for both the La Jolla (0.5118455 ± 0.0000011) and JNd; (0.5121014 ± 0.0000007) Nd isotopic standards using 300 nanogram loads and analyzed in static-Faraday mode with amplifier rotation. Subsequent Nd standards run by all operators indicate ~15 ppm (1σ) external reproducibility, but careful loading and analysis by highly experienced operators commonly produce more consistent results. External reproducibility of Sr isotope standard NIST 987 (0.710243 ± 0.000011) is ~16 ppm (1σ) for all users since installation. Repeat analyses of EarthTime synthetic U-Pb standards yield 100.22 ± 0.029 Ma for the 100 Ma (nominal) standard, 500.49 ± 0.17 Ma for the 500 Ma (nominal) standard, and 2000.13 ± 0.28 Ma for the 2Ga (nominal) standard; all individual analyses are within error of the ages obtained from these standards in three well-established laboratories using the EarthTime double-Pb spike.
The ThermoFisher Element XR inductively-coupled-plasma mass spectrometer (ICP-MS) was funded through a NSF MRI grant and commissioned in February 2009. This instrument is equipped with a secondary electron multiplier, that can be used in ion counting (<3x10^6 cps) and analog (3x10^6 – 10^9 cps) modes, and with a faraday detector (10^9 to 10^12 cps). The dynamic range of the instrument spans five orders of magnitude for 1 ms sample times. The instrument operates at three mass resolutions, ~330, 4500, and 11,600. The dark noise in ion counting mode is less than 0.1 cps. The usual sensitivity of the instrument using a Meinhard concentric self-aspiration nebulizer is better than 10^6 cps per ppb of In. The short-term (10-minute) stability of the signal intensity is approximately 0.06%, while the long-term (1-hr) stability is approximately 0.6%. Major and trace element analyses generally yield external reproducibilities of approximately 0.5%. Analyses of 206Pb/207Pb, 206Pb/208Pb, 234U/238U isotope ratios on NIST standards (981 and U500) are reproducible to within 0.1%.

The ThermoScientific iCAP-RQ quadrupole inductively-coupled-plasma mass spectrometer (QICP-MS) was funded through the TAMU Research Development Fund program and was placed into service in March 2017. Since installation, this instrument has been used primarily for detrital zircon U-Th-Pb dating and zircon trace-element analysis by laser ablation. Internal reproducibility of primary zircon reference material is better than 0.5% and external accuracy of secondary zircon reference material is generally better than 1.5%. Reproducibility of zircon reference material trace element concentrations are better than 5% for most elements.

A ThermoFisher Neptune multicollector inductively-coupled-plasma mass spectrometer (MICP-MS) was funded in July 2016 through an NSF MRI grant. Site preparation and installation is scheduled to be completed in Fall of 2017.

**XRF Scanner.** A 3rd generation Avaatech XRF core scanner ([http://odases.tamu.edu/lab/xrf/](http://odases.tamu.edu/lab/xrf/)) was installed (June, 2009) at the IODP gulf Coast Repository, on campus, for the purpose of non-destructive multi-element chemical analyses of split IODP sediment cores. This instrument was acquired as part of the university's Ocean Drilling and Sustainable Earth Sciences (ODASES) initiative, in support of IODP research and of ODASES faculty and their students. All four departments of the College of Geosciences have faculty members involved in the program. The XRF scanner irradiates the geologic material with X-rays produced by a 100 watt Rh-anode X-ray tube and detects the excited X-ray fluorescence with a Canberra multichannel analyzer. Elements between Mg and U can be measured in a wide range of geologic materials. The step size between measurements is analyst-controlled and can be spaced as little as 0.1 mm between each analysis.
University Shared Facilities

Geology and geophysics faculty and students have access to a number of University-sponsored facilities and labs of other departments. Three facilities are described that we have used in recent years.

Microscopy and Imaging Center. All of the electron microscopy at Texas A&M University is done in its central Microscopy and Imaging Center (http://microscopy.tamu.edu/). The Microscopy and Imaging Center (MIC) hosts a number of high-resolution electron microscopes, employs qualified technicians and electron microscope specialists in support of research and teaching, and maintains instrument service contracts. Students can enroll in courses taught through the Center in basic and specialized methods of electron microscopy. Geology faculty and students have access to three scanning electron microscopes (SEM), including a conventional JEOL 6400 SEM and an Electroscan environmental SEM. The MIC’s high resolution scanning instrument is a FEI Quanta 600 field emission SEM with SE (resolution up to 1.2 nm), BSE, EDS, full color CL, and X-ray mapping and digital capture capabilities. This instrument has EBSD and orientation contrast capabilities using HKL/Oxford software.

The MIC maintains three transmission electron microscopes (TEM), of which two are high-resolution, 200kV microscopes. The Jeol 2010 has a point resolution of 0.23nm, and is capable of EDS micro-chemical analysis, convergent-beam diffraction, and nanobeam diffraction. Sample holders include single- and double-tilt stages, one made of Be to optimize EDS analysis, and a heating stage. Image capture is by photographic plate or digital CCD camera. A FEI Tecnai G2F20 field emission TEM has recently been acquired with a point resolution of 0.27 nm, and STEM, EDS, and EELS, and mapping capabilities. This instrument has single tilt, double tilt, and cryogenic specimen holders, and digital imaging.

In addition to electron microscopes, the MIC maintains a confocal light microscope with 6 color lasers for high-resolution epifluorescent imaging, which faculty and students of our department have access to, but have yet to explore.

While there are many advantages to Texas A&M operating a centralized electron microscopy facility, we find it convenient to prepare samples in-house. Equipment in the Halbouty Geosciences Building used to prepare samples for electron microscopy includes conventional saws, grinding and polishing facilities, as well as a LADD carbon coater. A Buehler vibratory polisher is used for the final, chemical polish of samples for SEM EBSD, and a Gatan dual ion mill is used for final preparation of TEM samples.

X-ray Scanner and Computed Tomography. Geology faculty and students are able to acquire X-ray CT images in the Imaging laboratory of the Harold Vance Department of Petroleum Engineering using a Universal Systems hd-350e high resolution X-ray CT scanner. This instrument is managed by Dr. Schechter, Professor of Petroleum Engineering, who has offered members of our department access to obtain nondestructive 3D images of the internal structure.
of opaque solids. This facility is commonly used to measure porosity, saturations, and a fault rock structure in cores, and to perform enhanced oil recovery flood experiments.

**3-D Visualization Lab.** The Immersive Visualization Facility in room 260 of the Halbouty Geosciences Building provides advanced 3D visualization for all TAMU researchers using a semi-rigid, rear projected, curved screen. The IVF facilitates imaging large datasets. The screen is 7 m long and 3 m high and is driven by a Dell Precision 690 workstation running Linux. The IVF is operated by the Texas A&M Institute for Scientific Computation.

**Integrated Ocean Discovery Program (IODP)**
Faculty and students of the department benefit from research interactions with research scientists of the Integrated Ocean Discovery Program (IODP). The United States Implementing Organization (IODP-USIO) is responsible for the scientific operations of the dynamically positioned, riserless drilling vessel, JOIDES Resolution (http://iodp.tamu.edu/publicinfo/drillship.html), archiving the scientific data and samples that are collected, and producing and disseminating program publications. The goal of the program is to recover the record of Earth’s history that is written in the rocks and sediments of the ocean floor. These scientific samples and data are used to study, for example, plate tectonics, ocean currents, climate changes, evolutionary characteristics and extinctions of marine life, and mineral deposits. The IODP Director, Dr. Brad Clement is a Professor in the Department of Geology and Geophysics and many IODP research scientists have adjunct appointments in the Department. In addition, Texas A&M University initiated the Ocean Drilling and Sustainable Earth Science (ODASES) Program as an interdisciplinary, multi-college research and education effort, in order to enhance faculty participation in IODP. Led and directed by The College of Geosciences, ODASES sponsors laboratory facilities, including a recently-installed XRF core scanner, as part of the Gulf Coast Repository. ODASES faculty in Geology and Geophysics include Drs. P.J. Fox, E. Grossman, B. Wade, and D. Thomas (a joint faculty member with Oceanography). IODP scientists with adjunct faculty appointments in Geology and Geophysics include Drs. Levay, Kulhanek, Malone, and Williams.

**Geochemical and Environmental Research Group**
Faculty and students have the opportunity to collaborate with research scientists of the Geochemical and Environmental Research Group (GERG) of the College of Geosciences, a soft-money research lab that addresses applied problems in petroleum and environmental research (http://gerg.tamu.edu/). GERG employs two dozen scientists, managers and technical staff with expertise in geochemistry, oceanography, atmospheric sciences, and environmental and analytical chemistry. GERG hosts extensive organic geochemistry laboratory facilities, with four high performance liquid chromatographs, ten gas chromatographs, and five gas chromatograph/mass spectrometers. Environmental geosciences faculty and students of the Department have recently collaborated with GERG scientists on organic biomarker research.
**Department of Oceanography**
Currently Dr. Debbie Thomas, the Interim Dean of Geosciences, has a joint appointment in the Department of Geology and Geophysics and the Department of Oceanography (http://ocean.tamu.edu/).
Faculty members from Oceanography and Geology and Geophysics co-teach some classes that are taken by students from both departments, and serve on graduate committees for students in either department. Because geological oceanography students often have undergraduate degrees in geology, these students can serve as teaching assistants (GATs) in our introductory courses. Research areas of greatest interaction between the departments include paleoclimate, geochemistry, paleoceanography, seismic exploration, geodynamics, and micropaleontology. Stable isotope geochemistry laboratories of Geology and Geophysics and Oceanography have recently been merged, and faculty from both departments share oversight of the College's new radiogenic isotope geochemistry laboratory.

**Department of Geography**
Two faculty members, Drs. R. Giardino and V. Tchakerian, with interests in geomorphology have joint appointments in Departments of Geology and Geophysics, and Geography (http://geography.tamu.edu/). Dr. Giardino has his administrative location in our department, while Dr. Tchakerian has his adloc in Geography. The department's course in GPS (Geol 352) is cross-listed as Geog 352. Faculty from Geography have been members of graduate research committees of our students. Facilities between the two departments are also shared, particularly the new Stable Isotopes Geosciences Facilities, which is directed by Dr. Roark of Geography.

**Water Management and Hydrological Sciences Program**
Several faculty members of the department, Drs. Giardino, Knappert, and Zhan, conduct research and advise students as part of the University's Water Management and Hydrological Sciences Program (http://waterprogram.tamu.edu/). Both Drs. Giardino and Zhan serve on the water program's Executive Committee. Dr. Zhan is the advisor of the student organization "Water without Boundaries." Geology and Geophysics offers several key courses of the water program, including Hydrogeology (Geol 410), Applied Ground Water Modeling (Geol 625), Contaminant Hydrogeology (Geol 621), and Environmental Geochemistry (Geol 641). Geology and Geophysics faculty serve as Chairs of Research Advisory Committees of about ten graduate students in this program.
Industrial Partnerships
The Department of Geology and Geophysics at Texas A&M is committed to establishing and maintaining strong ties with industry. The ongoing cooperation, collaboration and communication with industry benefits the research endeavors of the Department and our industry partners. Traditionally, the goals of universities (reputation for quality education and published research) differ from those of the energy industry (profitable endeavors of exploration and production, refining, and supply) (Figure 4.1). However, our ability to achieve our goals depends on the quality of students, our ideas, and the development and application of methods, much as the ability of a company to succeed depends on its people, ideas, and tools.

Mutual Benefits of University-Industry Partnerships with Petroleum Companies.

Recruiters
A significant number of oil and gas companies offer recruiting events in the Department. Environmental and engineering consulting firms also recruit within the Department but these events are fewer in number. Recruiting events are organized both by the department as well as the Texas A&M Career Center. They include on-campus interviews, industry seminars, industry-supported field trips to geological sites and to company research and production facilities, and social/mentoring events. The following companies will recruiting in the department in fall of 2017: Anadarko, Chevron, ConocoPhillips, ExxonMobil, and Hess.
Appendix C. Undergraduate Course Descriptions
GEOL 101 Principles of Geology
Credits 3. 3 Lecture Hours.
(GEOL 1303, GEOL 1403) Principles of Geology. Physical and chemical nature of the Earth and dynamic processes that shape it; plate tectonics, Earth's interior, materials it is made of, age and evolution, earthquakes, volcanism, erosion and deposition; introduces physical and chemical principles applied to the Earth. Not open to students who have taken GEOL 103 or GEOL 104.

GEOL 102 Principles of Geology Laboratory
Credit 1. 2 Lab Hours.
(GEOL 1103, GEOL 1403) Principles of Geology Laboratory. Laboratory exercise-based introduction to the physical and chemical nature of the Earth and dynamic processes that shape it; rock and mineral types; topographic and geologic maps; complements GEOL 101 but may be taken independently.

GEOL 104 Physical Geology
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Earth materials, structures, external and internal characteristics; physical processes at work upon or within the planet. A working knowledge of high school chemistry and mathematics is required.

GEOL 106 Historical Geology
Credits 4. 3 Lecture Hours. 3 Lab Hours.
(GEOL 1104 and 1304, 1404) Historical Geology. Hypotheses of Earth's origin; age dating of geologic materials; development and history of life; plate tectonic reconstructions, geologic history, and paleogeography, with emphasis on the North American plate.
Prerequisite: GEOL 101 or equivalent.

GEOL 108 Dinosaur Life and Times
Credit 1. 1 Lecture Hour.
Dinosaur paleobiology and paleoecology; terrestrial paleoclimate and paleoenvironments of the Mesozoic; dinosaur ancestors; appearance and radiation of dinosaurs; paleoecology and paleobiology of major dinosaur groups; extinction of large dinosaurs and the Cretaceous-Paleogene mass extinction; the appearance and ancestry of birds. Not open to students who have taken GEOL 307.

GEOL 150 Introduction to the Solid Earth
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Introduction to the dynamic earth for careers in geosciences; origin and structure of the earth; earth materials and processes, particularly as they relate to plate tectonics; maps as a basic tool of geologists; not open to students who have taken GEOL 101 or GEOL 104.

GEOL 152 History of the Earth
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Evolution of life, plate tectonics processes, geography and climate through earth's history; the timing of major events in earth history; sedimentary environments and stratigraphy; fossils; biostratigraphic and radiometric dating of rocks; not open to students who have taken GEOL 106.
Prerequisites: GEOL 150, GEOL 101 and GEOL 102, or GEOL 104 or equivalent.

GEOL 180 Introduction to Geology and Geophysics
Credit 1. 1 Lecture Hour.
Introduction to careers in geology and geophysics; campus resources for academic and personal success; tools for developing study skills and navigating the university; use of reflection to assess personal strengths, weaknesses and responsibilities and to devise strategies for improvement.
Prerequisite: Approval of instructor.

GEOL 203 Mineralogy
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Crystallography, crystal chemistry, mineral chemistry, optical crystallography, physical properties, and geologic occurrence of rock-forming and economic minerals.

Prerequisites: MATH 151; CHEM 101 and 111 or CHEM 107 and 117; GEOL 150 or equivalent.

GEOL 210 Geological Communication
Credits 3. 3 Lecture Hours.
Introduction to communicating as a scientist particularly in geological settings; using precise language, illuminating graphs and correct mathematical and chemical symbols to describe geological observations and concepts in writing; using basic statistics to describe geological data and uncertainty; recognizing scientific ethical dilemmas and plagiarism and interpretation.
Prerequisites: MATH 151, ENGL 104, GEOL 150 or equivalent.

GEOL 250 Geological Field Methods
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Fundamental aspects of geologic mapping; field observation, data gathering and recording, use of a Brunton compass, pace-and-compass mapping, measurement of stratigraphic sections; topographic map use and interpretation, interpretation of geologic map patterns, construction of geologic cross sections; Integrating field and remote data to address geologic problems using GIS software.
Prerequisites: GEOL 152 or equivalent.

GEOL 285 Directed Studies
Credits 1 to 4. 1 to 4 Other Hours.
Directed studies in specific problem areas of geology.
Prerequisite: Approval of instructor.

GEOL 289 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.
Selected topics in an identified area of geology. May be repeated for credit.
Prerequisite: Approval of instructor.

GEOL 291 Research
Credits 0 to 4. 0 to 4 Other Hours.
Research conducted under the direction of faculty member in geology. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.
Prerequisites: Freshman or sophomore classification and approval of instructor.

GEOL 300 Field Geology
Credits 6. 6 Other Hours.
Basic concepts of field relationships and field techniques are used to develop geologic maps, stratigraphic columns, cross-sections and geologic interpretations for a variety of geologic provinces. Course conducted off-campus in a field camp for six weeks.
Prerequisites: GEOL 302, GEOL 306, GEOL 309, GEOL 312 or approval of instructor.

GEOL 301 Mineral Resources
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Origin, geologic relations and geographic distribution of mineral and energy resources; mineral economics, mining and reclamation and global economics in the resource industry; identification and classification of economic minerals including energy resources, base and precious metals, chemical industrial minerals and gemstones.
Prerequisites: GEOL 101 or GEOL 320; CHEM 106 or higher.

GEOL 302 Introduction to Petrology
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Introduction to the origin and evolution of igneous, sedimentary, and metamorphic rocks; classification and petrographic analysis of major rock types; relationships to tectonic settings. **Prerequisites:** GEOL 104 and GEOL 203 or approval of instructor.

**GEOL 304 Igneous and Metamorphic Petrology**

Credits 4. 3 Lecture Hours. 3 Lab Hours.

Origin and evolution of igneous and metamorphic rocks; identification, classification and petrographic analysis; relationships to tectonic settings; genetic processes inferred from laboratory studies and field occurrences. **Prerequisites:** GEOL 203; CHEM 107 and CHEM 117 or CHEM 102 and 112.

**GEOL 305 Paleobiology**

Credits 3. 2 Lecture Hours. 3 Lab Hours.

Principles of paleobiology; study of organisms important in the marine fossil record; application of paleontology to geologic problems. **Prerequisite:** GEOL 106 or approval of instructor.

**GEOL 306 Sedimentology and Stratigraphy**

Credits 4. 3 Lecture Hours. 3 Lab Hours.

Origin of sediments and sedimentary rocks; climate, weathering, and weathering products; transport, deposition, and depositional environments for sediments; field and laboratory studies in description and interpretation of genesis of sedimentary rocks; principles of stratigraphy and basin analysis; plate tectonics and the formation of sedimentary basins; stratigraphic nomenclature; geologic time and correlation; sequence stratigraphy and basin architecture. **Prerequisite:** CHEM 101 and CHEM 111 or CHEM 107 and CHEM 117; PHYS 218; GEOL 152 or equivalent.

**GEOL 307 Dinosaur World**

Credits 4. 3 Lecture Hours. 3 Lab Hours.

Evolutionary development of dinosaurs and Mesozoic geography, climate and terrestrial environments including dinosaur morphology; evolutionary relationships; dinosaur metabolism; and constraints imposed by gigantism; their latitudinal distribution; casual mechanism for dinosaur extinction.

**GEOL 308 Integrated Earth Science**

Credits 4. 3 Lecture Hours. 3 Lab Hours.

Integrated processes shaping Earth's crust, continents, ocean basins, atmosphere and biosphere; place of Earth in the universe; relationship between Earth and human society; related fundamental physical and biological science principles and processes within an integrated Earth science context. Not an elective for students pursuing degrees as professional geologists. **Prerequisite:** GEOL 101 or GEOG 203.

**GEOL 309 Introduction to Geological Field Methods**

Credits 3. 1 Lecture Hour. 6 Lab Hours.

Geological mapping methods, field observation procedures and data gathering and recording; use of Brunton compass; pace-and-compass mapping; topographic map use and interpretation; measurement of structural elements; interpretation of geologic map patterns; measurement of stratigraphic sections; construction of geologic cross sections; six day geologic mapping project during either spring break or two three-day weekends. **Prerequisites:** GEOL 101 or GEOL 104; GEOL 106.

**GEOL 310 Planetary Geology**

Credits 3. 3 Lecture Hours.

Introduction to planetary science; organization and composition of the solar system, including the planets, satellites and asteroids; surface features and internal structures of the terrestrial planets and moons; the dynamic processes of planetary resurfacing, including volcanism, tectonism, weathering and impacts; the
history and future of solar system exploration.

**Prerequisites:** GEOL 101 or 104; junior or senior classification or approval of instructor.

**GEOL 311 Principles of Geological Writing**

**Credit 1. 1 Lecture Hour.**
Principles of writing for geological reports; format and style for abstracts, grant proposals, journal manuscripts and industry reports; evaluating written reports for revision and editing; using proper referencing and citation style; methods of maintaining clarity in documents; using web tools for geological communication.

**GEOL 312 Structural Geology and Tectonics**

**Credits 4. 3 Lecture Hours. 3 Lab Hours.**
Fundamentals of the deformation of the lithosphere ranging from plate to atomic scales; stress, strain, experimental rock deformation, microscopic mechanisms and mechanical behaviors; analysis of faults, folds, flow and rock fabrics; subsurface interpretation; regional tectonics of selected areas; practical experience in geometric and kinematic analysis, constructing balanced cross sections.

**Prerequisites:** GEOL 104 or GEOL 150 or equivalent; MATH 151, MATH 152 and PHYS 218.

**GEOL 314 Paleontology and Geobiology**

**Credits 4. 3 Lecture Hours. 3 Lab Hours.**
Biosphere-geosphere interactions, including procaryote controls on sedimentary geochemistry and organismal distributions, and fossil preservation; fossils in the context of evolutionary theory and global change; identification of important groups of marine fossils; use of fossils to determine the stratigraphic age of rocks and the history of life on Earth.

**Prerequisites:** CHEM 101 or CHEM 107, or GEOL 152 or equivalent; GEOL 306.

**GEOL 316 Team Research in Geology and Geophysics**

**Credits 3. 0 Lecture Hours. 9 Lab Hours.**
Team-based research in geology and geophysics; hypothesis development, data collection, data interpretation; communication of geological/geophysical interpretations and data. May be taken four times for credit.

**Prerequisites:** GEOL 203 or concurrent enrollment and approval of instructor.

**GEOL 320 Geology for Civil Engineers**

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**
Principles of physical and engineering geology; properties of minerals, rocks and soils; active surface and subsurface processes; applications to the siting, design, construction, operation and maintenance of engineered works and the protection of the environment. A three-day field trip is required (a field trip fee is charged at registration).

**Prerequisite:** Sophomore classification.

**GEOL 330 Geologic Field Trips**

**Credits 1 to 3. 1 to 3 Other Hours.**
Field trips to observe, analyze and interpret the geology and geophysics of selected localities in Texas and adjacent regions; complements classroom experience. Trip frequencies, duration, dates and study localities vary with semester.

**Prerequisite:** GEOL 101 or GEOL 104 or approval of instructor. May be repeated for credit.

**GEOL 350 Summer Field Geology**

**Credits 3. 3 Other Hours.**
Intense immersive geologic mapping experience, integrating geological skills from throughout the curriculum; concepts of field relationships and field techniques are used to develop geologic maps, stratigraphic columns, cross-sections and geologic interpretations for a variety of geologic provinces; conduct off-campus in a field area or areas for three to four weeks.

**Prerequisites:** GEOL 304, GEOL 314, GEOL 306, GEOL 250 and GEOL 312.
GEOL 352/GEOG 352 GNSS in the Geosciences  
**Credits 3. 2 Lecture Hours. 3 Lab Hours.**
Fundamentals of Global Navigation Satellite Systems (GNSS); basic geodesy, figure of the earth; frames of reference, map projection, datums, ellipsoids; GPS accuracy and precision; applications in earth resource mapping and database creation; elementary GPS phase data processing.  
**Prerequisites:** Junior or senior classification; approval of instructor.  
**Cross Listing:** GEOG 352/GEOL 352.

GEOL 400 Reservoir Description  
**Credits 3. 2 Lecture Hours. 3 Lab Hours.**
An integrated reservoir characterization and design experience for seniors in petroleum engineering, geology and geophysics; includes using geophysical, geological, petrophysical and engineering data; emphasis on reservoir description (reservoir and well data analysis and interpretation), reservoir modeling (simulation), reservoir management (production optimization) and economic analysis (property evaluation).  
**Prerequisite:** Junior or senior classification or approval of instructor.

GEOL 404 Geology of Petroleum  
**Credits 3. 2 Lecture Hours. 3 Lab Hours.**
Origin, migration and accumulation of petroleum; typical U.S. oil and gas fluids; laboratory work in subsurface geology.  
**Prerequisites:** GEOL 312; senior classification in geology.

GEOL 410 Hydrogeology  
**Credits 3. 2 Lecture Hours. 2 Lab Hours.**
Geologic conditions determining the distribution and movement of ground water and their effect on the hydrologic properties of aquifers.  
**Prerequisite:** MATH 151 and MATH 152, or equivalent; junior or senior classification.

GEOL 420 Environmental Geology  
**Credits 3. 2 Lecture Hours. 2 Lab Hours.**
Geologic concepts of the nature of geologic environments and the dynamics of geologic processes needed to characterize and quantify human interactions with specific geologic systems including aquifers, watershed, coastlines and wetlands; specific techniques, including geophysical and geochemical techniques, field mapping, geographical information systems and remote sensing used to monitor human-geosphere interactions.  
**Prerequisites:** GEOL 101 or GEOG 203; junior or senior classification or approval of instructor.

GEOL 440 Engineering Geology  
**Credits 3. 2 Lecture Hours. 3 Lab Hours.**
Fundamentals of soil, rock and fluid mechanics and basic engineering practices as applied to the analysis of the geologic environment for engineering uses. Designed for geoscience majors who have not had engineering courses.  
**Prerequisites:** GEOL 312 or approval of instructor; PHYS 218.

GEOL 450 Geology Senior Project  
**Credits 3. 3 Lecture Hours.**
Conducting and communicating a team research project in geology and/or geophysics; formulating a research question and a plan to answer that question; synthesizing and interpreting the geological and geophysical literature; written and oral presentation of findings and critiquing those findings.  
**Prerequisites:** GEOL 210 and GEOL 312, or approval of undergraduate advisor.

GEOL 451 Introduction to Geochemistry  
**Credits 3. 2 Lecture Hours. 2 Lab Hours.**
Chemical principles and processes responsible for the formation and cycling of earth materials, with emphasis on low temperature equilibria and kinetics in rockwater systems.  
**Prerequisite:** GEOL 302 or approval of instructor.
GEOL 478 Earth Science Modeling  
Credits 4. 3 Lecture Hours. 3 Lab Hours.  
Techniques for building, solving and analyzing numerical models applied to a wide variety of problems in geology, geochemistry, geobiology and geophysics; derivation and scaling of conservation laws; finite difference and finite element techniques; programming in MATLAB or a higher-level language.  
Prerequisites: MATH 151; MATH 152; junior or senior classification.  

GEOL 484 Internship  
Credits 0. 0 Other Hours.  
Directed internship in a private firm, government agency or non-governmental organization to provide work experience related to the student’s degree program and career objectives. May be taken two times.  
Prerequisites: Junior or senior classification and approval of internship agency and approval of instructor.  

GEOL 485 Directed Studies  
Credits 1 to 12. 1 to 12 Other Hours.  
Advanced problems in geology.  

GEOL 489 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Selected topics in an identified area of geology. May be repeated for credit.  
Prerequisite: Approval of instructor.  

GEOL 491 Research  
Credits 0 to 4. 0 to 4 Other Hours.  
Research conducted under the direction of faculty member in geology. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.  
Prerequisites: Junior or senior classification and approval of instructor.  

GEOP 291 Research  
Credits 0 to 4. 0 to 4 Other Hours.  
Research conducted under the direction of faculty member in geophysics. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.  
Prerequisites: Freshman or sophomore classification and approval of instructor.  

GEOP 313 Geophysical Field Methods  
Credits 4. 3 Lecture Hours. 2 Lab Hours.  
Planning, safe execution and analysis of applied geophysical surveying including magnetics, gravity, resistivity, induced polarization, seismic reflection, seismic refraction, ground-penetrating radar, frequency-domain and time-domain electromagnetic induction; experimental design, precise navigation, quality assurance and control, data management, elementary processing, error analysis and estimation, visualization and interpretation procedures.  
Prerequisites: GEOP 341, PHYS 208, PHYS 218, MATH 308 and GEOL 250.  

GEOP 341 Fundamentals of Geophysics  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
The structure, composition and evolution of the earth; the concepts and application of various geophysical methods to infer earth structure, including seismology, gravity and geodesy, magnetics; generation of internal heat and heat loss; quantification of the driving forces of plate tectonics and isostatic topography.  
Prerequisites: PHYS 208, PHYS 218, MATH 308, GEOL 210 and GEOL 150 or equivalent.  

GEOP 361 Geophysical Signal Processing  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  

Fundamental concepts in digital signal processing for geophysicists; practical applications of sampling theory, Fourier analysis, filter design, spectral decomposition, instrument deconvolution, and methods of finding hidden signals within geophysical data; Matlab-based laboratory exercises involve analysis of various types of real geophysical/geological data.

**Prerequisites:** GEOP 341, PHYS 221 and MATH 311 or equivalent.

**GEOP 413 Near-surface Geophysics**

**Credits 3. 3 Lecture Hours.**

Fundamentals of traditional and emergent surface and borehole geophysical methods, as they are applied to shallow (less than 100 meters) subsurface investigations; emphasis on electrical, magnetic and electromagnetic methods; seismic reflection and crosswell tomography.

**Prerequisites:** GEOP 313 and GEOP 361, or approval of instructor.

**GEOP 421 Seismology**

**Credits 4. 3 Lecture Hours. 2 Lab Hours.**

Mathematical theory of elasticity and seismic wave propagation; properties of body and surface waves and applications to inference of earth structure; introduction to source theory; use of seismic data to determine major earth structures; characteristics of seismic noise fields; influence seismic anisotropy.

**Prerequisites:** GEOP 361, MATH 311 and PHYS 221, or approval of instructor.

**GEOP 435 Methods of Geophysical Exploration**

**Credits 4. 3 Lecture Hours. 3 Lab Hours.**

Introduction to theory of gravity, magnetic, electrical and seismic exploration methods; physical properties of earth materials and their influence on geophysical measurements; limitations of geophysical data in the interpretation of subsurface structure.

**Prerequisites:** GEOL 309; MATH 251.

**GEOP 470 Computational Geophysics**

**Credits 3. 3 Lecture Hours.**

Techniques used in the study of geophysical processes, including heat and chemical transport in the Earth, rock deformation and viscous fluid flow; development of conservation laws, relevant boundary conditions and analytical solutions; introduction to numerical solutions.

**Prerequisites:** GEOL 101 or GEOL 104; MATH 308; or approval of instructor.

**GEOP 475 Interpretation of Gravity and Magnetic Fields**

**Credits 3. 3 Lecture Hours.**

Applications of potential theory in the interpretation of gravity and magnetic fields; analysis of geophysical anomalies produced by geologic structures and by variation in the physical properties of rocks; use of regional gradients, residual anomalies, higher derivatives and surfaces, line integrals and two and three dimensional models.

**Prerequisites:** GEOL 312; MATH 311 or approval of instructor.

**GEOP 484 Internship**

**Credits 0. 0 Other Hours.**

Directed internship in a private firm, government agency or non-governmental organization to provide work experience related to the student’s degree program and career objectives. May be taken two times.

**Prerequisites:** Junior or senior classification and approval of internship agency and approval of instructor.

**GEOP 485 Directed Studies**

**Credits 1 to 12. 1 to 12 Other Hours.**

Advanced problems in geophysics.

**GEOP 489 Special Topics In...**

**Credits 1 to 4. 1 to 4 Other Hours.**

Selected topics in geophysics. May be repeated for credit.

**Prerequisite:** Junior or senior classification.
GEOP 491 Research
Credits 0 to 4. 0 to 4 Other Hours.
Research conducted under the direction of faculty member in geophysics. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.
Prerequisites: Junior or senior classification and approval of instructor.
Appendix D. Undergraduate Curricula
### B.A. Geology Degree Requirements (2010-2016)

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<tr>
<th>Fall</th>
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Total Hours 120
# B.S. Geology Degree Requirements (2010-2016)

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Total Hours 120
# B.S. Geophysics Degree Requirements (2010-2016)

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**Total Hours** 120
### B.S. Geology Degree Requirements (2017)

**Bold:** Newly required, *Italics:* Moved and/or renamed

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# B.S. Geophysics Degree Requirements (2017)

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</tr>
<tr>
<td>Geop 341</td>
<td>Fundamentals of Geophysics</td>
</tr>
<tr>
<td>Geol 306</td>
<td>Sedimentology and Stratigraphy</td>
</tr>
<tr>
<td>Math 311</td>
<td>Topics in Applied Math.</td>
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| 16 | 17 |

<table>
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<th>4th Year</th>
<th></th>
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<tbody>
<tr>
<td>Geop 421</td>
<td>Seismology</td>
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<tr>
<td>Geop 413</td>
<td>Near-surface Geophysics</td>
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<tr>
<td>Geol 450</td>
<td>Senior Project</td>
</tr>
<tr>
<td>Language, philos. culture elective</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

| 13 | 15 |

Total Hours 120
Appendix E. Graduate Course Descriptions and List of Theses
Appendix E1. Graduate Course Descriptions

GEOL 609 Field Geology
Credits 1 to 6. 1 to 6 Other Hours.
Individual instruction in advanced and specialized field methods, geologic interpretation and field evaluation procedures. Choice of topics and locations of field studies will vary depending upon individual and specific needs.
Prerequisite: GEOL 300 or approval of instructor.

GEOL 610 Field Methods in Hydrogeology
Credits 3. 1 Lecture Hour. 6 Lab Hours.
Field methods in hydrogeology; including ground water drilling technology and law; investigation and planning of well sites; installation of ground water wells; field testing of aquifer properties and analysis of field data. Field trips may be required for which departmental fees may be assessed to cover costs.
Prerequisite: GEOL 410 or approval of instructor.

GEOL 612 Structural Geology
Credits 3. 3 Lecture Hours.
Mechanical principles important to structural geology and experimental results relating to rock deformation followed by applications to natural deformation; mechanisms, rather than geometries. Primarily for students not concentrating in structural geology but who desire an advanced general course.
Prerequisite: Approval of instructor.

GEOL 614 Advanced Hydrogeology
Credits 3. 2 Lecture Hours. 2 Lab Hours.
Geologic conditions determining the distribution and movement of ground water and their effect on the hydrologic properties of aquifers.
Prerequisites: MATH 151 and MATH 152, or equivalent.

GEOL 619 Petroleum Geology
Credits 3. 3 Lecture Hours.
Properties of reservoir rocks; origin, migration and accumulation of petroleum; geologic interpretation of borehole logs and fluid-pressure measurements and the role of hydrostatic and hydrodynamic pressures in oil accumulation.
Prerequisite: Approval of instructor.

GEOL 621 Contaminant Hydrogeology
Credits 3. 3 Lecture Hours.
Physical concepts of mass transport; dispersion; diffusion; advection; geochemical processes including surface reaction; hydrolysis; biodegradation; aspects of modeling; process and parameter; and remediation.
Prerequisite: GEOL 410 or approval of instructor.

GEOL 622 Stratigraphy
Credits 3. 3 Lecture Hours.
Principles for correlating and naming stratigraphic units; controls on stratigraphic development (sediment supply, base-level change, subsidence, climate, and compaction); principles and application of sequence stratigraphy; subsurface stratigraphy; facies analysis and stratigraphic architecture.
Prerequisite: Graduate classification or approval of instructor.
GEOL 623 Carbonate Rocks
Credits 3.3 Lecture Hours.
Principles of carbonate sedimentology; carbonate depositional sequences defined in modern environments and utilized to interpret the rock record; introduction to depositional and diagenetic microfacies; shelves, ramps and isolated platforms and their tectonosedimentary significance; suggested for geoscience majors. 
Prerequisites: A basic understanding of sedimentology and the associated terminology; graduate classification.

GEOL 624 Carbonate Reservoirs
Credits 3.3 Lecture Hours.
Recognition and description of hydrocarbon reservoirs in carbonate rocks; classification of carbonate porosity; capillary pressure curves and pore types; pore characteristics as proxies for permeability in reservoir modeling; techniques for mapping flow units. 
Prerequisites: Graduate classification and approval of instructor.

GEOL 625 Applied Ground Water Modeling
Credits 3.3 Lecture Hours.
Concept of groundwater flow and contaminant transport; numerical simulations of solving flow and transport equations; finite difference and finite element methods; software structures of groundwater flow, contaminant transport, density-dependent fluid flow and hydrocarbon remediations; real case applications of software including geological, physical, chemical, biological and hydrological information. 
Prerequisite: GEOL 410 or approval of instructor.

GEOL 629 Regional Geology of North America
Credits 3.3 Lecture Hours.
Regional geology of North America, examining the accumulation and deformation of the rock units involved; structural form and style emphasized; entire geologic history investigated. 
Prerequisite: Graduate classification or approval of instructor.

GEOL 631 Engineering Geomorphology
Credits 3.3 Lecture Hours.
Active surface processes as they influence engineering construction; erosion, rivers and floods, slope processes, subsidence, coastal processes, ice, weathering and ground water. 
Prerequisites: Graduate classification in engineering or geosciences; GEOG 331 or approval of instructor.

GEOL 633 River Restoration
Credits 3.3 Lecture Hours.
Geologic, geomorphic and geomechanical principles applied to the investigation, design, construction, and maintenance of river restoration projects. 
Prerequisite: GEOL 631 or GEOG 626 or approval of instructor.

GEOL 635 Engineering Geology
Credits 3.3 Lecture Hours.
Geological principles applied to the investigation design, construction and maintenance of engineering projects; history, development and role of engineering geologic practice as applied to dams, waste disposal, surface and ground water, tunneling, quarrying and construction materials.

GEOL 640/WMHS 640 Geochemistry of Natural Fresh Waters
Credits 3.3 Lecture Hours.
Chemistry of aqueous solutions; weathering/redox reactions and controls on fresh waters; natural and anthropogenic factors affecting major, minor, and trace elements in fresh waters; evaluation of fresh water composition; application of water-quality measurements to quantitative hydrology. 
Cross Listing: WMHS 640/GEOL 640.
GEOL 641 Environmental Geochemistry
Credits 3. 3 Lecture Hours.
Geochemical processes affecting the fate and transport of inorganic and organic pollutants in terrestrial systems; equilibrium and kinetic modeling.
Prerequisite: GEOL 451 or approval of instructor.

GEOL 643 Introduction to Electron Microprobe Analysis
Credits 2. 1 Lecture Hour. 3 Lab Hours.
Digital imaging and qualitative and quantitative chemical analysis of geological and material science samples using the electron microprobe; emphasis on quantitative chemical analysis using WDS (wavelength-dispersive spectrometry) methods; use the electron microprobe and correctly interpret analytical results.
Prerequisite: Approval of instructor.

GEOL 645 Geochronology
Credits 3. 3 Lecture Hours.
Earth's 4.5 billion-year history is divided into units of geologic time based on the observed changes in the rock record: the timing of those changes is quantified by numerical dating methods: this course examines both dating methods and physical and biological changes observed in the rock record.
Prerequisite: Graduate classification or approval of instructor.

GEOL 647 Radiogenic Isotope Geology
Credits 3. 3 Lecture Hours.
Use of radiogenic isotopes in addressing problems in high- and low-temperature geochemistry; their use as tracers for past and present-day processes at the surface and interior of the Earth.
Prerequisite: Approval of instructor.

GEOL 648 Stable Isotope Geology
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Stable isotopes of oxygen, carbon, sulfur and hydrogen applied to problems in paleontology and paleoecology, carbonate diagenesis, petroleum exploration, and igneous and metamorphic petrology; isotopic paleotemperatures; analytical methods; theory of isotopic fractionation.
Prerequisite: GEOL 451 or approval of instructor.

GEOL 650 Paleocology
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Interrelationships of organisms and environment in the fossil record; methods and criteria available for interpreting ancient environments; critical review of classical studies and current research in paleocology.
Prerequisite: Approval of instructor.

GEOL 651 Paleocological Community Analysis
Credits 3. 3 Lecture Hours.
Quantitative analysis of multivariate paleocological community data; measurement of diversity; cluster analysis; gradient analysis by standard and canonical ordination techniques.
Prerequisite: A basic course in statistics or approval of instructor.

GEOL 652 Biogeology
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Major trends and processes in the evolution of life through geologic time. Interrelationships of biological and physical processes in earth history; application of paleontology to current problems in geology; critical review of modern developments in biogeology.
Prerequisite: GEOL 305 or approval of instructor.
GEOL 653 Geobiological Research
Credits 3. 1 Lecture Hour. 6 Lab Hours.
Team-based research in modern or historical geobiology; definition of questions and hypothesis testing; analytical techniques; project lifecycle; reporting of results. May be taken two times for credit.
Prerequisite: Approval of instructor.

GEOL 654 Evolutionary Patterns and Theory
Credits 3. 3 Lecture Hours.
Evolutionary patterns in the fossil record and application of evolutionary theory to understanding these patterns; comparisons of neo-Darwinian and punctuational hypotheses; events and processes pertaining to microevolutionary and macroevolutionary change; and methods of determine phylogenies of organisms.
Prerequisite: Graduate classification in geological or biological sciences.

GEOL 658 Earth Systems Through Deep Time: Global Change, Paleoclimate and Life
Credits 3. 3 Lecture Hours.
History and cause of global change in the earth system, Archean to Holocene; Impact of biotic change on the earth system; influence of tectonics on paleochemistry and climate change; influence of climate on tectonics; methods and models for evaluating global change.
Prerequisite: Graduate classification.

GEOL 663 Fracture and Faulting of Rocks
Credits 3. 3 Lecture Hours.
The structure of fractures and faults in the Earth's crust at the macroscopic and microscopic scale; formation and evolution of faults, faults networks and fault zones; fault-related rocks and faulting mechanisms; influence of faults on fluid flow properties; seismic faulting and creep; current problems and research opportunities.
Prerequisite: Graduate classification.

GEOL 664 Mechanical Analysis in Geology
Credits 3. 3 Lecture Hours.
Mechanical analysis of geological problems based on concepts of stress, strain, strength, elasticity, viscosity and plasticity; folding, faulting, dike formation, hydraulic fracturing, magma and glacial flow, and cooling of magmatic bodies.
Prerequisites: MATH 253; approval of instructor.

GEOL 665 Structural Petrology
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Mechanisms of rock deformation from single crystal to mountain range; techniques for mapping stresses and strains and for inferring physical conditions and mechanical behavior at time of deformation; laboratory assignments on descriptive techniques include petrographic microscope-universal stage methods, field procedures and data analysis.
Prerequisite: Approval of instructor.

GEOL 668 Clastic Sedimentology and Sedimentary Petrology
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Detailed analyses of clastic sedimentary rocks: relationships of facies and depositional environments with emphasis on continental, coastal and shallow shelf clastic sediments; petrography and diagenesis of modern and ancient clastic sediments.
Prerequisites: Optical mineralogy course and sedimentology (undergraduate); graduate classification.

GEOL 678 Earth Science Modeling
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Techniques for building, solving and analyzing numerical models applied to a wide variety of problems in geology, geochemistry, geobiology and geophysics; derivation and scaling of conservation laws; finite difference and finite element techniques and error analysis; programming in MATLAB or a high-level language.
GEOL 681 Seminar
Credit 1. 1 Lecture Hour.
Reports and discussions of current research and selected topics from geologic literature.
Prerequisite: Graduate classification.

GEOL 685 Directed Studies
Credits 1 to 12. 1 to 12 Other Hours.
Enables graduate students to undertake limited investigations not within their thesis or dissertation research and not covered in established curricula.
Prerequisites: Graduate classification and approval of instructor.

GEOL 689 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours. 1 to 7 Lab Hours.
Selected topics in an identified area of geology. May be repeated for credit.
Prerequisite: Approval of instructor.

GEOL 691 Research
Credits 1 to 23. 1 to 23 Other Hours.
Original research on problems in various phases of geology. Research for thesis or dissertation.

GEOP 611 Geomechanics
Credits 3. 3 Lecture Hours.
Development of continuum mechanics and its application to rock deformation; stress, strain, stress equilibrium, constitutive relations; governing equations for elastic solids and viscous fluids formulated and used to solve elementary boundary-value problems which have application to structural geology and solid-state geophysics.
Prerequisite: MATH 221 or equivalent.

GEOP 615 Experimental Rock Deformation
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Results of laboratory testing of mechanical properties of rocks at high pressure and temperature; interaction of theoretical, experimental, petrofabric and field studies of rock deformations as applied to problems in structural geology, seismology and engineering; philosophy of experimentation, apparatus design, data interpretation and extrapolation.
Prerequisite: GEOP 611 or GEOL 665 or approval of instructor.

GEOP 618 Numerical Methods for the Geosciences
Credits 3. 3 Lecture Hours.
Mathematical theory and numerical techniques for modeling physical systems and processes in the Geosciences; discretization of continuum equations for solids and fluids; finite difference methods, convergence, consistency, and stability; finite element and spectral methods in fluid dynamics and seismology; iterative solvers; implicit and explicit methods for diffusion and advection.
Prerequisite: Graduate classification or approval of instructor.
Cross Listing: ATMO 618 and OCNG 618.

GEOP 620 Geophysical Inverse Theory
Credits 3. 3 Lecture Hours.
Inferences about Earth structure from geophysical data; explicit treatment of sparse and noisy observations; construction of smooth Earth models; linear inversion of marine magnetic anomalies from seafloor magnetization; smooth inversion of DC sounding data from electrical structure; seismic tomography and geodetic fault-plane reconstructions; advanced methods for nonlinear deterministic inversion.
Prerequisite: Graduate classification.
GEOP 622 Petroleum Seismology II  
**Credits 4. 3 Lecture Hours. 2 Lab Hours.**  
Sampling (wavefield sampling); F-K analysis (applications to dip filtering and migration); deconvolution (deterministic and predicative); velocity estimation and tomography (travel time inversion); imaging in time and depth (migration); Zoeppritz equations and AVO analysis.  
**Prerequisite:** GEOP 421 or approval of instructor.

GEOP 628 Basin Architecture  
**Credits 3. 3 Lecture Hours.**  
Tectonic classification of basins; tectonic mechanisms responsible for basin formation: mechanical behavior of the lithosphere; subsidence; geophysical signatures of sedimentary basins; tectonic controls on sedimentation and basin filling; petroleum systems and basin-scale hydrologic systems.  
**Prerequisite:** Approval of instructor.

GEOP 629 Seismic Interpretation  
**Credits 4. 3 Lecture Hours. 3 Lab Hours.**  
Introduces the problem of converting seismic properties of reflection time, velocity, impedance, amplitude and phase to geologic parameters of lithology, structures and stratigraphy using both models and real data.  
**Prerequisite:** Approval of instructor.

GEOP 631 Seismic Data Processing  
**Credits 4. 3 Lecture Hours. 3 Lab Hours.**  
Methods used to image the Earth using seismic reflection data, including deconvolution, f-k filtering, velocity analysis and migration; processing software; emphasis on field data.  
**Prerequisite:** Graduate classification or approval of instructor.

GEOP 651 Theoretical Seismology  
**Credits 3. 3 Lecture Hours.**  
Wave propagation in unbounded and bounded elastic media; seismic reciprocity and the elastodynamic representation theorem; radiation patterns from earthquake sources; body waves, Rayleigh waves, Stoneley waves, Love waves and Lamb waves; characteristic equation for surface waves in a layered half-space; dispersion and phase and group velocities; methods of stationary phase and steepest descents; Cagniard-deHoop technique; ray theory in an inhomogeneous earth; inversion of travel times; viscoelastic wave propagation; normal modes of vibration of the earth.  
**Prerequisite:** GEOP 652 or approval of instructor. (Offered in alternate years.)

GEOP 652 Earthquake Seismology  
**Credits 3. 3 Lecture Hours.**  
Seismometry and earthquake precursors; mathematical theory of elasticity and its application to earthquake studies; dissipation of elastic energy; seismic sources; earthquake risk; free modes of the earth; discrimination between underground nuclear explosions and earthquakes.  
**Prerequisite:** GEOP 421 or approval of instructor.

GEOP 655 Borehole Acoustic  
**Credits 3. 3 Lecture Hours.**  
Introduces propagation of acoustic waves in boreholes, with applications to petroleum exploration and comparisons to other waveguide phenomena in the earth sciences; survey of full waveform acoustic logging and influence of borehole modes for crosswell and vertical seismic profile experiments; exercised in data analysis with industry software.  
**Prerequisite:** GEOP 421 or GEOP 652 or approval of instructor.
GEOP 660 Physics of the Earth's Interior  
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Physics of the Earth's Interior. Structure, composition and physical state of the Earth's interior; constraints on models of the Earth imposed by seismic, gravity, heat flow, and electrical conductivity; thermodynamics and high pressure mineral physics; Earth's motion and deformation; rheology. 
Prerequisite: Graduate classification.

GEOP 661 Reservoir Rock Physics  
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Poroelasticity and electrodynamics of porous media; Biot Theory, Gassman fluid substitution and advanced rock physics models; relationships between seismic/electromagnetic properties and multiphase reservoir properties such as porosity, saturation, permeability, wettability, connectivity and other pore-structure parameters; computer-based rock physics modeling; application to reservoir characterization; time-lapse reservoir monitoring. 
Prerequisite: Approval of instructor. (Spring, alternate years.)

GEOP 662 Advanced Reservoir Rock Physics  
Credits 3. 3 Lecture Hours.
Continuation of GEOP 661; topological characterization of fractured porous media and Reimannian manifold, balance laws of an effective medium, balance laws of interacting fields, compatibility equations and structural evolution, equations of relative motion, thermodynamics and constitutive relations, wave phenomena and fluid flow in fractured porous media. 
Prerequisites: GEOP 661 and approval of instructor.

GEOP 666 Principles of Geodynamics  
Credits 4. 4 Lecture Hours.
Geological and geophysical methods and phenomena pertinent to geodynamics; plate tectonics; seismicity and seismology; magnetics; gravity; heat flow; igneous, metamorphic and sedimentary petrology; paleontology; and rock mechanics. 
Prerequisite: Approval of instructor.

GEOP 681 Seminar  
Credit 1. 1 Lecture Hour.
Discussion of subjects of current importance. 
Prerequisite: Graduate classification.

GEOP 685 Directed Studies  
Credits 1 to 6. 1 to 6 Other Hours.
For graduate students to undertake limited investigations not within their thesis or dissertation research and not covered in established curricula. 
Prerequisites: Graduate classification and approval of department head.

GEOP 689 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours.
Selected topics in an identified area of geophysics. May be repeated for credit. 
Prerequisites: Graduate classification and approval of instructor.

GEOP 691 Research  
Credits 1 to 23. 1 to 23 Other Hours.
Research toward thesis or dissertation.
### Appendix E2. Graduate Degrees in Department of Geology and Geophysics at Texas A&M 2010-2017

<table>
<thead>
<tr>
<th>Student</th>
<th>Degree</th>
<th>Advisor(s)</th>
<th>Date</th>
<th>Title</th>
<th>Discipline</th>
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<tr>
<td>Brunk, Timothy J.</td>
<td>M.S.</td>
<td>Giardino, John R.</td>
<td>2010-05</td>
<td>A Geomorphological Assessment of Armored Deposits Along the Southern Flanks of Grand Mesa, CO, USA</td>
<td>Geology</td>
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<tr>
<td>Navarro Zelasco, Luis</td>
<td>M.S.</td>
<td>Hopper, John</td>
<td>2010-05</td>
<td>Tectonic Evolution of the Contaya Arch Ucayali Basin, Peru</td>
<td>Geology</td>
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<tr>
<td>Harvey, Omar R.</td>
<td>Ph.D.</td>
<td>Herbert, Bruce E.</td>
<td>2010-05</td>
<td>Mechanisms of Organic-inorganic Interactions in Soils and Aqueous Environments Elucidated using Calorimetric Techniques</td>
<td>WMHS</td>
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<tr>
<td>Kolkmeier, Benjamin D.</td>
<td>M.S.</td>
<td>Mathewson, Christopher C.</td>
<td>2010-05</td>
<td>Engineering Geologic Assessment of Risk to Visitors: Canyon Lake Gorge, Texas</td>
<td>Geology</td>
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<td>Hull, Thomas Frederick</td>
<td>M.S.</td>
<td>Sun, Yuefeng, Yancey, Thomas E.</td>
<td>2010-08</td>
<td>High-Resolution Characterization of Reservoir Heterogeneity and Connectivity in Clastic Environments</td>
<td>Geology</td>
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<tr>
<td>Mukherjee, Souvik</td>
<td>Ph.D.</td>
<td>Everett, Mark E.</td>
<td>2010-08</td>
<td>Electromagnetic Induction for Improved Target Location and Segregation Using Spatial Point Pattern Analysis with Applications to Historic Battlegrounds and UXO Remediation</td>
<td>Geophysics</td>
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<td>Pierce, Carl J.</td>
<td>Ph.D.</td>
<td>Everett, Mark E.</td>
<td>2010-08</td>
<td>Effect of Load Path on Mode of Failure at the Brittle-ductile Transition in Well-sorted Aggregates of St. Peter Sand</td>
<td>Geology</td>
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<td>De Leon, Tiffany Lucinda</td>
<td>M.S.</td>
<td>Zhan, Hongbin</td>
<td>2010-08</td>
<td>Evaluation of Collector Well Configurations to Model Hydrodynamics in Riverbank Filtration and Groundwater Remediation</td>
<td>Geology</td>
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<td>Regmi, Netra Raj</td>
<td>Ph.D.</td>
<td>Giardino, John R.</td>
<td>2010-08</td>
<td>Hillslope Dynamics in the Paonia-McClure Pass Area, Colorado, USA</td>
<td>Geology</td>
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<td>Dadi, Sireesh Kumar</td>
<td>M.S.</td>
<td>Zhan, Hing-Bin, Sparks, David</td>
<td>2010-08</td>
<td>A Study to Verify the Material Surface Concept of Water Table by Examining Analytical and Numerical Models.</td>
<td>Geology</td>
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<td>Fall, Leigh Margaret</td>
<td>Ph.D.</td>
<td>Olszewski, Thomas D.</td>
<td>2010-08</td>
<td>Processes Influencing the Diversity of Middle Permian Brachiopods in the Bell Canyon Formation of the Delaware Basin (West Texas, Guadalupe Mountains National Park)</td>
<td>Geology</td>
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<td>Zhuang, Kelin</td>
<td>Ph.D.</td>
<td>Giardino, John I, North, Jerry</td>
<td>2010-08</td>
<td>Occurrence and Stability of Glaciations in Geologic Time</td>
<td>Geology</td>
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<td>Miller, Clint Matthew</td>
<td>M.S.</td>
<td>Herbert, Bruce E.</td>
<td>2010-08</td>
<td>Adhesion and the Surface Energy Components of Natural Minerals and Aggregates</td>
<td>Geology</td>
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<td>Wells, Rachel Kristen</td>
<td>M.S.</td>
<td>Newman, Julie</td>
<td>2010-12</td>
<td>Microstructures and Rheology of a Limestone-Shale Thrust Fault</td>
<td>Geology</td>
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<td>Coble, Clayton Gage</td>
<td>M.S.</td>
<td>Chester, Frederick M.</td>
<td>Chester, Judith S.</td>
<td>Frictional Strength of the Creeping Segment of the San Andreas Fault</td>
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<td>Sills, David Wayne</td>
<td>M.S.</td>
<td>Chester, Judith S.</td>
<td>2010-12</td>
<td>The Fabric of Clasts, Veins and Foliations within the Actively Creeping Zones of the San Andreas Fault at SAFOD: Implications for Deformation Processes</td>
<td>Geology</td>
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<td>Strauss, Josiah</td>
<td>Ph.D.</td>
<td>Grossman, Ethan L.</td>
<td>2010-12</td>
<td>Stable Isotope Characterization and Proxy Records of Hypoxia-Susceptible Waters on the Texas-Louisiana Shelf</td>
<td>Geology</td>
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<td>Kitajima, Hiroko</td>
<td>Ph.D.</td>
<td>Chester, Frederick M.</td>
<td>Chester, Judith S.</td>
<td>Evolution of Frictional Behavior of Punchbowl Fault Gouges Sheared at Seismic Slip Rates and Mechanical and Hydraulic Properties of Nankai Trough Accretionary Prism Sediments Deformed at Different Loading Paths</td>
<td>Geology</td>
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<td>Cai, Rui</td>
<td>M.S.</td>
<td>Sun, Yuefeng</td>
<td>2010-12</td>
<td>Seismic Analysis Using Wavelet Transform for Hydrocarbon Detection</td>
<td>Geophysics</td>
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<td>Howson, Andrea Melissa</td>
<td>M.S.</td>
<td>Raymond, Anne</td>
<td>2010-12</td>
<td>Mineralogical and Microbial Controls on Iron Reduction in a Contaminated Aquifer-Wetland System</td>
<td>Geology</td>
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<tr>
<td>Name</td>
<td>Degree</td>
<td>Advisor 1</td>
<td>Advisor 2</td>
<td>Year</td>
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<td>Casey, Michael Chase</td>
<td>M.S.</td>
<td>Sun, Yuefeng</td>
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<td>2011-05</td>
<td>Integrated Reservoir Characterization: Offshore Louisiana, Grand Isle Blocks 32 &amp; 33</td>
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<td>Artan, Sinem</td>
<td>M.S.</td>
<td>Tice, Mike M.</td>
<td>Herbert, Bruce E.</td>
<td>2011-05</td>
<td>Aeolian Delivery of Organic Matter to a Middle Permian Deepwater Ramp</td>
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<td>Dou, Qifeng</td>
<td>Ph.D.</td>
<td>Sun, Yuefeng</td>
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<td>2011-05</td>
<td>Rock Physics-Based Carbonate Reservoir Pore Type Evaluation by Combining Geophysical, Petrophysical and Seismic Data</td>
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<td>Mieles, John Michael</td>
<td>M.S.</td>
<td>Zhan, Hongbin</td>
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<td>Semi-Analytical Solutions of One-Dimensional Multispecies Reactive Transport in a Permeable Reactive Barrier-Aquifer System</td>
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<td>Chen, Bo</td>
<td>M.S.</td>
<td>Gibson, Richard L.</td>
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<td>2011-08</td>
<td>Efficient Smoothing and Interpolation of Velocity Models for Seismic Wavefront Construction Algorithms</td>
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<td>Hsiung, Shih-Yi</td>
<td>M.S.</td>
<td>Raymond, Anne</td>
<td>Firth, John</td>
<td>2011-08</td>
<td>Mid-Cretaceous Palynoflora from Central Mid-Pacific Ocean</td>
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<tr>
<td>Gunderson, Spencer</td>
<td>M.S.</td>
<td>Tice, Michael M.</td>
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<td>2011-08</td>
<td>Early Channel Evolution in the Middle Permian Brushy Canyon Formation, West Texas, USA</td>
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<td>Harper, Rebecca Anne</td>
<td>M.S.</td>
<td>Mathewson, Christopher C.</td>
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<td>2011-08</td>
<td>Geology of the McMillan Ranch in Mason, Texas: An Assessment of the Nature of Normal Faults in the Mason Area</td>
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<td>Mammadova, Elnara</td>
<td>M.S.</td>
<td>Sun, Yuefeng F.</td>
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<td>2011-08</td>
<td>Influence of Rock Types on Seismic Monitoring of CO2 Sequestration in Carbonate Reservoirs</td>
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<tr>
<td>Yeatman, Ryan Yeatman</td>
<td>M.S.</td>
<td>Pope, Micheal C.</td>
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<td>2011-08</td>
<td>Reservoir Characterization and Modeling of the Glorieta and the Clearfork Formations, Monahans Field, Permian Basin, Texas</td>
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<tr>
<td>Hansen, David Joseph</td>
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Appendix F. Graduate Policies
GEPL GRADUATE ADMISSIONS POLICIES

APPLICATION DEADLINES

Applications for fall semester admission close on January 1; however, applications must be in by December 15 to receive full consideration for fellowships. Applications for spring semester admissions close on August 15. No summer semester admissions will be considered. Initial offers will be made no later than six weeks after the application deadlines. All decisions must be made by May 31 and November 30, respectively.

ADMISSIONS POLICY

Admission into the graduate program requires: (a) a positive vote from the graduate admissions committee (see below) and; (b) a faculty advisor has been identified, as evidenced by a written statement of advocacy. The statement must include examples of prior contact with the student, a statement that a project has been identified and a proposed role for this student, and exceptional or intangible qualifications of the student. Except under exceptional circumstances (e.g. applicants who have non-traditional forms of support) substantiated in writing, no PhD students shall be admitted without guaranteed support. Some exceptional MS students should be supported. Unsupported, but fully qualified, MS students will also be considered.

Strong justification in the advocacy statement is required for applicants whose scores fall below the department historical averages for GRE, GPA and TOEFL. The historical averages shall be provided on the departmental web site.

Departmental or university support will not be guaranteed after 5 years from the starting semester as stated in the offer letter for incoming PhD-64 students, in 6 years for incoming PhD-96 students, and in 3 years for incoming MS students.

REGULAR VOTING POLICY

All graduate admissions committee members, including the chair, will vote to admit or deny each candidate. A minimum of 4 committee members, including the chair, being present is required to conduct a vote. A clear majority is required for an admit decision. A tied vote results in a deny decision if all committee members are present, or in the case that at least one committee member is absent, it triggers a re-vote at the next meeting. All committee members must provide a justification for each negative vote which he or she casts.
ELECTRONIC VOTING POLICY

In rare cases it is required to conduct a vote electronically. The chair will issue a call for votes by email with a specified deadline. A discussion through e-mail will ensue. Each committee member can submit a vote, and optionally submit a changed vote in response to the e-mail discussion, at any time prior to the stated deadline. A simple majority of those voting will apply for tallying the result, except that a tied electronic vote will constitute a deny.

REPORTING OF THE VOTE POLICY

After each vote is conducted, the decision of each member of the committee who voted will be made available to faculty members upon request.

TA 101-QUALIFICATION POLICY

The following are the minimum requirements of an incoming graduate student without an undergraduate degree in geology or geophysics in order to qualify for a Geology 101/104 TA:

(a) in a semester prior to the first award of a Geology 101/104 TA, the student must successfully complete all course requirements in Geology 104 (or Geology 101 if 104 is not offered) and provide letters that attest to such, including grade achieved, from both the lecture and lab instructors.

(b) in a semester prior to or concurrent with the first award of a Geology 101/104 TA, the student must officially register and successfully complete all course requirements in one of Geology 309 (Field Methods), or Geology 203 (Mineralogy), or Geology 306 (Sedimentology), or Geology 312 (Structural Geology).

INCOMING-STUDENT TA ALLOCATION POLICY

Preference for a TA award amongst equally qualified incoming graduate students will be made so as to promote an equitable use of departmental or university support amongst all the faculty members in the department. TA offers to incoming graduate students will be made starting from 10 days after the day that the faculty have been shown the complete list of applicants.

INCOMING 96-HOUR TA AWARD POLICY

An incoming student admitted to the 96-hour PhD program will receive not more than 4 semesters of guaranteed TA support, however, this is renewable for not more than 6 additional semesters upon provision of a letter from the faculty advisor attesting that satisfactory progress is being made toward the PhD degree.
GEPL GRADUATE “SPECIAL” ADMISSION POLICIES

1. re-instatement of students discontinued by OGS
   recommendation from current faculty advisor
   majority vote

2. new applicants for non-degree-seeking G6 status
   full package on TAMUDOCS (transcript, application only)
   majority vote
   letter of support from TAMU faculty advocate
   2 letters from someone other than the TAMU faculty advocate
   GRE required
   statement from student outlining rationale for undertaking G6 studies

3. transfers of current TAMU graduate students from other units into GEPL
   recommendation from potential faculty advisor that addresses the
   rationale for transfer
   statement of interest from the student
   full package on TAMUDOCS
   majority vote

4. GEPL students continuing on from G7 into G8 status
   statement from student
   recommendation from the previous and the proposed faculty advisors
   majority vote

Each admitted candidate will receive a letter of admission stating a commitment to a
specific level and duration of support.
Appendix G. Graduate Procedures
GEPL Admissions Procedure:

The procedure for admission of graduate students into Geology and Geophysics involves multiple steps. Briefly, the admissions committee meets and determines whether each candidate proposed by a faculty advisor meets our departmental requirements for graduate study and, if so, fully qualified students not in need of support are recommended for admission while fully qualified students in need of support are “admitted conditionally” with their final decisioning depending on the availability of department and other internal resources, and their ranking relative to others. The details with a rough time scale is provided below:

**Week 1** The faculty is provided with the list of applicants.

**Week 2** The faculty provides statements of advocacy, which defines the list of candidates.

**Week 3** The admissions committee is provided with application packages of candidates; each candidate is assigned a primary (and starting last year, a secondary) discussion leader.

**Week 4** Admits (for sponsored students) and conditional admits (for other students) are determined based on discussion, followed by a vote.

**Week 5** Offer letters for sponsored admits are forwarded to department head for approval; the conditional admits are then ranked by the committee members.

**Week 6** Decisions on incoming-student fellowships are normally made about here; then, offer letters for the top-ranked conditional admits are forwarded to department head for approval.

**Until end of semester:** Additional rounds of decisioning are performed, as needed, following the above prescription.

**Additional Notes:**

The number of offer letters forwarded to the department head for approval is up to the committee but is typically guided by the amount of resources available, as communicated by the department head.

Once the department head has indicated no further resources are available, generally the committee has made additional offers without support to top-ranked conditionally-admitted MS students, following consultation with the prospective faculty advisor, with approval of the department head.

Each committee member takes into account departmental policies, such as equitable use and distribution of department resources, during the ranking process.

Following the tally of the rankings, there is normally a discussion to ensure that the final admission decisions do, in fact, conform to departmental policies and objectives and faculty expectations.
Appendix H. Faculty Curriculum Vitaes
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<td>CHRISTY SWANN</td>
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<td>PLANETARY GEOLOGY AND EOLIAN SEDIMENT TRANSPORT</td>
<td></td>
</tr>
<tr>
<td>CALEB HOLYOKE</td>
<td>ASSIST. RES. SCI.</td>
<td>ROCK DEFORMATION/MICROSTRUCT.</td>
<td>NSF</td>
</tr>
<tr>
<td>HYE-JEONG KIM</td>
<td>POSTDOC. FELLOW</td>
<td>SCIENCE EDUCATION</td>
<td>NSF</td>
</tr>
<tr>
<td>SANTANU MAJUMDER</td>
<td>POSTDOC. FELLOW</td>
<td>HYDROGEOLOGY</td>
<td>NSF</td>
</tr>
<tr>
<td>JASON MOORE</td>
<td>POSTDOC. FELLOW</td>
<td>QUANTITATIVE PALEOBIOLOGY</td>
<td>HARRIS ENDOWMENT</td>
</tr>
<tr>
<td>KIM MYERS</td>
<td>POSTDOC. FELLOW</td>
<td>GEOBIOLOGY</td>
<td>NASA</td>
</tr>
<tr>
<td>FABIO SARTORI</td>
<td>POSTDOC. FELLOW</td>
<td>BIOGEOCHEMISTRY/SOIL SCIENCE</td>
<td>HARRIS ENDOWMENT</td>
</tr>
<tr>
<td>JINQUAN ZHONG</td>
<td>POSTDOC. FELLOW</td>
<td>EARTHQUAKE RUPTURE MODELING</td>
<td>USGS/NSF</td>
</tr>
</tbody>
</table>
EDUCATION

Ph.D. (2010), Geology, California Institute of Technology, Advisor: Paul D. Asimow
M. S. (2009), Geology, California Institute of Technology
B. S. (2002), Geology, Indiana University

RESEARCH INTERESTS
1) Igneous petrology of the planet Mars and Martian meteorites. Investigated through direct measurements of the chemistry of martian igneous meteorites, modeling melting of the martian mantle using thermodynamics-based geochemical algorithms, and producing experimental samples representative of martian magmatic compositions.
2) Investigating the history and igneous petrology of the Mexican Volcanic Belt using samples collected from a drilling operation in Mexico City
3) Using meteorites to interpret igneous processes on asteroids in the early solar system, focusing currently on asteroid 4 Vesta
4) Abundance of dissolved volatile elements such as H₂O and CO₂ in Earth’s upper mantle and impact of those elements on the composition of magmas erupted at the surface.

EXPERIENCE
Visiting Professor of Petrology, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2016 to present

Visiting Professor of Petrology, Department of Earth and Atmospheric Sciences, University of Pittsburgh, Pittsburgh, PA
September 2014 to May 2016

Post-Doctoral Research Associate, University of Tennessee, Knoxville TN
October 1995 to July 1998
Research on the major and trace element chemistry of meteorites from Mars and asteroid 4 Vesta, in addition to supporting work on the Emeiishan large igneous province in China.

COMPETITIVE GRANTS AND AWARDS RECEIVED
N/A

AWARDS AND DISTINCTIONS
N/A

PUBLICATIONS (5 most recent)


MAURO ROBERTO BECKER
Research Professor,
Chevron Basin Modeling Center of Excellence
Berg-Hughes Center
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (979) 845-6269; FAX: (979) 845 6162
e-mail: mbecker@tamu.edu

EDUCATION

RESEARCH INTERESTS
My research interests focus on three main topics:
1) Petroleum Systems and Basin Analysis and Modeling – Permian Basin
2) Sedimentology and Stratigraphy of Riffs and Atlantic Margin Systems
3) Reservoir Characterization and Modeling and Petroleum Field Development and Management

EXPERIENCE
Research Professor, Basin Modeling Center, Berg-Hughes Center, Dept. of Geology and Geophysics, Texas A&M University, College Station, TX
April 2017 to present

Reservoir Area Manager Walker Ridge (Gulf of Mexico) Asset, Petrobras America, Inc, Houston, TX
August 2012 to June 2016

Integrated Reservoir R&D Manager Petrobras R&D Center (CENPES), Rio de Janeiro, Brazil
December 2006 to July 2012

Manager of E&P School Petrobras SA Corporate University, Rio de Janeiro, Brazil
November 2004 to December 2006

Reserve and Reservoir Technical Support Manager Petrobras SA, E&P Rio de Janeiro Business Unit, Brazil
January 2001 to November 2004

Geologist Researcher Petrobras R&D Center (CENPES), Rio de Janeiro, Brazil
July 1987 to December 2000

Development Geologist Petrobras SA E&P Department, Rio de Janeiro, Brazil
January 1985 to July 1987
PUBLICATIONS (5 most recent)


Christina L. Belanger, Ph.D
Assistant Professor, Department of Geology and Geophysics, Texas A&M University
Halbouty Bld, 3115 TAMU, 611 Ross St, College Station, TX 77843, Christina.Belanger@tamu.edu

Ph.D 2011 University of Chicago, Geophysical Sciences
B.A. 2005 University of California, Santa Barbara Creative Studies (Biology)

Research Interests
Paleoecology, paleoenvironments, biotic responses to climate change, invertebrates, microfossils

Experience
2017-present Assistant Professor, Department of Geology & Geophysics, Texas A&M University
2012-2017 Assistant Professor, Department of Geology & Geological Engineering, SDSM&T
2012-2017 Curator of Microfossils, Museum of Geology, SDSM&T
2011-2012 Lecturer, Lake Forest College, Department of Environmental Studies
2011-2012 Research Professional, University of Chicago, Department of Geophysical Sciences

Research Grants History
Collaborative Research: Distinguishing the drivers of benthic foraminiferal faunal change to improve mechanistic interpretations of abrupt hypoxic events in the North Pacific, $479,338 total, NSF-P2C2 (September 2015-August 2018) – P.I. Belanger, Co-PI Mix (Oregon State University)
Curation and Digitization of Newly Acquired Modern and Fossil Invertebrate and Protist Research Collections at the SDSM&T Museum of Geology, $499,887, NSF-DBI Collections in Support of Biological Research (awarded 2014) – P.I. Anderson, Co-P.I.s Belanger, Pagnac, Shelton
Dynamics and drivers of faunal changes in relation to productivity and oxygenation through glacial-interglacial cycles, $14,981, COL-NSF-IODP-USSP (awarded 2014) – P.I. Belanger

Awards/Honors
NSF Graduate Research Fellowship, $120,000 (awarded 2005)

5 most recent papers (*=student co-author)
EDUCATION

Ph.D.  Geology, The Australian National University, Canberra, Australia, 1982
M.Sc. (Hons) Panjab University, Chandigarh (India), 1972
National Merit Scholar
B.Sc. (Hons) Panjab University, Chandigarh (India), 1971

EXPERIENCE

Executive Professor & Director, Berg-Hughes Center for Petroleum and Sedimentary Systems
Department of Geology and Geophysics, Texas A&M University, College Station, TX
March 2017 to present

Vice President Winsdor Oil & Gas Consultants, Houston
March 2016- March 2017

Senior Manager Field Studies, BHP Billiton Petroleum, Houston
January 2013 to March 2016

Head of Production Geoscience Function, BHP Billiton Petroleum, Houston
January 2011 to December 2012

Manager Geosciences, Gulf of Mexico Production Unit, BHP Billiton Petroleum
January 2008 to December 2010

Subsurface Manager, Neptune Development, GOM
January 2005 to December 2007

Team Lead, GOM Appraisal and Development Planning, BHP Billiton Petroleum
September 1999 to December, 2004
Subsurface Team Lead, BHP Petroleum Billiton,
Timor Sea, Bass Strait, NW Shelf
Senior Geologist/ Planner, AGL Petroleum
September 1986 to October 1989
Senior Geologist/ Planner, Elf Aquitaine Petroleum
February 1982 to March 1986
RESEARCH INTERESTS
Upstream Oil & Gas
Reservoir Characterization
Field Development
Reservoir Modeling
Unconventional Resource Development
Deepwater Developments
Reserves and Uncertainty Analysis

AWARDS AND DISTINCTIONS
Dan A. Hughes ’51 Chair
Dudley J. Hughes Endowment Chair

PUBLICATIONS

• Reece, D., Chow, Y.S., Currie, J., Bhatia, M., Bayu-Undan Field: Appraisal and Development Planning: SPE 38064, 401-414, 1997
• Bhatia, M. - Plate Tectonics and Geochemical Composition of Sandstones. Journal of Geology, v 91, 611-627, 1983

SYNERGISTIC ACTIVITIES

• Invited by Bureau of Economic Geology, UT Austin to give a special talk on Unconventional Resource Development: Industry’s Challenges and Progress, August 2016
• Organizer for SPE Workshop on Field Development in Bali
• Referee for technical papers for Elsevier Geoscience Journals:
  - Sedimentary Geology, Chemical Geology, Paleoecology and Precambrian Geology
• Lead Recruiter for Graduates and Interns for University of Oklahoma
• Organizer of Unconventional Geoscience Forum Series in BHPB
Thomas A. BLASINGAME  
Professor  
Department of Petroleum Engineering/Geology and Geophysics  
Texas A&M University | College Station, TX 77843-3116  
PH: (979) 845-2292 | FAX: (979) 845-7142 | e-mail: t-blasingame@tamu.edu

EDUCATION

RESEARCH INTERESTS
Reservoir Engineering:
- Integration of formation evaluation data — core, well log, and reservoir performance data.  
- Material balance methods (e.g., new approaches for abnormally (high and low) pressured gas reservoirs).  
- Correlations for rock properties.  
- Correlations for hydrocarbon fluid properties.  
- Development of analytical solutions for modeling the flow of single/multiphase fluids in porous media.

Well Testing/Analysis of Reservoir Performance:
- Pressure transient analysis and production data analysis using the pressure integral technique.  
- Semi-analytical methods for modeling wellbore storage behavior in pressure transient test data.  
- Estimation of recoverable reserves using production data (empirical and semi-analytical methods).  
- Deconvolution of well test and production data.  
- Model-based analysis of production data: (many of these developments are implemented by commercial vendors)  
- Development of software for the analysis, interpretation, and modeling of well test and production data.

Unconventional Reservoirs: (Ultra-low permeability sands/shales):
- Diagnostic analysis of time-rate production data (i.e., the $q_{Db}$-plot).  
- The "Continuous EUR" methodology (EUR = $f(t)$).  
- The "Power-Law Exponential" time-rate (decline curve analysis) model (as well as several related time-rate models).  
- Rate-Time-Pressure Analysis for Unconventional Reservoir Systems: (collaborations with students/colleagues)  
- Modeling of Ultra-Low Permeability Reservoirs: (collaborations with students/colleagues)

Highlighted Technical Contributions:
- Material Balance Decline Type Curve Analysis (also known as "Rate Transient Analysis" (or RTA))  
- Pressure Integral and "Beta" Derivative Functions  
- Time-Rate (Decline Curve) Analysis Relations for Unconventional Reservoirs  
- Analysis of Water-Oil-Ratio (WOR) Behavior using Production Data  
- Diagnostic Analysis of Time-Rate Data (i.e., the $q_{Db}$-plot)  
- Correlations for Rock and Hydrocarbon Fluid Properties  
[global standard]  
[led to several PTA and RTA methodologies]  
[global standard]  
[theory-based approach for an empirical problem]  
[recent development — expected to become a global standard]  
[Hg permeability & gas density/viscosity relations are global standards]

EXPERIENCE
2005:  Professor  Department of Petroleum Eng.  Texas A&M U.  (College Station, TX)  
1991 - 2005:  Associate Professor  Department of Petroleum Eng.  Texas A&M U.  (College Station, TX)  
1991 - 1996:  Assistant Professor  Department of Petroleum Eng.  Texas A&M U.  (College Station, TX)  
1989 - 1990:  Research Associate  Department of Petroleum Eng.  Texas A&M U.  (College Station, TX)  
1984 - 1989:  Graduate Assistant  Department of Petroleum Eng.  Texas A&M U.  (College Station, TX)

COMPETITIVE GRANTS AND AWARDS RECEIVED
Externally Funded Research Projects:
- (THECB) Reservoir Performance Using Acid Fracturing — Clear Fork Formation  
- (SLERO) Well Stimulation: Fracture Cleanup in Oil and Gas Wells  
- (DOE Class II) Appl. of Integrated Res. Mgmt. and Res. Char. to Optimize Infill Drilling  
- (Mobil Tech) Gas Condensate Reservoir Performance Analysis  
- (Anadarko) Program for Production-Based Reservoir Characterization and Development  
- (GPRI consortia) Risk Assessment for Current Multilateral Well Systems  
- (GPRI consortia) Advanced Casing Lateral Juncture Technologies for Multilateral Wells  
- (DOE/U. Alabama) Improved Oil Recovery from Upper Jurassic Smackover Carbonates  
- (DOE/U. Alabama) Integrated Geologic-Engineering Model (Smackover Formation)  
- (Anadarko) Semi-Analytical Est. of Permeability Obtained from Capillary Pressure  
- (Apache) Klinkenberg-Correction for Low Permeability Sandstones  
- (ExxonMobil) Reservoir Characterization of the Cerro-Negro Field (Venezuela)  
- (RPESEA/DOE) New Albany Shale Gas  
- (RPESEA/DOE) A Self-Teaching Expert System for Gas Production from Shales  
- (RPESEA/DOE) Flow-Geo-Mechanical-Geophysical-Geochemical Analysis of Tight Gas Production  
- (Shell-Canada) Well Performance Analysis for Tight Gas Sands and Gas Shales in the Digital Age  
- (ENI/US GOM) Quantitative Assessment of Formation Compaction Issues for GOM Reservoirs
COMPETITIVE GRANTS AND AWARDS RECEIVED (Continued)

Internally Funded Research Projects:

- (ERP/TAMU) Wireless Power Transmission For Smart Well Applications 1998-1999  (USD 25,000)
- (Crisman/TAMU) Eval. of Strategies Low-Viscosity Liquids from Tight/Shale Reservoirs 2012-2015  (USD 105,925)
- (Crisman/TAMU) 3D Anls/Mdlg of the Transport of Proppants in Inclined/Sharply-Angled Fractures 2016-2017  (USD 55,140)
- (Crisman/TAMU) Model Validation of Decline Curve Analysis for Unconventional Reservoirs 2016-2017  (USD 55,140)

AWARDS AND DISTINCTIONS

- 2015-2018 SPE Technical Director for Reservoir Description and Dynamics, Society of Petroleum Engineers (SPE).
- 2015 SPE Honorary Member (SPE's highest honor), Society of Petroleum Engineers (SPE).
- 2014 SPE Distinguished Achievement Award for Petroleum Engineering Faculty, Society of Petroleum Engineers (SPE).
- 2013 SPE DeGolyer Distinguished Service Medal, Society of Petroleum Engineers (SPE).
- 2012 SPE Lucas Award (SPE's preeminent technical award), Society of Petroleum Engineers (SPE).
- 2007 Charles W. Crawford Service Award — College of Engineering/Texas A&M University.
- 2006 Distinguished Achievement (Teaching) Award, Association of Former Students — Texas A&M University.
- 2006 SPE Uren Award (for technology contributions before age 45), Society of Petroleum Engineers (SPE).
- 2005 SPE Distinguished Lecturer (Performance-Based Reservoir Characterization), Soc. of Petroleum Engineers (SPE).
- 2005 SPE Distinguished Service Award, Society of Petroleum Engineers (SPE).
- 2004 John J. Koldus Faculty/Staff Achievement Award — Texas A&M University.
- 2004 "Fish Camp" Blasingame (University freshmen orientation group) — Texas A&M University.
- 2000 Distinguished Member, Society of Petroleum Engineers (SPE).
- 1997 Jerry Davis Faculty Fellow, College of Engineering — Texas A&M University.
- 1986 Graduate Student Teaching Award, Association of Former Students — Texas A&M University.

PUBLICATIONS (5 most recent) *Denotes Student

FREDERICK M. CHESTER  
Professor of Geology & Geophysics  
Director of the Center for Tectonophysics  
Holder of the David Bullock Harris Chair in Geology  
Texas A&M University, College Station, TX  77843-3115  
chesterf@tamu.edu

Education

B.A. Geology with Geophysics Option (1980) University of California at Santa Barbara.

Research Interests

Experimental Rock Mechanics, Structural Geology, Ocean Drilling Sciences, and Tectonophysics.

Academic Employment History

2002–present  Professor of Geology & Geophysics, Texas A&M University.  
1997–2002  Associate Professor of Geology & Geophysics, Texas A&M University.  
1994–1996  Associate Professor of Geophysics, Saint Louis University.  
1990–1994  Assistant Professor of Geophysics, Saint Louis University.  

Research Grants and Contracts (While at TAMU, partial list)

Collaborative Research: Linking Salt Rock Deformation Regimes and Microstructure Organization, NSF, CMMI-1361996, Co-PI C. Arson (Georgia Tech), J.S. Chester, F.M. Chester, $399,581 (total), $199,458 (TAMU), 9/14 - 8/18.  
Geomechanics Study of Heterogeneous Carbonate Formation in Tazhong, Tarim Field, Ideal Oil & Gas, M1601135, Co-PI D. Zhu (PETE), F.M. Chester, J. Kim (PETE), N. Morita, $300,000, 1/16 - 6/17.  
Use of drilling data to constrain stress state and sediment strength, Post-expedition funding for IODP Expedition 343, Consortium for Ocean Leadership, PI F.M. Chester, $14,026, 1/13 –2/14.  
Off-fault Damage and Fault Zone Complexity of the San Gabriel Fault: A Unique Opportunity to Study New Exposures Following the Station Fire, Southern California Earthquake Center, SCEC-, Co-PI J.S. Chester and F.M. Chester, $21,000, 2/10 - 1/12.  
Frictional Strength and Microstructures of SAFOD Gouge Sheared at Coseismic and Aseismic Creep Rates, Southern California Earthquake Center, SCEC-, Co-PI J.S. Chester and F.M. Chester, $21,887, 2/08 - 1/12.  
Collaborative Research: Influence of Structure, Composition and Fluid-Rock Chemistry on Mode of Slip in the San Andreas Fault Zone at SAFOD, NSF, EAR-0643339, Co-PI J.S. Chester, F.M.
Chester, J.P. Evans (Utah State Univ.), D. Kirschner (Saint Louis Univ.), $399,021 total, $201,398 to TAMU, 6/07 - 5/12.

Geologic Constraints on Fracture Energy of the San Andreas Fault, NSF, EAR-0510892, Co-PI J.S. Chester and F.M. Chester, $303,094, 7/05 - 6/11.

Collaborative Research: Structural-Petrologic Characterization of the San Andreas Fault Zone in the SAFOD Drill Holes, NSF, EAR-0454525, Co-PI J.S. Chester, F.M. Chester, J.P. Evans (Utah State Univ.), and D. Kirschner, (Saint Louis Univ.), $244,975 total, $119,982 to TAMU, 6/05–5/08.

Experimental and Petrofabric Study of Hybrid Fractures and the Transition from Joints to Faults, NSF, EAR-0310284, Co-PI F.M. Chester and J.S. Chester (TAMU), $299,546, 6/03 - 5/06.


Fault Structure and Permeability in Sandstone-Shale Sequences, American Chemical Society PRF, Co-PI F.M. Chester and J.L. Jensen (Petroleum Engineering), $60,000, 6/01-8/03.


Awards and Distinctions

2013 Ocean Leadership IODP Distinguished Lecturer.
2010–2019 David Bullock Harris Chair in Geology, Texas A&M University.
2001 Texas A&M University Faculty Fellow.
1993 Saint Louis University Graduate School Research Committee Grantsmanship Award.
1980 Outstanding Graduating Senior in the Geological Sciences, University of California at Santa Barbara.

Publications (5 most recent, *denotes student)


Judith S. Chester  
Professor  
Department of Geology and Geophysics,  
Texas A&M University, College Station, TX 77843-3115  
PH: (979) 845-1380; FAX: (979) 845-6162;  
e-mail: chesterj@tamu.edu

EDUCATION
Ph.D. (1992), Geology, Texas A&M University  
M.S. (1985), Geology, Texas A&M University  
B.S. (1979), Earth and Space Sciences, UCLA

RESEARCH INTERESTS  
Structural Geology and Rock Mechanics

EXPERIENCE
Professor, Texas A&M University, College Station, TX, September 2011 to present  
Associate Professor, Texas A&M University, College Station, TX, July 2004 to August 2011  
Assistant Professor, Texas A&M University, College Station, TX, Sept. 2001 to July 2004  
Senior Lecturer & Lecturer, Texas A&M University, College Station, TX, Jan. 1997 - 2001  
Assistant Professor, Saint Louis University, Saint Louis, MO, 1992 to 2006  
Adjunct Instructor, Saint Louis University, Saint Louis, MO, 1989 to 1991  
Teaching Assistant, Texas A&M University, College Station, TX, 1985-1989, 1981-1983  

COMPETITIVE GRANTS AND AWARDS RECEIVED (Only selected grants included)
Experimental Investigation of Multi-Scale Flash Weakening, Southern California Earthquake Center (SCEC) #17253, PIs: F. Chester, J. Chester, $25,000, 5/17-4/18.  
Quantifying Active Deformation through San Gorgonio Pass on the Northern Strands of the SAF-2, SCEC #16263, Pls: J. Chester, Oskin (UC Davis), $50,000 total, $15,000 TAMU, 2/16-1/17.  
Quantifying Active Deformation through San Gorgonio Pass on the Northern Strands of the SAF, SCEC #15202, Pls: J. Chester, Oskin (UC Davis), $49,000 total, $18,000 TAMU, 2/15-1/17.  
Basement Deformation in the SGP, SCEC #14135, Pls J. Chester & M. Oskin (UC Davis), $50,000 total, $15,000 (TAMU), 5/14-4/15.  
Off-fault Damage and Fault Zone Complexity of the San Gabriel Fault: A Unique Opportunity to Study New Exposures, SCEC #10199, Pls, J. Chester, F. Chester, $21,000, 3/10-1/12.  
Characterization of Pulverized Granitoids in the Little Rock Core Along the SAF, SCEC#08123, Pls: T. Rockwell (SDSU), Y. Ben-Zion (USC), J. Chester, $86,000 total, $12,194 TAMU, 02/08-1/12.  
Frictional Strength and Microstructures of SAFOD Gouge Sheared at Coseismic and Aseismic Creep Rates, SCEC #08180, Pls: J. Chester, F. Chester, $22,000, 02/08-1/12.  
Investigation of Weakening Mechanisms in High-speed Experimental and Natural Slip-surfaces, SCEC #07186, Pls: J. Chester, F. Chester, $19,462, 10/07-1/09.
Collaborative Res.: Influence of Structure, Composition and Fluid-rock Chemistry on Mode of Slip in the SAF Zone at SAFOD, NSF EAR-064333, PIs J. Chester, F. Chester, with J. Evans (Utah St. Univ.), D. Kirschner (Saint Louis Univ.), $399,021 total, $201,398 TAMU, 6/07-5/11.

Collaborative Res.: Structural-Petrologic Characterization of the SAF Zone in the SAFOD Drill Holes, NSF EAR-0454525; PIs J.S. Chester, F.M. Chester, with J. Evans (Utah St. Univ.), D. Kirschner (Saint Louis Univ.), $244,975 total, $119,982 TAMU, 6/05-5/08.


Experimental and Petrofabric Study of Hybrid Fractures and the Transition from Joints to Faults, NSF, EAR-0310284; PIs F.M. Chester and J.S. Chester, $299,546, 6/03-5/06.

Structure and Petrology of the Kern Canyon Fault, California: A Deeply Exhumed Strike-slip Fault, USGS 00HQGR0029 & 01HQGR0056, PI J. Chester, $113,407, 2/00-6/04.

Fluid-assisted Compaction and Deformation of Reservoir Lithologies, DOE DE-FG03-98ER14887; PIs F. Chester, J. Chester, A. Kronenberg, and A. Hajash; $602,586, 8/98-1/03.

AWARDS AND DISTINCTIONS
Vice Chair of the Science Planning Committee, Southern CA. Earthquake Center (SCEC), 2014-present
Manager, NSF-EarthScope SAFOD Office for Physical Samples, 2013-present
Member, DEFORM Executive Committee, 2013-2016
Member, AGU Mineral and Rock Physics (MRP) Executive Committee, 2010-2016
Member, Board of Directors, Southern California Earthquake Center, 2012-2014
Chair, AGU Physical Properties of Earth Materials (PPEM) Steering Committee, 2010-2013
Leader, Fault and Rupture Mechanics Interdisciplinary Focus Group, SCEC, 2006-2012
American Rock Mechanics Association Award for Research, 2009
NSF EarthScope Speaker, 2008-2009
Co-Leader, Fault and Rock Mechanics Interdisciplinary Focus Group, SCEC, 2004-2006
El Paso Energy Foundation Faculty Achievement Award, College of Geosciences, Texas A&M. 2003
Montague-Center for Teaching Excellence Scholar, Texas A&M University, 2002-2003
Distinguished Graduate Assistant-Research Award, Association of Former Students, Texas A&M, 1986
Exxon Teaching Fellow, College of Geosciences, Texas A&M University, 1985-1986
Best Student Paper, South-Central Section Geological Society of America, 1983
Outstanding Student Award, Houston Geological Society, 1983
Distinguished Graduate Assistant-Teaching Award, Association of Former Students, Texas A&M, 1982
Summer Field Scholarship, University of California at Los Angeles, 1979

PUBLICATIONS (5 of most recent) *Denotes Student
Saugata Datta  
Professor, Michel T Halbouty Visiting Chair  
Department of Geology and Geophysics  

Research Specialty: Aqueous Geochemistry and Chemical Hydrogeology  
Texas A&M University  
College Station, TX 77843-3115  
PH: (979) 458-3875; FAX: (979) 845-6162  
e-mail: sdatta1511@exchange.tamu.edu

EDUCATION

Ph.D. (2001), Earth Sciences, University of Western Ontario, London, Ont, Canada, Advisor: W.S. Fyfe  
M. S. (1996), Geological Sciences and Geological Engineering, Queens University, Ont, Canada  
Advisors: Kurt Kyser and Thomas Pearce  
M.S. (1995), Geology, University of Calcutta, India, Advisor: Chitta Bhattacharya  
B. S. (1993), Geological Sciences, Presidency College, Calcutta, India

EXPERIENCE

Visiting Halbouty Chair, Professor, Department of Geology and Geophysics, Texas A&M University,  
College Station, TX  
July 2017 to present

Professor, Chemical Hydrogeology, Geochemistry, Department of Geology, Kansas State University,  
Manhattan, Kansas  
September 2016 to present

Associate Professor, Low Temperature Geochemistry and Hydrogeology, Kansas State University,  
Manhattan, Kansas  
August 2012 to August 2016

Assistant Professor, Department of Geology, Kansas State University, Manhattan, Kansas  
August 2008 to July 2012

Assistant Professor, Department of Biology and Environmental Sciences, Program Director of  
Environmental Science Major-Minor, Georgia College and State University, Milledgeville,  
Georgia  
August 2004 to July 2008

Associate Professor/Reader, Department of Geology, University of Calcutta, India  
May 2005 to July 2006

Columbia Earth Institute Research Scientist and Mellon Scholar,  
Lamont Doherty Earth Observatory of Columbia University, New York  
September 2001 to July 2004

NIEHS/USEPA Superfund Basic Research Program: Health effects and Geochemistry of Arsenic  
and Lead: Arsenic mobilization in soils and groundwater of Bangladesh, Winthrop-Maine and  
Vineland-New Jersey.  
Postdoctoral Advisors: Martin Stute, Yan Zheng and Peter Schlosser

COMPETITIVE GRANTS AND AWARDS RECEIVED

>$1.74 M raised (in LAST 6 years) in competitive FEDERAL grants only. (Source: NSF, DOE, NASA,  
BLM, EPSCoR, USDA); Other Award Amounts are not mentioned/included here.

AWARDS AND DISTINCTIONS

2nd Vice Chair, 1st Vice Chair, Chair and Past Chair: of Division of Geology and Health, Geological  
Society of America, 2012-2016
Chair, Division of Geology and Health, Geological Society of America, 2017-2019, 2nd Term
Kansas State University- Big 12 Faculty Fellow Award 2015
Faculty Research Award, Georgia College and State University, 2006, 2007
Asiatic Society of India Medal, Professor Nirmal Nath Chatterjee Medal, for creative contribution to the knowledge of Economic Geology, 2006
Graduate Teaching Assistant Award for excellence in teaching, Faculty of Graduate Studies & Society of Graduate Students, University of Western Ontario (2000).
Robert and Ruth Lumsden Fellowship in Science, University of Western Ontario. (2000)
Arcangelo Rea Family Foundation Graduate Scholarship, University of Western Ontario. (1998-2001)
Queen’s Graduate Award (School of Graduate Studies and Research, Queen’s University, Canada) (1996-1997)
First Class First Award in order of merit, Master of Science, University of Calcutta, India (1996)
N.N. Chatterjee Memorial Grant, for First Position in M.Sc. Part I Examination in Geology, University of Calcutta., offered by The Geological, Mining and Metallurgical Society of India (1995)

PUBLICATIONS
41 Refereed Journal Articles/Book Chapters (in last 9 years)
5 Conference Proceedings

5 most recent Publications:


ABSTRACTS
Over 175 abstracts submitted for a variety of national and international conferences with students as co-authors (since 2009)

GRADUATE STUDENTS SUPERVISED
26 M.S. Students, 2 Ph.D. Candidates, 3 Postdoctoral Scholars
**Benchun Duan**
Associate Professor
Seismology and Geomechanics
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (979) 845-3297; FAX: (979) 845-6162
e-mail: bduan@tamu.edu

**EDUCATION**

Ph.D. (2006), Geological Sciences, University of California, Riverside, Advisor: David D. Oglesby
M. S. (1994), Geophysics, Ocean University of China
B. S. (1991), Geophysics, Ocean University of China

**RESEARCH INTERESTS**

My current research focuses on three main scientific topics:
1) Earthquake source physics, in particular
   a) Dynamic rupture modeling on geometrically complex faults to understand how observable fault geometry may control co-seismic earthquake ruptures and thus the maximum size of earthquakes on a given fault system, which is an utmost important parameter in seismic hazard analysis.
   b) Earthquake cycle simulation of subduction zones and large-scale strike-slip faults to understand how earthquakes of different sizes on a fault system interact with one another.
2) Strong ground motion simulations using dynamic earthquake source characterization and parallel computing to assess ground shaking hazards from future earthquakes in earthquake-prone regions.
3) Geomechanical modeling of subsurface processes, in particular
   a) Microseismicity generation mechanisms during hydraulic fracturing in unconventional reservoirs.
   b) Induced earthquakes due to wastewater injections in unconventional reservoir development.
To address the above scientific questions, I also develop needed techniques, mainly numerical tools:
4) Dynamic finite element methods for simulating dynamic rupture and seismic wave propagation.
5) Earthquake simulators for realistically complex fault systems to integrate the quasi-static processes and the dynamic process for earthquake cycle simulations.
6) Coupling fluid flow models and dynamic rupture models for fluid injection related problems.
7) Parallel computing using MPI and OpenMP.

**EXPERIENCE**

**Associate Professor**, Dept. of Geology & Geophysics, Texas A&M University, College Station, TX
September 2013 to present

**Assistant Professor**, Dept. of Geology & Geophysics, Texas A&M University, College Station, TX
August 2007 to August 2013

**Post-Doctoral Researcher**, Dept. of Geological Sciences, San Diego State University, San Diego, CA
July 2006 to July 2007. Advisor: Steven M. Day

Researcher and Lecturer, Ocean University of China
July 1994 to August 2001
COMPETITIVE GRANTS AND AWARDS RECEIVED
National Science Foundation Grant EAR-1254573 (NSF-Career), 2013-2018, $600,000
National Science Foundation Grant EAR-1524743, 2015-2018, $165,739
National Science Foundation Grant EAR-1049834, 2011-2015, $203,090
National Science Foundation Grant EAR-1015597, 2010-2013, $126,000
National Science Foundation Grant EAR-0809571, 2008-2010, $75,000
United States Geological Survey NEHRP Grant 08HQGR0048, 2008-2010, $68,545
Southern California Earthquake Center (NSF/USGS funded) Grants, 2008-present, $343,500

AWARDS AND DISTINCTIONS
NSF Early Career Award, 2013
The Francesco Pailo di Gangji/Heep Endowed Professor in Theoretical Geophysics, College of Geosciences, Texas A&M University, 2017
Distinguished Achievement Award for Faculty Research, College of Geosciences, Texas A&M University, 2010
MiniGrant for graduate students presenting results based on original research in professional conferences, University of California, Riverside, 2003.
Science and Technology Achievement Awards (2), Ocean University of China, 1998
Outstanding Paper Award, Ocean University of China, 1995
Science and Technology Achievement Award, Ocean University of China, 1993

PUBLICATIONS (5 most recent) *Denotes Student


EDUCATION

M. Ss. (1987), Physics, York University (Canada), Advisor: W.R. Frisken
B. Sc. (1985), Physics, York University (Canada)

RESEARCH INTERESTS

near-surface applied geophysics; environmental site characterization, controlled-source
electromagnetic induction; geomagnetic induction and mantle structure; ground-penetrating
radar; magnetics; marine electromagnetics; resistivity and induced polarization;
archaeological prospecting; hydrogeophysics; nonlinear deterministic inverse problems;
enGINEERING GEOPHYSICS; inductive reasoning; time series analysis

EXPERIENCE

Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
January 2003 to present

Associate Professor Texas A&M University, College Station, TX
September 1997 to August 2003

Assistant Professor, Texas A&M University, College Station, TX
September 1995 to August 1997

Visiting Professor, Dept. of Geotechnology, Khon Kaen University, Thailand
Summer 2014

Visiting Professor, Institut fur Geophysik, ETH Zurich, Switzerland
Summer-Fall 2010

Post-doctoral Researcher, University of Cambridge, U.K.
January 1993 to December 1994, Advisor: A. Schultz

Post-doctoral Researcher, Scripps Institution of Oceanography, UCSD
COMPETITIVE GRANTS AND AWARDS RECEIVED
City College of New York 2015 M1502984 $11,069.
National Science Foundation (Hydrology) 2010 M1000382 $150,854.
American Battle Monuments Commission 2007 4847110000 $69,000.
Texas Commission on Environmental Quality 2004 C05-00197 $3,900.
Texas Advanced Technology Program 2002 0000160105 $276,050.
National Science Foundation (Geophysics) 2001 4507610000 $59,273.
National Science Foundation (Geophysics) 2001 4507610000 (suppl) $14,882.
National Science Foundation (Marine Geol. Geophys.) 2001 4509210000 $53,446.
National Science Foundation (EAR Instr. and Fac.) 2000 4485510000 $110,838.

AWARDS AND DISTINCTIONS
co-Editor-in-Chief 2017-present Journal of Applied Geophysics
Editorial Board 1999-2013 Geophysics
Howard Karren Endowed Professor 2010-present Texas A&M University
Royal Astronomical Society, Fellow
State of Texas Professional Geoscientist #5141

PUBLICATIONS (5 most recent) *Denotes Student

*Knicley, J., Everett, M.E., and Sparks, D.W., 2017, Magnetic anomalies on Io and their relationship
to the spatial distribution of volcanic centers: Physics of the Earth and Planetary Interiors, v. 269,
p. 133-147.

Chave, A.D., Everett, M.E., Mattsson, J., Boon, J. and Midgely, J., 2017, On the physics of frequency
domain controlled source electromagnetics in shallow water, I: isotropic conductivity: Geophysical

electrical conductivity from low-frequency, controlled-source electromagnetic responses:

tidal and seasonal effects on barrier island hydrogeology: testing the utility of portable multi-

*Ge, J., Everett, M.E., and Weiss, C.J., 2015, Fractional diffusion analysis of the electromagnetic field
Ryan C. Ewing  
Associate Professor  
Process Sedimentology and Planetary Geology  
Department of Geology and Geophysics,  
Texas A&M University  
College Station, TX, 77843-3115  
PH: 979-845-2089  
email: rce@tamu.edu

EDUCATION

PhD (2009) Geology, University Of Texas at Austin, Advisor: G. Kocurek  
M.S. (2004) Geology, University Of Texas at Austin, Advisor: G. Kocurek  

RESEARCH INTERESTS

1) Modern eolian (wind-blown) systems. Assessing desert sand dunes dynamics through a process-based framework requires integrating fieldwork, modeling, and remote sensing using high-resolution images and topographic datasets. Applications include climatic and environmental change, hazard mitigation, oil and gas resources.

2) Earth history of the eolian stratigraphic record. Constraining the role of atmospheric dynamics during major climate shifts in Earth’s history, and determining how sediments disperse by wind, requires interrogating the eolian rock record using geochemical datasets, and process-based analyses. Applications include paleoclimate, paleoenvironment, oil and gas resources.

3) Planetary eolian systems. Determining the modern and ancient wind-blown histories of Mars and Titan requires evaluating sand dunes within boundary conditions (e.g., gravity, atmospheric density) outside the range of those found on Earth using remote sensing. Applications include robotic and manned space exploration.

EXPERIENCE

Associate Professor, Geology and Geophysics, Texas A&M University, 2016 - present  
Assistant Professor, Geology and Geophysics, Texas A&M University, 2013 -2016  
Assistant Professor, Geological Sciences, University of Alabama, 2011-2013  
Postdoctoral Scholar, Geological and Planetary Sciences, California Institute of Technology, 2010-2011, (part of NSF Postdoctoral Fellowship)  
Postdoctoral Fellow, Geosciences, Princeton University, 2009-2010 (part of NSF Postdoctoral Fellowship)

SELECTED COMPETITIVE GRANTS AND AWARDS RECEIVED

(Co-I) NASA, MDAP, NNX16AJ43G, 2016-2019, award to Co-I, $65,554  
(PI) National Parks Service, 2014-2017, $99,000
SELECTED RECENT PUBLICATIONS


EDUCATION
Ph.D. (2008), Geoscience, The Pennsylvania State University
B.S. (2001), Earth and Atmospheric Sciences, Georgia Institute for Technology
A.S. (1999), Science, Young Harris College

RESEARCH INTERESTS
Earthquake Physics, Hydrogeology, Thermal Geophysics

Dr. Fulton’s research interests are related to hydrologic and thermal processes within fault zones and how these processes either control fault slip behavior or provide insightful signatures within fault rocks and borehole and geophysical observations.

Much of the work his group does incorporates field and laboratory data, including innovative new borehole monitoring techniques, along with careful signal processing, quantitative analysis, and numerical modeling. This science often combines aspects of hydrogeology, geophysics, and rock mechanics.

Ongoing projects involve scientific ocean drilling with the International Ocean Discovery Program (IODP) and the design, installation, and monitoring of subseaflor observatories in the Japan Trench and Hikurangi (New Zealand) subduction zones. Other study areas involve on-land observations from New Zealand, the San Andreas Fault in California, and the Cascadia Subduction Zone in the Pacific Northwest of North America.

EXPERIENCE
Assistant Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
January 2016 to present

Assistant Researcher, Department of Earth and Planetary Sciences, University of California Santa Cruz, Santa Cruz, CA
October 2012 to January 2016

Research Scientist Associate V, University of Texas Institute for Geophysics (UTIG), The University of Texas at Austin, Austin, TX
March 2012 to October 2012

UTIG Postdoctoral Research Fellow, University of Texas Institute for Geophysics (UTIG), The University of Texas at Austin, Austin, TX
September 2010 to March 2012

Postdoctoral Research Scientist, College of Oceanographic and Atmospheric Sciences, Oregon State University, Corvallis, OR
August 2010 to September 2012
COMPETITIVE GRANTS AND AWARDS RECEIVED
Southern California Earthquake Center Award #17245, (Co-PI with H. Kitajima) 2017-2018 $24,000
National Science Foundation Grant OCE-1649977, 2016-2020 $126,662
National Science Foundation Grant OCE-1458947, 2015-2016 $79,959
Gordon and Betty Moore Foundation (PI Emily Brodsky) 2012-2015 $757,856
Consortium for Ocean Leadership, IODP US Science Support Program, 2012 $8,668
Consortium for Ocean Leadership, IODP US Science Support Program, 2012 $22,003
IODP Management International, Inc., 2011-2012 $281,929
Consortium for Ocean Leadership, IODP US Science Support Program, 2010-2011 $24,003

AWARDS AND DISTINCTIONS
Editor’s Citation for Excellence in Refereeing for Geophysical Research Letters, 2015
Jason Morgan Early Career Award, American Geophysical Union Tectonophysics Section, 2014
Consortium for Ocean Leadership Distinguished Lecturer for IODP, 2014-2015
UTIG Postdoctoral Research Fellowship, University of Texas at Austin, 2010
Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellowship (declined offer), 2010
1st Prize Poster Presentation, Penn State Geosciences Grad Student Colloquium, 2008
Honorable Mention, Student Poster Competition, Earthscope National Meeting, 2007
ConocoPhillips Geopressures Fellowship, Penn State University, 2006
Editor’s Citation for Excellence in Refereeing for J. Geophys. Res. - Solid Earth, 2005
Best Oral Presentation Award, Univ. of Wyoming Graduate Student Symposium, 2004
Sigma Xi Undergraduate Research Excellence Award, Georgia Tech, 2002
Top graduating student in Earth & Atmospheric Sciences, Georgia Tech, 2001
Outstanding graduating student in College of Sciences, Georgia Tech, 2001
Rutt Bridges Undergraduate Research Fellowship, Georgia Tech, 2001
NSF REU for GCE-LTER research at Georgia Tech, 2001
NSF REU for SAGE research at Los Alamos National Lab, 2001, 2002
Georgia HOPE Scholar, full tuition scholarship, 1997-2001

PUBLICATIONS (5 most recent) *Denotes Student
Fulton, P.M., E.E. Brodsky (2016), In situ observations of earthquake-driven fluid pulses within the Japan Trench plate boundary fault zone, Geology, doi:10.1130/G38034.1
Li, H., L. Xue, E.E. Brodsky, J.J. Mori, P.M. Fulton, H. Wang, Y. Kano, K. Yun, R.N. Harris, Z. Gong, C. Li, J. Si, Z. Sun, J. Pei, Y. Zheng, and Z. Xu (2015), Long-term temperature records following the Mw 7.9 Wenchuan (China) earthquake are consistent with low friction, Geology, doi:10.1130/G35515.1
John R. Giardino  
Professor of Geology & Geophysics,  
Water Management and Hydrological Science  
Department of Geology and Geophysics  
Texas A&M University  
College Station, TX  77843-3115  
PH: (979) 845-3224; FAX: (979) 845-6162  
Email: rickg@tamu.edu

EDUCATION
Ph.D.  (1979), Geosciences, University of Nebraska  
M.A.  (1971), Geology and Geography, Arizona State University  
B.S.  (1969), Geology and Geography, Colorado State University

RESEARCH INTERESTS
My research focuses on these topics:  
Periglacial, fluvial and mass movement geomorphology  
Critical Zone Studies  
Engineering Geology

EXPERIENCE
Professor (joint appointments), Geology and Geophysics, Geography and Water Management and Hydrological Science, Texas A&M University, September 1989 to present: Hydrological Science, 2005 to present
Professor and Department Head, Department of Geology and Geophysics, Texas A&M University, September 2011 to August 2015
Dean of Graduate Studies, Texas A&M University, September 2000 to September 2007
Executive Director of Graduate Studies, Texas A&M University, June 1998 to September 2000
Associate Director, Office of Graduate Studies, Texas A&M University, April 1996 to June 1998
Department Head, Department of Geography, Texas A&M University, September 1989 to April 1996
Director of Cartographic Laboratory, Texas A&M University, September 1989 to April 1996
Editor, Engineering Geology Newsletter, Geological Society of American, September 1990 - September 1997
Graduate Advisor, Department of Geography, Texas A&M University, September 1988 to January 1991
Editorial Board: Geomorphology, AIMS Geosciences; Geology

COMPETITIVE GRANTS AND AWARDS RECEIVED
Texas Water Development Board, Sediment Budgets for the Sabine Watershed and Sabine River, 2011-2014, $45,000
Texas Water Development Board, Formation and Development of Meanders on the Brazos Rive, TX. 2009-2010, $40,000
Texas Water Development Board, Visualization Modeling using the IVC for Meander Development Processes, 2010, $35,000

AWARDS AND DISTINCTIONS
George H. Bush Excellence Award for Faculty in International Teaching, 2017
Distinguished Alumni Award, University of Southern Colorado, 2001
Awarded the Texas A&M Former Students Association University-Level Distinguished Teaching Award, 1996
Meritorious Service Award, Geological Society of America, 1995
Award for Support and Encouragement, Hispanic Graduate Student Association of Texas A&M University, 1995
National Council for Geographic Education Distinguished Teaching Award, 1995
Visiting Geographic Scientist, University of Wyoming Visiting Geographic Scientist Program, 1994
E. Guthrie Advisor Award Nominee, 1992
Almon Fellow, Hockaday School, Dallas, Texas, 1989
Awarded the Texas A&M Former Students Association, Distinguished Teaching Award, 1989
First Finalists, President’s Excellence in Teaching Award, Texas Tech University, 1983
Nominated for Mortar Board Award at Texas Tech University for Outstanding Teaching, 1982
One of two finalists for New Faculty Member Excellence in Teaching Award, Texas Tech University, 1982

PUBLICATIONS (5 most recent)
Jeon, Kyungho, Giardino, John R., Gonzalez, Bree K.J. (in press), Geomorphic characteristics of fens in the San Juan Mountains, Colorado, New Mexico Geological Society. 68th Annual Fall Field Conference Guidebook.

Gamache, Kevin R., Giardino, John R., Panshu, Zhao, and Harper, Rebecca (in press), Bivouacs of the Anthropocene: Urbanization, Landforms and Hazards in Mountainous Regions (chapter) Elsiever


EDUCATION

Ph.D. (1991), Geophysics, Massachusetts Institute of Technology, Advisor: M. Nafi Toksöz
B. S. (1985), Geophysics, Baylor University

RESEARCH INTERESTS
My research interests focus on three main topics:
1) Theoretical and numerical methods for study of seismic wave propagation in complex, heterogeneous media, including development of new, innovative computational approaches.
2) Application of global optimization methods to inversion problems in applied seismology, including borehole data and surface seismic data for reservoir characterization and regional crustal studies.
3) Development of rock physics models for fractured media, with current emphasis on microseismic data and characterization of hydraulic fracturing

EXPERIENCE
Professor and Associate Director Berg-Hughes Center for the Study of Sedimentary and Petroleum Systems, Texas A&M University, College Station, TX
September 2015 to present

Professor, Texas A&M University, College Station, TX
September 2013 to August 2015

Associate Professor, Texas A&M University, College Station, TX
September 2000 to August 2013

Assistant Professor, Texas A&M University, Pullman, WA
January 1997 to August 2000

Research Scientist, Earth Resources Laboratory, Massachusetts Institute of Technology
September 1994-December 1996

Post-doctoral Associate, Earth Resources Laboratory, Massachusetts Institute of Technology
September 1992-August 1996
Studied seismic imaging methods and 3-D wave propagation. Analyzed radiation from borehole seismic sources using crosshole data. Assisted in the development and writing of research proposals. Associated Faculty: M. Nafi Toksöz

Post-Doctoral Researcher, Université Joseph Fourier, Grenoble, France
September 1991-August 1992
Initiated research on the modeling of elastic waves from
borehole seismic sources. Studied the propagation of Lg waves in complex crustal models to understand anomalous extinction of these waves. Associated Faculty: Michel Bouchon

COMPETITIVE GRANTS AND AWARDS RECEIVED

Dept. of Energy Small Business Innovation Research, Phase I (P.I. Nafi Toksöz) 1995 $75,000
Dept. of Energy Small Business Innovation Research, Phase II (P.I. Nafi Toksöz) 1996-1998 $750,000
Gas Research Institute, Advanced Seismic Data Acquisition and Processing 1997-2000 $150,000
Texas Advanced Technology Program 1998-2000 $152,500
Texas A&M University Energy Resources Program (P.I: Mark Everett) 1999-2000 $16,220
National Science Foundation DUE-9981150 (P.I. Bruce Herbert) 2000-2001 $392,051
Department of Energy – National Energy Technology Lab (P.I: Duane MacVay) 2002-2003 $125,777
Dept. of Energy National Petroleum Technology Office. (P.I. Michael Batzle) 2002-2005 $265,789
Department of Energy Basic Energy Sciences (P.I. Akhil Datta-Gupta) 2006-2009 $429,261
National Science Foundation OAC-0081510 (2000-2005) $437,927
Department of Energy Basic Energy Sciences (P.I. Akhil Datta-Gupta) 2010-2013 $664,365
Department of Energy Basic Energy Sciences (P.I. Akhil Datta-Gupta) 2013-2016 $705,085
Texas A&M Energy Institute (2015-2016) $75,000
Texas A&M Energy Institute (P.I. Eduardo Gildin) $75,000

AWARDS AND DISTINCTIONS
Francesco Paulo di Gangi/Heep Professor in Theoretical Geophysics (2010-2016)
2006 Practice Award-The Decision Analysis Soc.of the Inst. for Operations Research and the Management Sciences
College-Level Distinguished Teaching Award, Texas A&M Association of Former Students (2004)
A.I. Levorsen Award, Gulf Coast Association of Geological Societies (2000) Best paper award
National Science Foundation Fellowship (1986-1990)
Phi Beta Kappa (1985)

PUBLICATIONS (5 most recent) *Denotes Student

ETHAN L. GROSSMAN
Professor and Michel T. Halbouty Chair in Geology,
Co-Director, Stable Isotope Geosciences Facility, College of Geosciences
Stable Isotope Geochemistry
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (979) 845-0637; FAX: (979) 845-6162
e-mail: e-grossman@tamu.edu

EDUCATION

Ph.D. (1982) Geochemistry, T-L. Ku, advisor, Univ. of Southern California
B.S. (1976) Geology—magna cum laude, SUNY at Albany

RESEARCH INTERESTS

My research interests focus on three main topics:
1) Stable and clumped isotope geochemistry of carbonate systems
2) Global change and paleoclimates of the Paleozoic and Cenozoic
3) Biogeochemistry and geomicrobiology of aquifer systems, including the origin and fate of methane

EXPERIENCE

Professor and Michael T. Halbouty Chair in Geology, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2010 to present

Acting Executive Associate Dean and Associate Dean for Research, College of Geosciences, Texas A&M University, College Station, TX
August 2007-August 2008

Acting Deputy Director of Science Services, Integrated Ocean Drilling Program (IODP)-US Implementing Organization (USIO), Texas A&M University, College Station, TX; June 2008 to August 2008

Mollie B. and Richard A. Williford Professor, Dept. of Geology & Geophysics, Texas A&M University, College Station, TX; 2002 to December 2010

Professor, Texas A&M University, College Station, TX, September 1994 to August 2002

Associate Professor, Texas A&M University, College Station, TX, September 1988 to August 1994

Associate Professor, Texas A&M University, College Station, TX, September 1988 to August 1988

Instructor (part-time), California State Univ. at Northridge, Dept. of Geosciences, Jan. 1981-May 1982

SELECT COMPETITIVE GRANTS AND AWARDS RECEIVED (total ≈ $4.4 million; $3.3 million as Project Director)

TAMUS Research Development Fund, Grossman et al., 8/2016-7/2020, $1,040,000 (SIGF $507,506).
National Science Foundation (EAR-1226918). Passey et al., 9/12-8/15, TAMU $71,048.
National Science Foundation (EAR-0821455). MRI, Marcantonio et al., 8/08-7/11, $450,000.
National Science Foundation (EAR-0643309). Thomas et al., 1/08-12/13, $290,801.
National Science Foundation (EAR-0524285). Grossman (subaward), 8/05-8/08, $35,000.
National Science Foundation (EAR-03152216). Grossman (subaward), 8/03-7/07, $50,194
National Science Foundation (EAR-0321278, MRI). Grossman, 8/03 - 7/05, $252,907.
National Science Foundation (EAR-0126311). Grossman et al. 1/02-12/05, $79,005 (TAMU).
National Science Foundation (EAR-0003596). Grossman and Hyde. 5/01-1/04, $80,400,
National Science Foundation (EAR-9316937). Grossman and Slowey, 8/94-7/96, $35,000.
National Science Foundation (EAR-9005030). Grossman and Yancey, 7/90-6/92, $110,000.
Texas Advanced Research Program (010366-086). Grossman and Ammerman, 1/90-12/91, $100,000.
National Science Foundation (EAR-8720886). Grossman and Yancey, 2/87-6/90, $98,000.
National Science Foundation (EAR-8511187). Grossman and Morse, 11/85-10/87, $75,482.
National Science Foundation (OCE-8111948). Ku (Grossman, co-investigator), 9/81-8/82, $42,000.
National Science Foundation (OCE-7815937). Ku (Grossman, co-investigator), 9/78-8/80, $62,888.

AWARDS AND DISTINCTIONS

2nd Place, Gordon I. Atwater Award for poster: Hendricks et al., 2012 GCAGS Convention, TX (2012)
Awarded Michel T. Halbouty Chair in Geology (2010, renewed in 2015)
Elected Fellow of the Geological Society of America (2007)
Dean's Distinguished Achievement Award for Faculty Research, College of Geosciences (2005)
Awarded Mollie B. and Richard A. Williford Professorship (2002-2010)

FIVE MOST RECENT PUBLICATIONS (total = 83) *Denotes Student

HEANEY, Michael J. III

Professor of Instruction
Department of Geology
Texas A&M University
College Station, Texas 77843
(979) 204-8454; e-mail: heaney@geos.tamu.edu

Education

Ph.D., Texas A&M University, College Station, TX, May 1998.

M.S., Bowling Green State University, Bowling Green, Ohio, 1985
Masters thesis: Bivalves (Mollusca) from the Imo Formation (Mississippian, Chesterian) of North-Central Arkansas.

B.S., St. Lawrence University, Canton, New York, 1982

Research Interests

Fossil Mollusca

Professional Experience

January 2015-Present, Professor of Instruction TAMU
2000 - Present Taught TAMU six-week Field Camp TX, NM, UT, MT, CO.
September 1998-Present, Technical Lab Coordinator

September 1998-January 2010, Taught Principles of Geology, Historical Geology, Evolution and Field Methods in Geology. Department of Geol. and Geop., Texas A&M University
College Station, TX 77843-3115

January -May 1998 Visiting Lecturer, Principles of Geology Department of Geol. and Geop. Texas A&M University College Station, Texas 77843-3115

August 1990; May 1997 Teaching Assistantship Department of Geol. & Geop. Texas A&M University College Station, Texas 77843-3115
Taught Introductory Geology Labs, Invertebrate Paleontology Labs.
Three years Teaching Assistant for six-week Field Mapping course, Colorado, Utah, New Mexico.


August 1982- May 1984 Teaching Assistant Department of Geology Bowling Green State University, Bowling Green, Ohio 43403 Taught Introductory and Invertebrate Paleontology Labs. Occasional lecture duties, Introductory Geology and Invertebrate Paleontology

**Research Grants**

1993: Recipient of the Paleontologic Research Institute grant for systematic paleontology (500.00)
1993: Recipient of the Lerner-Gray grant for marine research, American Museum of Natural History ($800.00)
1993: Recipient of Chevron Research Fellowship (one year)

**Publications**


**Abstracts**


Heaney, M. J. and Yancey, T. E, 1998. Conocardioid molluscs from the Buckhorn Asphalt Quarry of South-Central Oklahoma, rostroconchs or rostroconch homeomorphic bivalves? Annual GSA meeting (South-Central Sectional) Norman, OK.


NURUL KABIR
Adjunct Professor
Seismic Data Processing and AVO Inversion
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (713) 873-1841; FAX: (979) 845-6162
e-mail: kabirn57@tamu.edu

EDUCATION
B. S. (1982), Exploration Geophysics, Algerian Petroleum Institute (IAP), Boumerdes, Algeria

RESEARCH INTERESTS
My research interests focus on two main topics:
1) Seismic data processing: noise removal using Radon and various other transforms; surface and internal multiple suppression methods.
2) AVO inversion using full Knott-Zoeppritz equations and applications for reservoir characterization.

EXPERIENCE
Adjunct Professor, Department of Geology and Geophysics, Texas A&M University, College Station, September 2015 to present

Research Geophysicist / Project Leader Upstream Technology Group, BP, Houston, TX.
January 2006 to September 2014

Research Geophysicist Upstream Technology Group, BP, Houston, TX.
July 1999 to December 2005

Research Geophysicist Technology Center, Amoco, Tulsa, OK.
December 1997 to June 1999

AWARDS AND DISTINCTIONS
EAGE Instructor for the course: Seismic Multiple Removal Techniques.
Best paper Award of the SEG publication The Leading Edge, Multiazimuth versus wide-azimuth acquisition designs for sub-Messinian imaging: A finite-difference modeling study in West Nile Delta, Egypt; Apr 2010, Vol. 29, No. 4, pp. 450-462.
BP Global Helios Awards winner 2006, Imaging the Invisible – beating the seismic challenge to see beneath salt.
Active member of the Society of Exploration Geophysicists (SEG)

PUBLICATIONS (5 most recent)


Nurul Kabir, Uwe Albertin, Min Zhou, Vishal Nagassar, Einar Kjos, Phillip Whitaker, Alan Ford, 2008, Use of refraction, reflection and wave-equation-based tomography for imaging beneath the shallow gas: A Trinidad field data example; Geophysics, Vol. 73, No. 5, pp. VE281-VE289.
EDUCATION
Ph.D. (2010), Geology, Texas A&M University, Advisor: Frederick Chester and Judith Chester
B. S. (2004), Science, Kyoto University, Japan, Advisor: Toshihiko Shimamoto

RESEARCH INTERESTS
My research interests focus on three main topics:
1) Understanding the deformation processes and mechanisms by employing rock and soil deformation experiments at a range of pressure, temperature, and strain rate conditions.
2) Integrating the experimental work with numerical modeling, fieldwork including ocean drilling, and microstructure analysis to constrain the deformation conditions.
3) Understanding the physics of earthquakes, and strength and stress state of the lithosphere.

EXPERIENCE
Assistant Professor, Texas A&M University, College Station, TX
August 2014 to present

Visiting Researcher, Geological Survey of Japan, Ibaraki, Japan
August 2014 to present

Tenure-track Research Scientist, Geological Survey of Japan, Ibaraki, Japan
April 2012 to July 2014

Post-Doctoral Scholar, The Pennsylvania State University, University Park, PA
October 2010 to March 2012
Research on the sediments’ mechanical, physical, and hydraulic properties, with a focus on in-situ stress and pore pressure estimation in the Nankai Trough subduction zone off Japan.
Associated Faculty: Demian Saffer and Chris Marone

COMPETITIVE GRANTS AND AWARDS RECEIVED
U.S. Science Support Program, Schlanger Ocean Drilling Fellowship, 2006-2008 $28,000
The Ministry of Education, Culture, Sports, Science and Technology (MEXT) Grant-in-Aid for Scientific Research on Innovative Areas (Research in a proposed research area) 21107004 (P.I. Kyuichi Kanagawa), 2009-2014 140,400,000 JPY (~$1,404,000) [Kitajima participated as Co-I in 2012-2014.]
GDL Foundation Fellowship, 2010-2011 $9,000
Southern California Earthquake Center (Co-P.I. with Judith Chester), 2011-2012 $28,445
National Science Foundation Grant OCE-1049591 (P.I. Demian Saffer), 2011-2012 $165,864
Japan Society for the Promotion of Science (JSPS) Grants-in-Aid for Young Scientists (B) 25800283, 2013-2015 3,120,000 JPY (~$37,440)
JSPS Grants-in-Aid for Scientific Research (B) 26289150 (P.I. Takashi Matsushima), 2014-2017 12,350,000 JPY (~$78,000)
National Science Foundation Grant OCE-1654586, 2017-2019 $234,473
Southern California Earthquake Center (Co-P.I. with Patrick Fulton), 2017-2018 $100,000
AWARDS AND DISTINCTIONS
Mel and Debby Friedman Scholarship, College of Geoscience, Texas A&M University, 2006
ConocoPhillips SPIRIT Scholars Program Scholarship, Texas A&M University, 2006 – 2009
ConocoPhillips Fellowship, College of Geoscience, Texas A&M University, 2007, 2009
Handin Fellowship, College of Geoscience, Texas A&M University, 2008
NSF-MARGINS/GeoPRISMS Postdoctoral Fellowship, 2010 – 2012
AGU Editor's Highlight and Research Spotlight on Kitajima and Saffer (2012, GRL), 2012

PUBLICATIONS (5 most recent) *Denotes Student


Peter S. K. Knappett  
Assistant Professor, Dept. Geology & Geophysics, Texas A&M University  
2162 Chestnut Oak Circle, College Station, TX 77845  
Cell: 917-797-8371  
Email: knappett@tamu.edu

Professional Preparation

<table>
<thead>
<tr>
<th>University</th>
<th>Location</th>
<th>Field</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Tennessee</td>
<td>Knoxville, TN</td>
<td>Geology</td>
<td>PhD, 2010</td>
</tr>
<tr>
<td>University of Waterloo</td>
<td>Waterloo, Ontario</td>
<td>Civil Engineering</td>
<td>MASc, 2006</td>
</tr>
<tr>
<td>University of Waterloo</td>
<td>Waterloo, Ontario</td>
<td>Honours Science</td>
<td>Hon. BSc, 2001</td>
</tr>
</tbody>
</table>

Research Interests

Groundwater-Surface Water Interactions, Microorganism transport in groundwater, Biogeochemistry, Geogenic Contaminants, Fecal pathogens, Arsenic, Fluoride, Drinking water quality in South Asia and Central America, International Education and Research, Impacts of urban groundwater pumping on water quality, iron and arsenic cycling in alluvial riverbank aquifers

Experience

Aug. 2013 – Present, Assistant Professor, Dept. of Geology & Geophysics, Texas A&M University, College Station, Texas  
2010 – 2011, Marie Curie Post-doctoral Research Fellow, Institute for Groundwater Ecology, Helmholtz Center, Munich, Germany  
2006 –2010, Graduate Research and Teaching Assistant, Dept. of Earth & Planetary Sciences, University of Tennessee  
2003 –2005, Graduate Research and Teaching Assistant, Dept. of Civil and Environmental Engineering, University of Waterloo, Canada  
2001 – 2002, Visiting Scientist, UFZ Center for Environmental Research, Leipzig, Germany

Selected Research Grants

- Role: Co-PI (research grant for my PhD student Jason Paul), Project: Investigating the unconfined aquifer as the source of low-pH in surface waters at Oak Hill Mine, Source: Luminant Environmental Research Program, Amount: $ 213,203, Period: August 2015 – August 2018, Location: Texas A&M University
- Role: Co-PI (fellowship for post-doctoral scholar), Project: Fulbright Fellowship to Dr. Santanu Majumder from India, Source: Fulbright Foundation – India, Amount: $ 110,000, Period: January 2017 – December 2018, Location: Texas A&M University
- Role: Subcontract, Project: Collaborative Research: The effects of river regulation on lateral and integrated longitudinal mass and energy transfers in coupled terrestrial-aquatic systems, Source: NSF – Hydrologic Sciences Program, Amount: $35,707, Period: August 2014-August 2016, Location: Texas A&M University; University of Texas at Austin
- Role: Subcontract, Project: Hydrogeology support laboratory (Core D) – sub-contract from National Institutes of Environmental Health Superfund Research Program: Health effects and geochemistry of arsenic and manganese at Columbia University, Source: NIEHS, Amount: $ 15,130, Period: September 2014 – August 2015, Location: Texas A&M University, Columbia University

Five most recent papers (*graduate student, #corresponding author)


Honors/Awards
Kohout Early Career Award, Hydrogeology Division, Geological Society of America (2014)
ANDREAS K. KRONENBERG  
Professor and Michel T. Halbouty Chair in Geology  
Tectonophysics, Structural Geology, Rock Mechanics, Mineral Physics  
Department of Geology and Geophysics  
Texas A&M University  
College Station, TX 77843-3115  
PH: (979) 845-0132; FAX: (979) 845-6162  
e-mail: kronenberg@geo.tamu.edu

EDUCATION  
Ph.D. (1983), Geology, Brown University, Advisors: Jan Tullis and Richard A. Yund  
M. S. (1979), Geology, Brown University, Advisors: Jan Tullis and Richard A. Yund  
B. S. (1977), Geology, University of California, Los Angeles, Senior Thesis Advisor: John M. Christie

RESEARCH INTERESTS  
My research interests include:  
1) High temperature, high pressure rheology of crustal silicates, their atomistic mechanisms of deformation, and how mechanical properties govern the character of the Earth’s continental lithosphere and tectonics.  
2) Effects of fluids, defect chemistry, and diffusional kinetics on the mechanical properties of quartz and silicate rocks.  
3) Mechanical properties of carbonates, effects of crystal chemistry and structure on dislocation creep, and potential roles of carbonates in downgoing lithosphere at subduction zones.  
4) Deformation of layer silicates and the mechanical anisotropy of foliated and layered rocks.

EXPERIENCE  
President, DEFORM Consortium (Deformation Experimentation at the Frontier Of Rock and Mineral Research); 2013 to present  
Head, Department of Geology and Geophysics, Texas A&M University, College Station, TX; 2007 to 2011  
Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX; 1995 to present  
Associate Director, Center for Tectonophysics, Texas A&M University, College Station, TX; 1989 to present  
Associate Professor, Department of Geophysics, Texas A&M University, College Station, TX; 1990 to 1995  
Assistant Professor, Department of Geophysics, Texas A&M University, College Station, TX; 1985 to 1990  

COMPETITIVE GRANTS AND AWARDS RECEIVED (5 most recent)  
National Science Foundation Grant EAR-1624249, Collaborative Research: Magnesite Deformation and Potential Roles in the Slip and Seismicity of Subduction Zones (collaborative research with C. Holyoke, Univ Akron, P. Raterron, Brown Univ) 2016-2019 $386,030 ($104,062 TAMU)  
National Science Foundation Grant EAR-1321882, A Reversible Rheology for Water-weakened Quartz 2013-2016, extended $420,123  
National Science Foundation Grant EAR-1220138, Collaborative Research: Deformation Thermometry and Water Weakening of Quarz Tectonites - Case Studies from the Himalaya and the Caledonides of NW Scotland (collaborate research with R. Law, Virginia Tech, J. Thomas, RPI) 2012-2015 $416,000 ($156,000 TAMU)
National Science Foundation Grant EAR-1126762, MRI: Development of a High Pressure and Temperature Biaxial Deformation Apparatus for Earthquake and Landslide Studies (co-PI with F. Chester, PI, G. Biscontin, J. Chester, and J. Newman, all at TAMU) 2014-2016, extended $687,482

National Science Foundation Grant EAR-1045820, Rheology of Orthopyroxene 2011-2013 $280,000

Awards and Distinctions
Michel T. Halbouty Chair in Geology, Department of Geology and Geophysics, Texas A&M University, College Station, TX, 2016 to present
Chair, NSF Deep Underground Science and Engineering Laboratory (DUSEL) Geoscience Review Panel, 2010-2011
American Rock Mechanics Association Research Award, 2009
EGU Keith Runcorn Travel Grant, 2009
Chair, AGU Mineral and Rock Physics Fellows Nomination Committee, 2006-2008
Editor, AGU Physical Properties of Earth Materials (PPEM) Newsletter, 2005
Member of Executive Committee, AGU Mineral and Rock Physics Executive Committee, 2004-2008
Chair, Gordon Conference on Rock Deformation, The Role of Water in Rock Deformation, 2004
Co-Chair, Gordon Conference on Rock Deformation, Deformation Mechanism and Mode of Failure Transitions in Rocks, 2002
Ray C. Fish Professorship in Geology, 2002-2007
Member of NSF Panel, EAR Instrumentation and Facilities, 2000-2003
Member of NSF Panel, EAR Continental Dynamics, San Andreas Fault Zone Drilling Project, 1999
Texas A&M College Level Distinguished Research Award, 1997
Chair, AGU Physical Properties of Earth Materials (PPEM) Committee, 1995-1998
Associate Editor, Journal of Geophysical Research, Solid Earth, 1994-1997
Member of Program Committee, AGU Mineral Physics Representative, 1991-1993
Texas A&M College Level Distinguished Teaching Award, 1991
National Research Council Fellowship, 1982-1984

Publications (5 most recent and manuscripts in press) *Denotes Student or Postdoc
EDUCATION

1987  Ph.D. in Geology, University of Wisconsin, Madison, Wisconsin, U.S.A.
      Dissertation: Metamorphic Fluids and Granulite Genesis
1983  M.A. in Geology, Rice University, Houston, Texas, U.S.A.
1980  B.A. in Geology, Earlham College, Richmond, Indiana, U.S.A.

RESEARCH INTERESTS

Metamorphic petrology and geochemistry; the characterization of metamorphism in the earth's crust and mantle including temperatures, pressures and, in particular, fluid compositions and movements. This research includes fieldwork, petrography, microprobe analyses, fluid calculations over a wide range of pressures and temperatures, fluid inclusion work and stable isotopic analyses. Recent research includes the production and examination of synthetic fluid inclusions. Additional interests include crustal genesis, Precambrian geology, economic geology, tectonics, and relations between metamorphism and deformation.

EXPERIENCE

1993-present  Associate Professor, Texas A&M University
      Metamorphic Petrology: Phase Equilibria, Fluid Inclusions, Stable Isotopes
1996-1997  Utrecht University, Utrecht, Netherlands
      Mantle Fluids and Deformation
1987-1993  Assistant Professor, Texas A&M University
1983-1987  Research Assistant, University of Wisconsin, Madison, Wisconsin
      Metamorphic Petrology
1982-1983  Manager, Electron Microprobe Facility, Rice University, Houston, TX
1981-1982  Research Assistant, Rice University, Houston, Texas
      Metamorphic Petrology
1980  Undergraduate Research in Palynology: Danish National Museum Copenhagen, Denmark and The Institute of Geology and Geophysics, Bucharest, Romania
1979  Earlham College, Richmond, Indiana: Undergraduate Research in Palynology

COMPETITIVE GRANTS AND AWARDS RECEIVED

Texas A&M University (Internal): Ibrahim Karaman (PI) Co-P.I.s: William Lamb, Julie Newman, Abraham Clearfield, Xinghang Zhang. Acquisition of a State-of-the-Art Electron Microprobe, Funded Fall 2013, $2,000,000.00


National Science Foundation. Integrated Structural and Geochemical Investigation of Alternate origins for “Crack-Seal” Veins. D.V. Wiltschko and W.M. Lamb co-P.I.’s, $224,995, 6/1/01 to 5/31/03


National Science Foundation. Fluids and high grade shear zones: Implications for Fluid Movement, the formation and evolution of primary fluid inclusions and the tectonic evolution of the Southern Grenville. W.M. Lamb P.I., EAR 9117731, 1/15/92 to 12/31/94, $60,000

National Science Foundation. Deformation of H$_2$O-CO$_2$ fluid inclusions at elevated P-T and microthermometric behavior of inclusions in the CH$_4$ + H$_2$O $\pm$ NaCl system: An experimental study. W.M. Lamb and R.K. Popp co-P.I.’s., EAR 9117735 1/15/92 to 12/31/94 $45,359

Center for Energy and Mineral Resources, Texas A&M University. Fluid Inclusions as Indicators of Hydrocarbon Migration in the Smackover Formation of East Texas. W.M. Lamb P.I., 9/1/90 to 9/1/91, $19,456

Department of Energy; Proposal to Obtain a State-of-the Art Electron Microprobe, #8802-102. $269,500, S. Dorobek P.I, 1988. W. Lamb was instrumental in obtaining the funding and acquiring the electron microprobe now housed in the Dept. of Geology and Geophysics

**PUBLICATIONS (5 most recent) (**Graduate Student Author**)


EDUCATION

MS (2010) Geological Sciences, Universidad Central de Venezuela (UCV) Advisor: Olga Rey

RESEARCH INTERESTS

My current research interests are in the broad area of carbonate sedimentology and stratigraphy. The topics I am focusing on include:

1) Carbonate reservoir characterization and digital outcrop modeling from reservoir analogues.
2) Diagenesis and porosity evolution, using image analysis tools as a key for petrophysics.
3) The use of stable isotope geochemistry including clumped isotopes in understanding deposition, diagenesis and basin evolution
4) Unconventional Carbonate reservoirs and basin analysis.
5) Late Paleozoic carbonate petroleum systems and opportunities for exploration

EXPERIENCE

Assistant Professor in Carbonate sedimentology (2015-Present)
Department of Geology and Geophysics, Berg-Hughes Center, Texas A&M University

Research Assistant Professor in Carbonate sedimentology (2013-2015)
Berg-Hughes Center, Department of Geology and Geophysics, Texas A&M University.

Lecturer in Stratigraphy and Sedimentology (2003/2008, and 2012)
Geological Engineering Department, Universidad de Los Andes, Venezuela.


COMPETITIVE GRANTS AND AWARDS RECEIVED

Microporous reservoirs of Qatar: Origin, Petrophysics and Productivity $1,100,000
Proposal in preparation for Qatar National Priority Research Program/ TOTAL. Qatar $149,000 will be allocated to Co-PI Juan Carlos Laya.

Diagenetic evolution of the Miocene Kardiva Platform $15,000

Digital outcrop modeling of Eagle Ford Outcrops in Lozier Canyon and Antonio Creek, west Texas. Funded by Statoil Allocated to Texas A&M University

Modelling facies distribution and origin of modern isolated platforms in Southern Caribbean. Funded by Hughes oil and gas Allocated to Texas A&M University

Permo-Carboniferous carbonates in Venezuelan Andes. Petroleum potential and paleogeographic implication Funded by (AAPG) Grant in AID, Horst & Jessie von Bandat Memorial Grant

AWARDS AND DISTINCTIONS

2010 American Association of Petroleum Geologist (AAPG) Grant in AID, ‘Horst & Jessie von Bandat Memorial Grant’
2010 International Association of Sedimentologists Postgraduate Grant Scheme.
2002 Best Undergraduate Dissertation School of Engineering Universidad de Los Andes.

PUBLICATIONS (5 most recent) *Denotes Student


EDUCATION

Ph.D. (1994), Geological Sciences, Columbia University, Lamont-Doherty Earth Observatory
M. Sc. (1989), Geology, McMaster University
B. Sc. (1985), Chemistry and Geology (highest honors), Carleton University

RESEARCH INTERESTS

Currently I am pursuing several areas of research, all of which involve isotope ratio variations in marine and terrestrial records. My focus is on how isotope and trace element tracers can be used to understand the relationship between past climate change (on Quaternary and even longer timescales) and past oceanic biological productivity, deep-ocean circulation, and patterns of continental aridity and hydrology based on past riverine discharge and eolian fluxes to the ocean.

EXPERIENCE

2017- : Jane and Ken R. Williams Chair in Ocean Drilling Science
2012-2016: Robert R. Berg Professor of Geology, TAMU
2014- : Joint Appointment, Department of Oceanography, TAMU
2011- : Assoc Department Head, Dept. of Geol. & Geophys., TAMU
2010- : Professor, Dept. of Geol. & Geophys., TAMU
2006-2010: Associate Professor, Dept. of Geol. & Geophys., TAMU
2002-2006: Associate Professor, Department of Earth & Environmental Sciences, Tulane University
1996-2002: Assistant Professor, Department of Geology, Tulane University
1995-1996: Post-doctoral research associate, Yale University (advisor: K.Turekian)

CURRENTLY ACTIVE GRANTS

NSF $1,121,909 (with B. Roark, J. Fitzsimmons, B. Miller, and D. Thomas) “Acquisition of a Multicollector Inductively Coupled Plasma Mass Spectrometer and Laser Ablation System for Investigating the Evolution of the Earth’s Climate, Oceans, and Tectonics at Texas A&M University (10/01/2015-09/30/2018)

NSF $235,121 “Collaborative Research: Dust deposition, paleo-export production, and migration of the ITCZ through the last glacial cycle in the west-central Pacific (Line Islands) (5/1/2015-4/30/2018)

AWARDS AND DISTINCTIONS

Elected Fellow of the Geological Society of America Fellow, 2015
PUBLICATIONS (10 most recent) *Denotes Student


ANDREA A. MICELI ROMERO  
Research Professor  
Chevron Basin Modeling Center of Excellence (CoRE)  
Texas A&M University  
3115 TAMU | 255 Halbouty  
College Station, TX 77843-3115  
PH: (979) 845-6269; FAX: (979) 845-6162  
e-mail: miceli@tamu.edu

EDUCATION

Ph.D. Geology (2014) University of Oklahoma. Advisor: Dr. R. Paul Philp  
B.Sc. Geochemistry (2006) Universidad Central de Venezuela

RESEARCH INTERESTS

Petroleum Systems Analysis  
Organic Geochemistry  
Basin Modeling  
Unconventional Resources

EXPERIENCE

Research Professor. Chevron Basin Modeling Center of Excellence, Department of Geology and Geophysics, Texas A&M University, College Station, TX - April 2017 to present

Basin Modeler. Chevron Energy Technology Company, Houston, TX - May 2014 to December 2015

Graduate Research/Teaching Assistant. The University of Oklahoma, Norman, OK - August 2007 to May 2014

Geologist – Professional Intern. Chevron Energy Technology Company, Houston, TX - June to August 2012

Geologist – Professional Intern. BP America, Houston, TX - May to August 2011

Geologist – Professional Intern. BP America, Houston, TX - May to August 2010

Consulting Geologist – Professional Intern. Schlumberger Oilfield Services, College Station, TX - May to August 2009

RESEARCH GRANTS

Oklahoma Geological Foundation Suzanne Takken Memorial Award (2012)  
University of Oklahoma School of Geology and Geophysics Student Research Grant (2012)  
University of Oklahoma Graduate College – Robberson Travel Grant (2011)  
AAPG Foundation Grants-in-Aid – Hugh D. Miser Memorial Grant (2009)
AWARDS/HONORS

University of Oklahoma School of Geology and Geophysics Endowed Fellowship (2011)
Special Mention on Poster Session at the XII Venezuelan Microscopy Congress (2006)
First place Universidad Central de Venezuela Academic Merits Award (2005)

SELECTED PUBLICATIONS


EDUCATION
Ph.D. (1997), Geology, Dalhousie University, Advisors: S. Barr and R. Jamieson
M.Sc. (1991), Geology, Ohio University, Advisor: R.D. Nance
B. S. (1987), Geology, Ohio University

RESEARCH INTERESTS
My research interests focus on three main topics:
1) Constraining the timing of tectonic processes of continent formation through geochronology and high-temperature thermochronology of igneous and metamorphic rocks.
2) Precise calibration of the sedimentary and biological response to oceanic anoxic events by integrating high-precision U-Pb and 40Ar/39Ar dating of volcanic ash beds with biostratigraphic and cyclostratigraphic analysis.
3) Improving elemental and isotopic analytical methods to provide new approaches to, and more precise data for, both of the above.

EXPERIENCE
Associate Professor, Texas A&M University, College Station, TX, Aug. 2008-present
Assistant Professor, Texas A&M University, College Station, TX, Aug. 2005-2008
Research Scientist, Texas A&M University, College Station, TX, Jan. 2004-2005
Research Assistant Professor, Univ. North Carolina, Jan. 1999 – Jan. 2004

COMPETITIVE GRANTS AND AWARDS RECEIVED
Precambrian bedrock mapping of the southern Highland Mountains, Madison County Montana: Twin Bridges SW and Nez Perce Hollow quadrangles (2017) USGS EdMap, $35,375, sole PI
MRI: Acquisition of a Multicollector Inductively Coupled Plasma Mass Spectrometer and Laser Ablation System for Investigating the Evolution of the Earth’s Climate, Oceans and Tectonics at Texas A&M University (2016), National Science Foundation, $1,000,237,
collaborative with Brendan Roark, Jessica Fitzsimmons, Franco Marcantonio, Deborah Thomas.

Chopawamsic fault: Main Iapetan suture in the southern Appalachians? (2011-2014), National Science Foundation, $82,292 (total project $314,930), collaborative with Jim Hibbard, North Carolina State University.

Acquisition of a High Resolution Inductively Coupled Plasma Mass Spectrometer for Earth and Environmental Science Research at Texas A&M University (2008-2011) National Science Foundation, $666,500 collaborative with Franco Marcantonio, Ethan Grossman, Deborah Thomas, Matthew Schmidt, Texas A&M University


A record of the timing, nature and geometry of the Rheic Ocean in the Appalachian Carolina and Avalon zones (2005-2009) National Science Foundation, $134,104 (total project $326,973); collaborative with Jim Hibbard, NC State Univ.

Tectonothermal History of the Acatlán Complex, Southern Mexico: A Record of the Closure of the Rheic Ocean? (2003-2007) National Science Foundation, $144,934 (total project $252,747); collaborative with Damian Nance, Ohio Univ.

Kinematics and geochronology of the Gold Hill shear zone: Implications for accretion of the peri-Gondwanan Carolina zone in the Southern Appalachians, (2001-2004) National Science Foundation, $80,978 (total project $236,425); collaborative Jim Hibbard, NC State Univ., Bill Hames, Auburn Univ.

**PUBLICATIONS (5 most recent) *Denotes Student**


EDUCATION
Ph.D. (1993), Geological Sciences, University of Rochester, Rochester, NY, Advisor: Gautam Mitra
M.S. (1990), Geological Sciences, University of Rochester, Rochester, NY, Advisor: Gautam Mitra
B.A. (1985), Geology, Oberlin College, Oberlin, OH

RESEARCH INTERESTS
Investigation of rheology, deformation processes, and deformation conditions (e.g., pressure, temperature, stress, strain-rate) in crustal and upper mantle environments through field, microstructural and geochemical studies.

EXPERIENCE
Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2016 to present

Associate Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2011 to August 2016

Assistant Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2005 to August 2011

Research Scientist (~1/3 time), Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2004 to August 2005

Visiting Assistant Professor (~1/3 time), Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2002 to August 2004

Research Scientist (half-time), Microscopy and Imaging Center, Texas A&M University, College Station, TX
September 2001-August 2003

Lecturer (~1/3 time), Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 1998-August 2002

Post-Doctoral Research Associate, Vening Meinesz Research School of Geodynamics, Faculty of Earth Sciences, Utrecht University, The Netherlands, Advisor: Professor Martyn Drury
June 1995-May 1998
Post-Doctoral Research Fellow, Center for Tectonophysics, Texas A&M University, College Station, TX
March 1993-May 1995

Geologist, BCM Eastern Inc., Consulting Engineers, Plymouth Meeting, PA
October 1985-August 1986

COMPETITIVE GRANTS AND AWARDS RECEIVED
National Science Foundation Grant EAR-EarthCube 2017-2020 $186,241
National Science Foundation Grant EAR-EarthCube 2016-2019 $25,426
National Science Foundation Grant EAR-Geoinformatics 1347323 2014-2018 $190,362
National Science Foundation Grant EAR-Tectonics 1050044 2011-2015 $237,376
National Science Foundation Grant EAR-MRI 1126762 2011-2016 $687,492
National Science Foundation Grant EAR-Tectonics 0911586 2009-2012 $399,918
National Science Foundation Grant EAR-Tectonics 0409567 2004-2009 $89,146
National Science Foundation Grant OCE 0221250 2002-2007 $262,836
National Science Foundation Grant EAR-Tectonics 0107078 2001-2004 $145,430

AWARDS AND DISTINCTIONS
Montague – Center for Teaching Excellence Scholar, Texas A&M University, 2010 - 2011

PUBLICATIONS (5 most recent) *Denotes Student


EDUCATION
Ph.D. (2015) Geological Sciences, University of Texas at Austin, Advisor: Brian K. Horton
B.S. (2009), Geological Sciences, University of Texas at Austin

RESEARCH INTERESTS
Basin evolution and deformation along active margins; role of structural inheritance on subsidence and deformation patterns; stratigraphic signature of lithosphere and surface processes; continent-scale sediment routing.

EXPERIENCE
Assistant Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2015 to present

Graduate Research and teaching assistant, Department of Geological Sciences, University of Texas at Austin
August 2010 to August 2015

COMPETITIVE GRANTS AND AWARDS RECEIVED

AWARDS AND DISTINCTIONS
NSF Graduate Research Fellow, 2011-2015

PUBLICATIONS (5 most recent)


EDUCATION

Ph.D. (1995), Geology, Virginia Polytechnic Institute and State University, Advisor: J. Fred Read
M. S. (1989), Geology, University of Montana, Advisors: Jim Sears and Don Winston
B. S. (1985), Earth and Space Sciences, UCLA

RESEARCH INTERESTS

My research interests focus on three main topics:

1) Integrating litho-, chemo- and chronostratigraphy in a regional sequence stratigraphic framework to understand high-frequency and long-term climatic and oceanic processes affecting development of sedimentary successions; towards this end I am currently most interested in the transitions that occur between global icehouse and greenhouse conditions and how these affect reservoir characterization.

2) Using detrital zircon geochronology to understand sediment dispersal and tectonic processes.

3) Understanding the depositional systems of unconventional resources (chalk, carbonate mudstone etc.)

EXPERIENCE

Professor and Department Head, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 2015 to present

Professor and Associate Director Berg-Hughes Center for the study of Sedimentary and Petroleum Systems, Texas A&M University, College Station, TX
January 2014 to August 2015

Professor and Interim Director Berg-Hughes Center for the study of Sedimentary and Petroleum Systems, Texas A&M University, College Station, TX; January 2013 to December 2014

Professor and Associate Director Berg-Hughes Center for the study of Sedimentary and Petroleum Systems, Texas A&M University, College Station, TX; August 2012 to December 2012

Associate Professor, Texas A&M University, College Station, TX
July 2009 to August 2012

Associate Professor, Washington State University, Pullman, WA, Taught a total of 10 years at WSU
September 2005 to July 2009

Assistant Professor, Washington State University, Pullman, WA
August 1999 to August 2005
Research Scientist, Mobil Technology Corporation, Dallas, Texas
August 1998-July 1999

Post-Doctoral Research Associate, Massachusetts Institute of Technology, Cambridge, MA
October 1995 to July 1998
Research on the evolution of Precambrian seawater composition by studying Paleoproterozoic carbonates and evaporites of northern Canada and Meso- to Neoproterozoic carbonates and siliciclastics of western Siberia. Associated Faculty: John Grotzinger

COMPETITIVE GRANTS AND AWARDS RECEIVED
National Science Foundation Grant EAR-9316057 (P.I. Fred Read) 1994-1996 $181,000
National Science Foundation Grant OPP-9725426 (P.I. John Goodge) 1998-2000 $270,000
ExxonMobil Regional Field Studies of Montoya Group, NM and TX, 2000-2001 $128,000
American Chemical Society-Petroleum Research Fund 2000-2001 $25,000
National Geographic Society Research Grant 7013-01 2001 $19,865
National Science Foundation Grant EAR-0107027 2002-2003 $114,805
National Science Foundation Grant EAR-Supplemental to EAR-0107027 2003-2004 $11,485
National Science Foundation Grant EAR-0230008 2003-2005 $128,714
National Aeronautics and Space Administration 05-PGG05-99 2006-2009 $258,678
EDMAP (United States Geological Survey) 2006 $10,500
National Science Foundation Grant EAR-0744393 2008-2010 $90,000
American Chemical Society-Petroleum Research Fund #51156-ND8, 2010-2012, $100,000

AWARDS AND DISTINCTIONS
National Association of Geology Teachers-U.S.G.S. Summer Field Assistantship, 1985
Geological Society of America, Sedimentary Division, Outstanding Student Research Proposal 1993
Chair, Sedimentary Geology Division, Geological Society of America 2007
Voted Geological Society of America Fellow, 2008

PUBLICATIONS (5 most recent) *Denotes Student

*Wahl, P.J., Yancey, T.E., Pope, M.C., Miller, B.V., and Ayers, W.B., 2016, U-Pb detrital zircon geochronology of the Upper Paleocene to Lower Eocene Wilcox Group, east-central Texas: Geosphere, v. 12, no. 5. Doi:10.1130/GES01313.1


Tice, M. M., *Quezerque, K., Pope, M.C., accepted to Astrobiology, Microbialite Biosignature Detection by Mesoscale X-ray Fluorescence (μXRF) Mapping


ANNE RAYMOND
Professor,
Paleobotany, Paleoecology, Evolution, Wetland Environments
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (979) 845-0644; FAX: (979) 845-6162
e-mail: raymond@geo.tamu.edu

EDUCATION
Ph.D. (1983), Geophysical Sciences, University of Chicago, Advisor: T. J. M. Schopf
A. B. (1977), Geology, Harvard University

RESEARCH INTERESTS
My research interests focus on three main topics:
1) Integrating geochemical, sedimentological, stratigraphic and paleontological data to understand
Pennsylvanian wetlands, wetland communities, and paleoclimate.
2) The history of terrestrial productivity through geologic time, the evolutionary ecology of terrestrial
decomposer communities, and how changes in terrestrial productivity affected marine ecosystems.
3) Modern peat-accumulating wetlands in marine and freshwater depositional systems.

EXPERIENCE
Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX
September 1996 to present

Associate Professor, Texas A&M University, College Station, TX
July 1988 to August 1996

Assistant Professor, Texas A&M University, College Station, TX
January 1983 to August 1988

Science Fellow, Bunting Institute, Harvard University, Cambridge MA
September 1986 to August 1987

COMPETITIVE GRANTS AND AWARDS RECEIVED
American Chemical Society-Petroleum Research Fund-Peat Taphonomy 1986-1988, $18,000
Whitehall Foundation-Mangrove Peat and Productivity 1987-1988 $10,000
National Science Foundation Grant EAR-Carboniferous Phytogeography 1988-1990 $60,000
NOAA National Underseas Research Program-SSETI 1992-1995 $81,000
National Science Foundation Grant EAR-Carb. plant diversity & phytogeography 1995-2000 $142,000
NOAA National Underseas Research Program-SSETI 1995-2006 $31,000

AWARDS AND DISTINCTIONS
NSF Graduate Fellowship 1977-1981
Texas A&M Association of Former Students College Teaching Award, 1988
Earl Cook Professor of Geosciences 2003-2008
Texas A&M Association of Former Students College Teaching Award, 2009
Voted Paleontological Society Fellow, 2015
PUBLICATIONS (5 most recent, 5 significant) *Denotes Student


JULIA S. REECE  
Assistant Professor  
Sedimentology and Sediment Mechanics  
Department of Geology and Geophysics  
Texas A&M University  
College Station, TX 77843-3115  
PH: (979) 458-2728; FAX: (979) 845-6162  
e-mail: jreece@geos.tamu.edu

EDUCATION

Ph.D. (2011), Geosciences, University of Texas at Austin, Advisor: Peter B. Flemings  
M. S. (2006), Geosciences, University of Bremen, Germany, Advisor: Katrin Huhn  
B. S. (2004), Geosciences, University of Bremen, Germany, Advisor: Tobias Mörz and Rüdiger Stein

RESEARCH INTERESTS

My research interests focus on three main topics:  
1) Understanding deposition, burial, and early diagenesis of marine mudstones; particularly the evolution of mechanical and transport properties as well as microstructure  
2) Understanding initiation and dynamics of submarine landslides  
3) Understanding depositional systems and diagenesis in unconventional resources

EXPERIENCE

Assistant Professor, Department of Geology and Geophysics, Texas A&M University, College Station, TX  
September 2014 to present

Postdoctoral Scholar, Department of Geophysics, Stanford University, Stanford, CA  
March 2013 to August 2014

Postdoctoral Fellow, Bureau of Economic Geology, The University of Texas at Austin, Austin, TX  
January 2012 to February 2013

COMPETITIVE GRANTS RECEIVED

Berg-Hughes Center – CoreLab Initiative on Soaking of Unconventional Reservoirs (Pending, JIP to be developed)  
American Chemical Society-Petroleum Research Fund #55617-DNI8, 2015-2018, $110,000  
Schlanger Ocean Drilling Fellowship Award, Consortium for Ocean Leadership, 2010-2011, $28,000

AWARDS

Author Achievement Award, Bureau of Economic Geology, UT Austin, 2012  
Best JSG Student Paper Award, UT Austin, Dept. of Geological Science, 2011  
Best Ph.D. technical talk, UT Austin, Dept. of Geological Science, 2011  
Ewing/Worzel Fellowship, UT Institute for Geophysics, 2011  
AGU Outstanding Student Paper Award (AGU Fall Meeting), 2010  
Outstanding Teaching Assistant Award, UT Austin, Dept. of Geological Science, 2010
**PUBLICATIONS (5 most recent)**


**CONFERENCE ABSTRACTS** (* denotes graduate student and o denotes undergraduate student)


Wu, W., Gensterblum, Y., **Reece, J.S.** and Zoback, M.D. (2016), Permeability evolution with shearing of simulated faults in unconventional shale reservoirs (Poster), Abstract MR51C-2727 presented at 2016 Fall Meeting, AGU, San Francisco, California, December 12-16.
EDUCATION

2012  Ph.D. Geosciences  The University of Texas at Austin  
   The impact of climate and tectonics on sedimentary and deformational processes, Gulf of Alaska  
   Committee: Sean Gulick, Gail Christeson, Brian Horton, David Mohrig, Ron Steel, John Jaeger

2008  B.A. Geology  Skidmore College

RESEARCH STATEMENT

My research interests include the study of plate boundaries and processes associated with climate-tectonic interaction, evolution of oceanic crust, development of carbonate systems, and high-resolution studies of marine hazards. I utilize most types of marine geophysical data, but specialize in seismic reflection, tomography, bathymetry, high-resolution techniques, and seismic-core integration. I am currently conducting research in Bonaire, White Sands, New Mexico, the South Atlantic Ocean, and the deep water Gulf of Alaska. Alaska research involves work with IODP Exp. 341; Atlantic work is in conjunction with IODP proposal 853.

PROFESSIONAL POSITIONS

2013-current  Assistant Professor, Dept. of Geology and Geophysics, Texas A&M University
2013  Geophysicist, US Geological Survey
2008-2012  Research and Teaching Assistant, University of Texas at Austin
2010  Intern, Geophysics, Shell International Exploration and Production, Inc.

FUNDED RESEARCH

2015-2018  National Science Foundation, Ocean Sciences  
   Collaborative Research: Evolution of South Atlantic Oceanic Crust: A Seismic Transect  
   Principal Investigator: Bobby Reece; Rick Carlson co-PI; collaborative with Gail Christeson (UT Austin)  
   Facilities: R/V Marcus G. Langseth (UNOLS), Ocean Bottom Seismometer Instrument Pool (OBSIP)  
   Total award: $662,948; TAMU portion: $273,843

2014-2016  National Science Foundation, Ocean Sciences  
   Collaborative Research: Linking climate-driven changes in erosion to tectonic processes along the southern Alaska Margin  
   Principal Investigator: Bobby Reece; collaborative with Eva Enkelmann (U. Cincinnati), Sean Gulick (UT Austin), John Jaeger (U. Florida), Ken Ridgway (Purdue), Ellen Cowan (App. St.)  
   Total award: $426,000; TAMU portion: $56,221

Pending

National Science Foundation, International Ocean Discovery Program (IODP)  
   Recommended for scheduling by Science Evaluation Panel (June 2017)  
   Full proposal for multidisciplinary IODP investigations along a crustal flow-line across the western flank of the southern Mid-Atlantic Ridge: The South Atlantic Transect (853-Full)  
   Principal Lead Proponent: Rosalind Coggon (Southampton); Data Lead Proponent: Bobby Reece  
   Proponents: William Gilhooly, Gail Christeson, Jason Sylvan, Brandi Reese, Mark Leckie, Damon Teagle, Nicholas Hayman, James Zachos, Danielle Sumy, Brandon Briggs, Clifford Heil, Matthew Huber, Svenja Rausch, John Kirkpatrick, Michelle Harris, Julia Reece, Debbie Thomas, Miriam Katz
Robert S. Reece

HONORS & AWARDS
Montague-Center for Teaching Excellence Scholar, Texas A&M University 2016-2017
Best Ph.D. technical talk, UT Austin, Dept. Geological Science 2012
ConocoPhillips SPIRIT Scholar 2011-2012
Outstanding Student Paper Award, Tectonophysics (AGU Fall Meeting) 2009
Navy Achievement Medal (Two awards, USS Louisville) 2003, 2004

PUBLICATIONS

Google Scholar h-index: 6; citations: 164 (June 2017)


CONFERENCE PROCEEDINGS
*indicates undergraduate student advisee; *indicates graduate student advisee

EDUCATION

Ph.D. (2000), Geological Sciences, University of California, Riverside, Advisor: Harry W. Green, II
B. A. (1989), English Literature, Pomona College

RESEARCH INTERESTS
The Riggs Group studies many related aspects of teaching, learning and cognition in the geosciences. Our primary research is in
1) understanding how people learn in complex geological settings through the lens of embodied cognition in the context of real geoscience working situations,
2) culturally-mediated cognition and the influence of diversity, language, curriculum and context,
3) emergence of expert behaviors as a result of experience and instruction.
Geologic settings investigated include petroleum geology and sedimentary systems, field and structural geology, and geoscience education in international or cross-cultural learning situations.

EXPERIENCE

Associate Professor, Department of Geology & Geophysics, Texas A&M University, College Station, TX,
September 2011 to present

Associate Dean, College of Geosciences, Texas A&M University, College Station, TX
September 2011 - September 2014 - Graduate Recruitment and Diversity
September 2014 - January 2017 - Graduate Affairs and Diversity
January 2017 - present - Diversity and Climate

Associate Professor, Department of Earth & Atmospheric Sciences and Department of Curriculum & Instruction, Purdue University, West Lafayette, IN;
September 2006 to August 2011

Founding Co-Director, Center for Research and Engagement in Science and Mathematics Education, Purdue University, West Lafayette, IN;
September 2006 to August 2011

Associate Professor, Department of Geology, San Diego State University, San Diego, CA
September 2005 to August 2006

Assistant Professor, Department of Geology, San Diego State University, San Diego, CA
September 2000 to August 2005

Adjunct Instructor, Pasadena City College, Pasadena, CA
January 1997 to August 1998
COMPETITIVE GRANTS AND AWARDS RECEIVED
National Science Foundation NSF-GEO 1202920- PI: Ellins, $432,000
National Science Foundation NSF-HRD 1136238 -PI: Sexton, $518,000,
National Science Foundation NSF-EF 1137302 - PI: Bowen, $4,300,000
National Science Foundation NSF-DUE 0963621 - PI: Sands, $1,250,000
National Science Foundation NSF-GEO 0914586 - PI: Riggs, $785,985
National Science Foundation NSF-DUE 0833298 - PI: Riggs, $899,043
National Science Foundation, NSF-DUE 0837272 - PI: Lasher-Trapp, $150,000
National Science Foundation, NSF-GEO 0650532 - PI: Riggs, $689,553
Lilly Endowment - Purdue Discovery Park, - PI: Riggs, $25,000
NASA, NNG05GP57G - PI: Mellors, $54,563
National Science Foundation, NSF-GEO 0122130 - PI Riggs, $91,393
National Science Foundation, NSF-GEO 9809709 - PI Trafzer, $21,000
National Science Foundation, NSF-EAR 9805368 - PI Green, $123,000

AWARDS AND DISTINCTIONS
Geological Society of America Fellow, 2016
President-Elect, President, and Past President, American Geosciences Institute (AGI), 2013-2016
Vice President, President and Past President, National Association of Geoscience Teachers (NAGT),
2005-2009
National Science Foundation Graduate Research Fellowship, 1995-1998

PUBLICATIONS (5 most recent) *Denotes Student
Wolfe, B.A. and Riggs, E.M., 2017, Macrosystem analysis of programs and strategies to increase
underrepresented populations in the geosciences, Journal of Geoscience Education special theme
issue "Synthesizing Results and Defining Future Directions of Geoscience Education Research" in
press 8/2017, to be published 11/2017
Faculty and Researchers to Respond. Journal of Geoscience Education: November 2016, Vol. 64,
No. 4, pp. 255-257. doi: http://dx.doi.org/10.5408/1089-9995-64.4.255
*Balliet, R.N., Riggs, E.M., and Maltese A.V., 2015, Students’ Problem Solving Approaches for
Initiating and Developing Geologic Models in the Field, Journal of Research in Science Teaching,
special issue on Disciplinary-Based Post Secondary-Education Research 52(8), DOI:
10.1002/tea.21236
National Research Council: Committee on Trends and Opportunities in Federal Earth Science Education
and Workforce Development (member and co-author), 2013, Preparing the Next Generation of
Earth Scientists: An Examination of Federal Education and Training Programs, NRC Report #18369
Conceptions About Geological Sedimentary Processes, International Journal Science Education,
DOI:10.1080/09500693.2013.775609
EDUCATION
1992 Ph.D. Geology, Brown University
1985 B. S. Geology, Rensselaer Polytechnic Institute

RESEARCH INTERESTS
Mathematical and numerical modeling of dynamic geophysical and geochemical systems, including grain-scale dynamics of unconsolidated sediment and fault gouge, pressure solution, fluid migration in the crust and mantle of planetary bodies, and flow in porous media

EXPERIENCE
2016-present Professor of Geology and Geophysics, Texas A&M University
2003-2016 Associate Professor of Geology and Geophysics, Texas A&M University
1998-2003 Assistant Professor of Geology and Geophysics, Texas A&M University
1995-1998 Associate Research Scientist, Lamont-Doherty Earth Observatory of Columbia University
1992-1994 Postdoctoral Fellow, Lamont-Doherty Earth Observatory of Columbia University
1992 Postdoctoral Research Associate, Brown University
1991-1992 Graduate Research Associate, Division of Earth and Environmental Science, Los Alamos National Laboratory

SELECTED EXTERNAL GRANTS
National Science Foundation, Earth Sciences-Geophysics, The role of fluids in earthquake initiation and suppression: models of fluid-grain interaction in fault zones 2011-2015, Principle Investigator, Award: $215,234
Texas Higher Education Coordinating Board, Advanced Research Program, Is the water table a material free surface?, 2008-2010, Co-Investigator, Award: $120,000
Incorporated Research Institutions for Seismology, Technology assistance with implementation and operation of Transportable Array element of USArray and Earthscope, 2008, Principle Investigator, Award: $31,000
National Science Foundation, Earth Sciences - Geophysics, The thermodynamics, fluid dynamics and chemistry of deep mantle melts: models of Archean magmatism, 1997-2000, Principle Investigator, Award: $145,225

AWARDS AND DISTINCTIONS
2015 Curriculum Faculty Fellow, Center for Teaching Excellence, Texas A&M Univ.
SELECTED PUBLICATIONS *Denotes Student
He, W., D. Sparks and A. Hajash, (2013), Reactive transport at stressed grain contacts and creep compaction of quartz sand, J. Geophys. Res, 118.

RECENT COURSES TAUGHT *Denotes co-taught
GEOL 210 Geological Communication
GEOL 310 Planetary Geology
GEOL 300 Summer Field Geology*
GEOL 302 Introduction to Petrology*
GEOP 341 Global Geophysics
GEOP 470 Computational Geophysics
GEOL 478/678 Earth Science Modeling

RECENT UNIVERSITY SERVICE
University level
University Grievance Committee, Achievement Awards Committee, Faculty Development Leave Committee, Committee on Academic Freedom, Responsibility and Tenure

College level
Undergraduate Curriculum Committee

Department level
Associate Department Head for Undergraduate Affairs (encompassing Curriculum Committee, Curriculum Study Group, Undergraduate Awards and Scholarships), Head Search Committee, Executive Committee, Tenure and Promotion Committee
EDUCATION

M. S. (1989), Geophysics, Columbia University, Advisor: John T. Kuo
B. S. (1981), Geophysics and Geology, China University of Petroleum (Dongying)

RESEARCH INTERESTS

My research interests focus on three main topics:

1) Rock physics: Petrophysics and well log analysis; Poroelasticity, mechanics and electrodynamics of multiphase fractured porous media; Biogeophysics.


3) Quantitative petroleum geology: Characterization of ultra-deep petroleum systems.

EXPERIENCE

Professor, Department of Geology and Geophysics, Texas A&M University, College Station, September 2012 to present

Director, TAMU Reservoir Geophysics Program (RGP), Texas A&M University, College Station, January 2007 to present

Associate Professor, Texas A&M University, College Station, TX, January 2007 to August 2012

Adjunct Associate Professor, University of Miami, Rosenstiel School of Marine and Atmospheric Science, Miami, FL, Pullman, September 2001 to July 2011

Associate Professor, Department of Petroleum Geosciences, The Petroleum Institute, Abu Dhabi, U.A.E., November 2005 to December 2006

Doherty Associate Research Scientist, Lamont-Doherty Earth Observatory, Columbia University, January 1998 to October 2005

Post-Doctoral Fellow and Logging Scientist, Lamont-Doherty Earth Observatory, Columbia University, January 1995 to December 1997

Graduate Teaching/Research Fellow, Henry Krumb School of Mine, Columbia University
SELECTED RECENT GRANTS AND AWARDS
Devon Energy Corporation, TAMU-500182 (Co-PI), 2007-2008, $247,000
U.S. Department of Energy, TAMU-RF-499171, 2008, $22,000
Abu Dhabi National Oil Company (ADNOC), TAMU-RF-499531, TAMU-RF-424231, TAMU-RF-429157, 2007-2011, $404,000
Apache Reservoir Geophysics Program Scholarship, TAMU-500182, 2009-2010, $40,000
Sinoppec, TAMU-500182, 2009-2012, $250,000
Abu Dhabi National Oil Company (ADNOC), TAMU-463181, TAMU-463221, 2012-2013, $220,000
Geoinfo, TAMU-500182, 2013-2014, $50,000
Abu Dhabi National Oil Company (ADNOC), TAMU-463222, TAMU-469571, 2014-2015, $480,000
Geoinfo, TAMU-500182, 2016, $30,000

AWARDS AND DISTINCTIONS
Holder of the Mollie B. and Richard A. Williford Professorship in Petroleum Geology, 2012-present
ADNOC R&D Impact Award for Pioneering Contributions in Seismic Shear Wave Imaging, 2015
Chairman of the Eleventh International Conference on Theoretical and Computational Acoustics, March 10-14, 2014, College Station, Texas, USA
Associate Editor, Geophysics (Section: Borehole Geophysics and Rock Properties), 2010-2013
Editor, Board of Editors, International Journal of Computational Acoustics (JCA), 2006-present

FIVE SELECTED MOST-RECENT PUBLICATIONS

*Denotes Student

*Huang, Q., Dou, Q., Jiang, Y., Zhang, Q., and Sun, Y., 2017, An integrated approach to quantify the geological control of carbonate pore type and permeability, Interpretation, accepted.


Deborah Thomas  
Interim Dean and Professor  
dthomas@tamu.edu  
845-3651  
3148 TAMU

**Education:**
- Ph.D. *Geological Sciences* (2002), University of North Carolina, Chapel Hill
- M.S. *Marine Sciences* (1998), University of North Carolina, Chapel Hill
- B.S. *Geological Sciences* (1995), Brown University

**Research Interests**
My primary research interest is paleoceanography of the Cretaceous and Cenozoic, using the deep-sea sedimentary record to investigate the role of the deep oceans in global heat transport during different overall climate states. In particular, I use radiogenic isotopes, stable isotopes, and trace element geochemistry to reconstruct the patterns of deep-water formation and circulation that operated under different boundary conditions.

My accomplishments as a faculty member and administrator have advanced basic research in the climate sciences, have advanced STEM pedagogy, have broadened participation in high impact educational experiences, and have contributed to the education of first generation and under-represented students.

**Academic Appointments:**
- Professor, Texas A&M University, Sept 2015 - present
- Associate Professor, Texas A&M University, Sept 2010 – Sept 2015
- Joint Appointment, Department of Geology & Geophysics, 2005 - present
- Assistant Professor, Texas A&M University, Jan 2004 – Sept 2010

**Awards and Honors:**
- Freshman Convocation Keynote Speaker, Texas A&M University, 2010
- Distinguished Lecturer, Consortium for Ocean Leadership, 2008-2009 (8 talks nationwide)
- Montague Center for Teaching Excellence Scholar Award, Texas A&M, 2008
- Distinguished Achievement Teaching Award (College Level), Texas A&M Association of Former Students, 2007

**Refereed Publications ( * indicates my student as author):**

Dameron, S., Leckie, R.M., Clark, K., MacLeod, K.G., **Thomas, D.J.**, in revision, *Palaeogeogr., Palaeoclim., Palaeoecol.*, Extinction, Dissolution, and Ocean Acidification Prior to the Cretaceous/Paleogene (K/Pg) Boundary in the Tropical Pacific.


**Thomas, D.J.** and *Tilghman, D.*, 2014, Geographically Different Oceanographic Responses to Global Warming During the Cenomanian - Turonian interval and Oceanic Anoxic Event 2, *Palaeogeogr., Palaeoclim., Palaeoecol.*, http://dx.doi.org/10.1016/j.palaeo.2014.06.014.

Michael M. Tice  
Associate Research Scientist, Department of Geology and Geophysics  
Texas A&M University  
College Station, TX 77843-3115  
Phone: 979-204-3272  
Email: mtice@geos.tamu.edu

Education
Stanford University  Ph.D. (Geology)  2006
Duke University  M.S. (Geology)  1999
California Institute of Technology  B.S. (Engineering & Applied Science)  1997

Research Interests
Martian exobiology; Archean paleobiology; sedimentary geology of shale

Professional Appointments
Associate Research Scientist, Dept. of Geology & Geophysics, Texas A&M University  2017–present
Associate Professor, Dept. of Geology & Geophysics, Texas A&M University  2013–2017
Assistant Professor, Dept. of Geology & Geophysics, Texas A&M University  2007–2013
Postdoctoral Fellow, Geobiology, California Institute of Technology  2005–2007
(start date after completion of degree requirements but before award of Ph.D. in Jan. 2006)

Funded Projects
ICDP, Peering into the Cradle of Life: Scientific Drilling in the Barberton Greenstone Belt, South Africa, $400,000, Pls: Nicholas Arndt (Université J. Fourier, France), Alan Wilson (University of Witswatersrand, South Africa), Axel Hofmann (University of KwaZulu-Natal, South Africa), Gary Byerly (Louisiana State University). (Participating as drilling team science leader in charge of site selection for one hole in the Fig Tree Group, logging and preliminary geochemical analyses, and working with the science team for selection of proposals for core access. I also consulted on the site survey for a hole in the Onverwacht Group.)


**Awards**

2012 Montague Scholar (University award for excellence in undergraduate teaching)

**Five Most Recent Peer-Reviewed Publications (‘Denotes graduate student advisee author)**

Z. Zeng* and M.M. Tice, Promotion and nucleation of carbonate precipitation during microbial iron reduction, Geobiology, DOI: 10.1111/gbi.12090, 2014.


Curriculum Vitae – Masako Tominaga

Masako Tominaga
Assistant Professor
Department of Geology and Geophysics, Texas A&M University
masako.tominaga@tamu.edu

Professional Preparation:
Texas A&M University, College Station, TX    Geological Oceanography    Ph.D 2009
Texas A&M University, College Station, TX    Geological Oceanography    M.S. 2005
Waseda University, Tokyo, Japan    Petroleum and Natural Resource Eng.    B. Eng. 2002

Research Interests:
Marine magnetics; Geophysical subsurface monitoring of water-rock interaction processes (e.g. carbon sequestration in ultramafic formations); Deep submergence geophysics.

Experience:
Assistant Professor, Dept. Geology and Geophysics, Texas A&M Univ., July 2015-present
Adjunct Scientist, Woods Hole Oceanographic Institution, Dec. 2012-present
Postdoctoral Research Associate, Texas A&M University, Apr. – Jul. 2009

Research Grants History (funded by federal agencies over last 5 years):
2016    PI, Early Career Seismic Chief Scientists Training Cruise (co-PI, Anne Trehu and Mitch Lyle (OSU), and Greg Mountain (Rutgers))
2015    PI, NSF-EAR-Geophysics, Collaborative Research: Establishing a Novel Geophysical Monitoring Scheme for Delineating In Situ Carbonation Processes in Ultramafic Complexes (co-PI, James Kinsey, Woods Hole Oceanographic Institution)
2015    Co-I, NASA Astrobiology Institute Co-I, Rock-Powered Life: Revealing mechanisms of energy flow from the lithosphere to biosphere (PI, Alexis Templeton (Univ. Colorado), co-Is, Billy Brazelton (Univ. Utah), Carol Cleland, Lisa Mayhew, and Tom McCollom (Univ. Colorado), Dawn Cardace (Univ. Rhode Island), Eric Boyd (Montana State Univ.), Everett Shock (Arizona State Univ.), John Spear (Colorado Sch. Mine), Masako Tominaga (Texas A&M Univ.), Matt Schrenk (Michigan State Univ.), Shuhei Ono (MIT), Tori Hoehler (NASA)).
2013    PI, NSF-OCE: A High-Resolution Deep-AUV Magnetic Survey of the Hawaiian Jurassic Basin. (co-PI: M. Tivey (WHOI), Note: Tominaga was original PI. The PI status had to remain WHOI under Tivey after Tominaga moved to MSU because the OCE program could not change the proposal into “collaborative”).
Awards/Honors (last 10 years):


2009  Distinguished Graduate Student Awards in Research, The Association of Former Students and the Office of Graduate Studies at Texas A&M University.

2008  Schlanger Ocean Drilling Fellowships.

2007  Outstanding Student Paper Award, AGU Fall 2007 Meeting.

5 most recent papers:


THOMAS E. YANCEY
Professor, Department of Geology & Geophysics
Texas A&M University, College Station, Texas  77843
BORN:Lowville, New York, 24 July 1941

EDUCATION:  Ph.D. (Paleontology), University of California, Berkeley, Calif,1971
(Advisor: W.B.N. Berry)
M.A. (Geology), Univ. California, Berkeley, Calif, 1969 (Advisor: W. Hay)
B.A. (Geology), University of California, Berkeley, Calif, 1966

RESEARCH INTEREST: Stratigraphy; Depositional environments; Molluscan paleontology

PROFESSIONAL ASSOCIATIONS:
Geological Society of America; American Association of Petroleum Geologists; SEPM
(Society for Sedimentary Geology); Paleontology Society; Paleontological Association;
Paleontology Research Institute

AWARDS:
Chauncey Holmes Plaque in elementary geology, Syracuse Univ, 1962.
Dorothy K. Palmer Prize in Paleontology, Univ. of Calif., Berkeley, 1971.
Distinguished Teaching Award of Association of Former Students, Texas A&M Univ., 1984.

PROFESSIONAL EXPERIENCE:
1970-1971  Teaching Asst, University California, Department Paleontology
1971-1975  Lecturer, University Malaya, Department of Geology, Kuala Lumpur, Malaysia
1975-1980  Assistant Professor, Idaho State Univ, Department of Geology
1980-1984  Ass't Prof, Assoc Prof, Texas A&M Univ, Department Geology
1994-present  Professor, Texas A&M Univ, Department Geology &Geophysics

RESEARCH GRANTS
"Carboniferous chemostratigraphy: Do epicontinental seas reflect global ocean conditions"; National
Science Foundation - EAR 0643309; $ 290,801; co-P. I. in D. Thomas, B. Miller, E. Grossman, T.
Olszewski & T. Yancey; 15 Jan 2008 - 31 Dec 2010
"Developing techniques for trace element characterization of Eocene-Oligocene volcanic ash in Texas";
Texas A&M University, Faculty Minigrant, FMG R4-034; $1400; P. I.: T. E. Yancey, R. N. Guillemette;
1 September 2000 - 31 August 2001
"Stable isotope record of Carboniferous paleoceanography, paleoclimate and global change"; National
Science Foundation - EAR9628430; 1 June 1997 - 31 May 1999;  E. Grossman and T. Yancey, co-
PIs, $98,325
"Stable isotope record for global and regional change in the late Paleozoic"; National Science Foundation
PIs
"Isotopic studies for late Paleozoic cyclical sedimentary deposits"; National Science Foundation - EAR
"Isotopic studies for late Paleozoic cyclical sedimentary deposits", National Science Foundation - EAR
"Trends in endemism in biotas of an accreted terrane, Permian McCloud formation, East Klamath
Mountains, California"; National Science Foundation - EAR 8217222, Sept. 1, 1984-Feb. 28,1987,
$81,455 - Thomas E. Yancey, sole P.I.
LIST OF MAJOR PUBLICATIONS


HONGBIN ZHAN
Professor and Holder of Endowed Ray C. Fish Professorship in Geology
Department of Geology and Geophysics
Texas A&M University
College Station, TX 77843-3115
PH: (979) 574-4819; FAX: (979) 845-6162
e-mail: zhan@geos.tamu.edu

EDUCATION
1989 B.Sc., University of Science & Technology of China (Physics)
1993 M.Sc., University of Nevada-Reno (Physics)
1996 Ph.D., University of Nevada-Reno (Hydrology/Hydrogeology)

RESEARCH INTERESTS
My research interests focus on groundwater hydrology, flow and transport in geological formations. In particular:
1. Flow and solute transport in low-permeability porous media (including highly deformable media)
2. Stream-aquifer interaction
3. Vapor flow and transport in the subsurface
4. Dynamics of horizontal wells and coupled conduit-aquifer flow problems
5. Non-Darcian flow and its impact on non-Fickian transport
6. Coupled unsaturated-saturated flow and transport problems
7. Radial dispersion and push-and-pull tests
8. Flow and transport in sloping aquifers

EXPERIENCE
Holder of Endowed Ray C. Fish Professorship in Geology, Texas A&M University, 2010-Present
Professor, Department of Geology and Geophysics, Texas A&M University; Water Management and Hydrologic Sciences Graduate Program, Texas A&M University, 2007-Present
Associate Professor, Department of Geology and Geophysics, Texas A&M University; and Water Management and Hydrologic Sciences Graduate Program, Texas A&M University, 2002-2007
Assistant Professor, Department of Geology and Geophysics, Texas A&M University, 1996-2002

COMPETITIVE GRANTS AND AWARDS RECEIVED
National Science Foundation of China Grant No. 41772252 (P.I. Quanrong Wang) 2018-2021, $107,000;
National Science Foundation of China Grant No. 41772259 (P.I. Zhang Wen) 2018-2021, $112,000;
National Science Foundation of China Grant No. 41521001 (P.I. Yanxin Wang) 2016-2021, $1,620,000;
National Science Foundation of China Grant No. 41372253 (P.I. Zhang Wen) 2014-2017, $133,000;
U.S. Geological Survey Grant No.2013TX462B (P.I. Hongbin Zhan) 2013-2015, $47,646.00; National Science Foundation of China Grant No. 41172281 (P.I. Bin Hu) 2012-2015, $128,000; Texas Higher Education Coordinating Board Advanced Research Program Grant (P.I. Hongbin Zhan) 2008-2010, $120,000; National Science Foundation of China Grant No. 40872166 (P.I. Jiazhong Qian) 2009-2011, $64,000; National Science Foundation of China Grant No. 50428907 (P.I. Hongbin Zhan) 2005-2008, $65,000; National Science Foundation Grant BES-9909964 (P.I. Hongbin Zhan) 1999-2001, $41,300; TAMU-CONACYT Grant (P.I. Hongbin Zhan), 2004-2005, $24,000;

AWARDS AND DISTINCTIONS
2016 Dean’s Distinguished Achievement Award in Faculty Research;
2013 Best Paper Award, Journal of Hydrologic Engineering, The American Society of Civil Engineers (the single paper won this award in 2013);
2011 Best Paper Award, Journal of Hydraulic Engineering (in Chinese), Chinese Hydraulic Engineering Society (one of the three papers won this award in 2011);
2010-2017 Distinguished Endowed Chang-Jiang Scholar, Ministry of Education (MOE), China;
2009 Dean’s Distinguished Achievement Award in Faculty Teaching;
2006 Fellow of Geological Society of America;
2004 Distinguished Oversea Young Scientist Award, National Science Foundation of China;
2002 Fred Burggraf Award, Transportation Research Board (TRB), The National Academics;
2001-2002 Big 12 Faculty Fellowship, Texas A&M University;
1999-2000 Montague Scholar, Center for Teaching Excellence, Texas A&M University;

PUBLICATIONS (5 most recent) (total number of publication 176, among them, 170 are peer-reviewed) (* denotes a graduate student author, ** denotes a supervised visiting scholar or postdoc)

Appendix I. Information from the Provost
January 2, 2017

TO: External Program Reviewers and Program Accreditors

FROM: Michael T. Stephenson  
Associate Provost for Academic Affairs and SACSCOC Accreditation Liaison

RE: Information required for USDOE Accrediting Bodies

Texas A&M University is accredited by the Southern Association of Colleges and Schools Commission on Colleges to award baccalaureate, master's, and doctoral degrees. Consistent with comprehensive standard 3.13.1, the following provides the institution’s official position on its purpose, governance, programs, degrees, diplomas, certificates, personnel, finances, and constituencies and is published in official university documents as noted.

**Purpose**

Classified by the Carnegie Foundation as a Research Doctoral University (Highest Research Activity), Texas A&M embraces its mission of the advancement of knowledge and human achievement in all its dimensions. The research mission is a key to advancing economic development in both public and private sectors. Integration of research with teaching prepares students to compete in a knowledge-based society and to continue developing their own creativity, learning, and skills beyond graduation.

The institution’s official mission statement, published both on the institution’s web page as well as in its annual university catalog, is:

> Texas A&M University (Texas A&M) is dedicated to the discovery, development, communication and application of knowledge in a wide range of academic and professional fields. Its mission of providing the highest quality undergraduate and graduate programs is inseparable from its mission of developing new understandings through research and creativity. It prepares students to assume roles in leadership, responsibility and service to society. Texas A&M assumes as its historic trust the maintenance of freedom of inquiry and an intellectual environment nurturing the human mind and spirit. It welcomes and seeks to serve persons of all racial, ethnic and geographic groups, women and men alike, as it addresses the needs of an increasingly diverse population and a global economy. In the twenty-first century, Texas A&M University seeks to assume a place of preeminence among public universities while respecting its history and traditions.

**Governance**

The governance of the institution was described in the 2012 certification of compliance submitted to SACSCOC.
Texas A&M University at College Station, the flagship institution of the Texas A&M University System, has branch campuses located in Galveston, Texas and Doha, Qatar. A ten-member Board of Regents, appointed by the Governor, directs the Texas A&M System. The appointment of each Regent follows Texas Education Code (TEC, Chapter 85, Section 21).

TEC outlines the duties and responsibilities of the Board of Regents. These responsibilities are also defined in System Policy 02.01 Board of Regents and TEC 51.352. The Board elects two officers: Chair and Vice Chair. There are four standing committees: Audit, Academic & Student Affairs, Finance, and Buildings & Physical Plant. Special committees may be appointed by the Chair with Board approval.

At Texas A&M University the President is the chief executive officer; the President is not the presiding officer of the Board of Regents. The President reports to the state-appointed Board of Regents through the Chancellor of the Texas A&M University System. System Policy 2.05 Presidents of System Member Universities defines the duties of the President. The appointment of the President follows conditions set forth in System Policy 01.03 Appointing Power and Terms and Conditions of Employment, section 2.2.

**Personnel**

The institution is led by the President and members of his cabinet:

- Michael K. Young, President
- Carol A. Fierke, Provost and Executive Vice President
- Jerry R. Strawser, Executive Vice President for Finance and Administration and CFO
- Michael Benedik, Vice Provost
- M. Dee Childs, Vice President for Information Technology and CIO
- Michael G. O’Quinn, Vice President for Government Relations
- Col Michael E. Fossum, Vice President and COO, TAMU-Galveston
- Barbara A. Abercrombie, Vice President for HR & Organizational Effectiveness
- Christine Stanley, Vice President and Associate Provost for Diversity
- Amy B. Smith, Senior Vice President and Chief Marking & Communications Officer
- Karen L. Butler-Purry, Interim Vice President for Research
- Carrie L. Byington, Senior Vice President TAMU Health Science Center, Dean of the College of Medicine, and Vice Chancellor for Health Services
- Daniel J. Pugh, Sr., Vice President for Student Affairs
- Joseph P. Pettibon, II, Vice President of Enrollment and Academic Services
- Gen Joe E. Ramirez, Jr. Commandant, Corps of Cadets
- Amy B. Smith, Senior Vice President and Chief Marketing and Communications Officer
- Scott Woodward, Director of Athletics

**Programs, Degrees, Diplomas, and Certificates**

See the Institutional Summary submitted to SACSCOC

**Finances**

See the Financial Profile 2016 submitted to SACSCOC

2
GENERAL INFORMATION

Name of Institution  Texas A&M University

Name, Title, Phone number, and email address of Accreditation Liaison
Michael T. Stephenson
Associate Provost for Academic Affairs and SACSCOC Accreditation Liaison
979.845.4016
mstephenson@tamu.edu

Name, Title, Phone number, and email address of Technical Support person for the Compliance Certification
Alicia M. Dorsey
Assistant Provost for Institutional Effectiveness
979.862.2918
amdorsey@tamu.edu

IMPORTANT:

Accreditation Activity (check one):

☒ Submitted at the time of Reaffirmation Orientation
☐ Submitted with Compliance Certification for Reaffirmation
☐ Submitted with Materials for an On-Site Reaffirmation Review
☐ Submitted with Compliance Certification for Fifth-Year Interim Report
☐ Submitted with Compliance Certification for Initial Candidacy/Accreditation Review
☐ Submitted with Merger/Consolidations/Acquisitions
☐ Submitted with Application for Level Change

Submission date of this completed document:  September 29, 2015
EDUCATIONAL PROGRAMS

1. Level of offerings (Check all that apply)

☐ Diploma or certificate program(s) requiring less than one year beyond Grade 12
☐ Diploma or certificate program(s) of at least two but fewer than four years of work beyond Grade 12
☐ Associate degree program(s) requiring a minimum of 60 semester hours or the equivalent designed for transfer to a baccalaureate institution
☐ Associate degree program(s) requiring a minimum of 60 semester hours or the equivalent not designed for transfer
☒ Four or five-year baccalaureate degree program(s) requiring a minimum of 120 semester hours or the equivalent
☒ Professional degree program(s)
☒ Master's degree program(s)
☒ Work beyond the master's level but not at the doctoral level (such as Specialist in Education)
☒ Doctoral degree program(s)
☐ Other (Specify) ______

2. Types of Undergraduate Programs (Check all that apply)

☐ Occupational certificate or diploma program(s)
☐ Occupational degree program(s)
☐ Two-year programs designed for transfer to a baccalaureate institution
☒ Liberal Arts and General
☒ Teacher Preparatory
☒ Professional
☐ Other (Specify) ______

GOVERNANCE CONTROL

Check the appropriate governance control for the institution:

☐ Private (check one)

☐ Independent, not-for-profit

Name of corporation OR
Name of religious affiliation and control: ______

☐ Independent, for-profit *

If publicly traded, name of parent company: ______
Public state * (check one)

☐ Not part of a state system, institution has own independent board
☒ Part of a state system, system board serves as governing board
☐ Part of a state system, system board is super governing board, local governing board has delegated authority
☐ Part of a state system, institution has own independent board

* If an institution is part of a state system or a corporate structure, a description of the system operation must be submitted as part of the Compliance Certification for the decennial review. See Commission policy “Reaffirmation of Accreditation and Subsequent Reports” for additional direction.

INSTITUTIONAL INFORMATION FOR REVIEWERS

Directions:
Please address the following and attach the information to this form.

1. History and Characteristics
Provide a brief history of the institution, a description of its current mission, an indication of its geographic service area, and a description of the composition of the student population. Include a description of any unusual or distinctive features of the institution and a description of the admissions policies (open, selective, etc.). If appropriate, indicate those institutions that are considered peers. Please limit this section to one-half page.

2. List of Degrees
List all degrees currently offered (A. S., B.A., B.S., M.A., Ph.D., for examples) and the majors or concentrations within those degrees, as well as all certificates and diplomas. For each credential offered, indicate the number of graduates in the academic year previous to submitting this report. Indicate term dates.

3. Off-Campus Instructional Locations and Branch Campuses
List all locations where 50% or more credit hours toward a degree, diploma, or certificate can be obtained primarily through traditional classroom instruction. Report those locations in accord with the Commission’s definitions and the directions as specified below.

Off-campus instructional sites—a site located geographically apart from the main campus at which the institution offers 50 % or more of its credit hours for a diploma, certificate, or degree. This includes high schools where courses are offered as part of dual enrollment. For each site, provide the information below. The list should include only those sites reported and approved by SACSCOC. Listing unapproved sites below does not constitute reporting them to SACSCOC. In such cases when an institution has initiated an off-campus instructional site as described above without prior approval by SACSCOC, a prospectus for approval should be submitted immediately to SACSCOC.
### Institutions with off-campus instructional sites

Institutions with off-campus instructional sites at which the institution offers 25-49% credit hours for a diploma, certificate, or degree—including high schools where courses are offered as dual enrollment—are required to notify SACSCOC in advance of initiating the site. For each site, provide the information below.

<table>
<thead>
<tr>
<th>Name of Site</th>
<th>Physical Address (street, city, state, country) Do not include PO Boxes.</th>
<th>Date Notified SACSCOC by SACSCOC</th>
<th>Date Implemented by the institution</th>
<th>Educational programs offered (specific degrees, certificates, diplomas) with 25-49% credit hours offered at each site</th>
<th>Is the site currently active? (At any time during the past 5 years, have students been enrolled and courses offered? If not, indicate the date of most recent activity.)</th>
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### Branch campus

Branch campus—an instructional site located geographically apart and independent of the main campus of the institution. A location is independent of the main campus if the location is (1) permanent in nature, (2) offers courses in educational programs leading to a degree, certificate, or other recognized educational credential, (3) has its own faculty and administrative or supervisory organization, **and** (4) has its own budgetary and hiring authority. *The list should include only those branch campuses reported and approved by SACSCOC.* Listing unapproved branch campuses below does not constitute reporting them to SACSCOC. A prospectus for an unapproved branch campuses should be submitted immediately to SACSCOC.

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<tr>
<th>Name of Branch Campus</th>
<th>Physical Address (street, city, state, country) Do not include PO Boxes.</th>
<th>Date Approved by SACSCOC</th>
<th>Date Implemented by the institution</th>
<th>Educational programs (specific degrees, certificates, diplomas) with 50% or more credits hours offered at the branch campus</th>
<th>Is the campus currently active? (At any time during the past 5 years, have students been enrolled and courses offered? If not, indicate the date of most recent activity.)</th>
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4. Distance and Correspondence Education
Provide an initial date of approval for your institution to offer distance education. Provide a list of credit-bearing educational programs (degrees, certificates, and diplomas) where 50% or more of the credit hours are delivered through distance education modes. For each educational program, indicate whether the program is delivered using synchronous or asynchronous technology, or both. For each educational program that uses distance education technology to deliver the program at a specific site (e.g., a synchronous program using interactive videoconferencing), indicate the program offered at each location where students receive the transmitted program. Please limit this description to one page, if possible.

5. Accreditation

(1) List all agencies that currently accredit the institution and any of its programs and indicate the date of the last review by each.

(2) If SACS Commission on Colleges is not your primary accreditor for access to USDOE Title IV funding, identify which accrediting agency serves that purpose.

(3) List any USDOE recognized agency (national and programmatic) that has terminated the institution's accreditation (include the date, reason, and copy of the letter of termination) or list any agency from which the institution has voluntarily withdrawn (include copy of letter to agency from institution).

(4) Describe any sanctions applied or negative actions taken by any USDOE-recognized accrediting agency (national, programmatic, SACSCOC) during the two years previous to the submission of this report. Include a copy of the letter from the USDOE to the institution.

6. Relationship to the U.S. Department of Education
Indicate any limitations, suspensions, or termination by the U.S. Department of Education in regard to student financial aid or other financial aid programs during the previous three years. Report if on reimbursement or any other exceptional status in regard to federal or state financial aid.

Document History
Adopted: September 2004
Revised: March 2011
Revised: January 2014
1. History and Characteristics

Provide a brief history of the institution, a description of its current mission, an indication of its geographic service area, and a description of the composition of the student population. Include a description of any unusual or distinctive features of the institution and a description of the admissions policies (open, selective, etc.). If appropriate, indicate those institutions that are considered peers. Please limit this section to one-half page.

History. Texas A&M University was established in 1871 as the state’s first public institution of higher education and opened for classes in 1876. We are now one of a select few institutions in the nation to hold land grant, sea grant (1971) and space grant (1989) designations. We are also one of few universities to host a presidential library; the George Bush Presidential Library and Museum opened in 1997. A mandatory military component was a part of the land grant designation until 1965 and today we are one of only three institutions with a full-time corps of cadets, leading to commissions in all branches of service. We have two branch campuses, one in Galveston, Texas, (established in 1962, officially merged with Texas A&M in 1991) and one in Doha, Qatar (established in 2003). In 2001 we were admitted to the Association of American Universities (AAU) and in 2004 to Phi Beta Kappa. We are classified by the Carnegie Foundation as a Research University (very high research activity).

Mission. Texas A&M University is dedicated to the discovery, development, communication, and application of knowledge in a wide range of academic and professional fields. Its mission of providing the highest quality undergraduate and graduate programs is inseparable from its mission of developing new understandings through research and creativity. It prepares students to assume roles in leadership, responsibility and service to society. Texas A&M assumes as its historic trust the maintenance of freedom of inquiry and an intellectual environment nurturing the human mind and spirit. It welcomes and seeks to serve persons of all racial, ethnic and geographic groups as it addresses the needs of an increasingly diverse population and a global economy. In the 21st century, Texas A&M University seeks to assume a place of preeminence among public universities while respecting its history and traditions.

Enrollment Profile.
77.42% Undergraduate, 18.41% Graduate, 4.02% Professional, and 0.14% Post-Doc Certificate

Undergraduate Students:
93.58% Texas Residents, 3.96% non-Texas Residents, 2.46% non-Texas, non-US Residents;
62.41% White, 3.11% Black, 22.33% Hispanic, 6.21% Asian

Graduate Students:
45.09% Texas Residents, 16.57% non-Texas Residents, 38.34% non-Texas, non-US Residents
Admissions Process. Selective. Automatic admission for Texas resident applicants in the top 10% of their high school graduating class; automatic admission for applicants who rank in the top 25% of their high school graduating class and achieve a combined (old) SAT math and SAT critical reading score of at least 1300 with a test score of at least 600 in each component, or combined (newly redesigned) SAT math and SAT evidence based reading and writing (EBRW) score of at least 1360 with a test score of at least 620 in Math and 660 in EBRW, or 30 composite on the ACT with a 27 in the math and English components; review of all other applicants based on academic potential, distinguishing characteristics, exceptional circumstances and personal achievements.

Peer Institutions. Georgia Institution of Technology, Ohio State University, Pennsylvania State University, Purdue University, University of California- Berkeley, Davis, Los Angeles, San Diego, University of Florida, University of Illinois – Champaign/Urbana, University of Michigan, University of Minnesota, University of North Carolina – Chapel Hill, University of Texas – Austin, and University of Wisconsin – Madison.
2. List of Degrees
List all degrees currently offered (A. S., B.A., B.S., M.A., Ph.D., for examples) and the majors or concentrations within those degrees, as well as all certificates and diplomas. For each credential offered, indicate the number of graduates in the academic year previous to submitting this report. Indicate term dates.

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<td>VETERINARY PUBLIC HEALTH - EPIDEMIOLOGY</td>
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</table>
3. Off-Campus Instructional Locations and Branch Campuses

List **all locations** where 50% or more credit hours toward a degree, diploma, or certificate can be obtained primarily through traditional classroom instruction. Report those locations in accord with the Commission’s definitions and the directions as specified below.

**Off-campus instructional sites**—a site located geographically apart from the main campus at which the institution offers **50 % or more** of its credit hours for a diploma, certificate, or degree. This includes high schools where courses are offered as part of dual enrollment. For each site, provide the information below. **The list should include only those sites reported and approved by SACSCOC.** Listing unapproved sites below does not constitute reporting them to SACSCOC. In such cases when an institution has initiated an off-campus instructional site as described above without prior approval by SACSCOC, a prospectus for approval should be submitted immediately to SACSCOC.

**Off-Campus Instructional Locations – 50% or more.**

<table>
<thead>
<tr>
<th>Name of Site</th>
<th>Physical Address</th>
<th>Date Approved by SACSCOC</th>
<th>Date Implemented by the institution</th>
<th>Educational programs offered (specific degrees, certificates, diplomas) with 50% or more credits hours offered at each site</th>
<th>Is the site currently active? (At any time during the past 5 years, have students been enrolled and courses offered? If not, indicate the date of most recent activity.)</th>
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<td>Saudi Aramco – Box 8926 Training &amp; Career Development South Administration Building, Room 242 Dhahran 31311 Saudi Arabia</td>
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<td>2007</td>
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<th>Date Implemented by the institution</th>
<th>Educational programs offered (specific degrees, certificates, diplomas) with 50% or more credits hours offered at each site</th>
<th>Is the site currently active? (At any time during the past 5 years, have students been enrolled and courses offered? If not, indicate the date of most recent activity.)</th>
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<td>Rangel College of Pharmacy</td>
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<tr>
<td>Baylor University Medical Center</td>
<td>3500 Gaston Avenue Dallas, TX 75246</td>
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### Off-Campus Instructional Locations – 25%-49%

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<th>Name of Site (Indicate if site is currently active or inactive. If inactive, date of last course offerings and date of projected reopening)</th>
<th>Physical Address (street, city, state, country) Do not include PO Boxes.</th>
<th>Date Notified SACSCOC</th>
<th>Date Implemented by the institution</th>
<th>Educational programs offered (specific degrees, certificates, diplomas) with 25-49% credit hours offered at each site</th>
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<td><strong>Department of State Health Services</strong></td>
<td>1100 West 49th Austin, TX. 78756</td>
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### Branch Campuses

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<th>Date Implemented by the institution</th>
<th>Educational programs (specific degrees, certificates, diplomas) with 50% or more credits hours offered at the branch campus</th>
<th>Is the campus currently active? (At any time during the past 5 years, have students been enrolled and courses offered? If not, indicate the date of most recent activity.)</th>
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4. Distance and Correspondence Education

Provide an initial date of approval for your institution to offer distance education. Provide a list of credit-bearing educational programs (degrees, certificates, and diplomas) where 50% or more of the credit hours are delivered through distance education modes. For each educational program, indicate whether the program is delivered using synchronous or asynchronous technology, or both. For each educational program that uses distance education technology to deliver the program at a specific site (e.g., a synchronous program using interactive videoconferencing), indicate the program offered at each location where students receive the transmitted program. Please limit this description to one page, if possible.

**Initial Approval in February 2000**

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<th>Credit Bearing Degree Programs</th>
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<td>AGRICULTURAL EDUCATION</td>
<td>EDD</td>
<td>Synchronous course offered worldwide via PC or LMS</td>
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<tr>
<td>AGRICULTURAL SYSTEMS MANAGEMENT</td>
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<td>NURSING EDUCATION</td>
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<tr>
<td>PETROLEUM ENGINEERING</td>
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<td>PLANT BREEDING</td>
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<td>MAGR</td>
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<td>PUBLIC SERVICE AND ADMINISTRATION</td>
<td>MPSA</td>
<td>College Station, TX Both</td>
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<tr>
<td>RECREATION &amp; RESOURCES DEVELOPMENT</td>
<td>MRRD</td>
<td>College Station, TX Both</td>
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<td>SAFETY ENGINEERING</td>
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<td>STATISTICS</td>
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<td>WILDLIFE SCIENCE</td>
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<td>APPLIED BEHAVIOR ANALYSIS</td>
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<td>EDUCATION FOR HEALTHCARE PROFESSIONALS</td>
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<td>ENERGY</td>
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<td>ENERGY SUSTAINABILITY ENGINEERING</td>
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<td>FORENSIC HEALTH CARE</td>
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<tr>
<td>HOMELAND SECURITY</td>
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<td>Asynchronous</td>
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<tr>
<td>INDUSTRIAL DATA ANALYTICS</td>
<td>CERT</td>
<td>Asynchronous</td>
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<tr>
<td>NATIONAL SECURITY AFFAIRS</td>
<td>CERT</td>
<td>College Station, TX; Livermore, CA; Sandia, NM</td>
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<tr>
<td>NONPROFIT MANAGEMENT</td>
<td>CERT</td>
<td>College Station, TX; Houston, TX</td>
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<tr>
<td>PUBLIC HEALTH</td>
<td>CERT</td>
<td>McAllen, TX</td>
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<tr>
<td>REGULATORY SCIENCE IN FOOD SYSTEMS</td>
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<td>SAFETY ENGINEERING</td>
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<tr>
<td>APPLIED STATISTICS</td>
<td>CERT</td>
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</table>

5. Accreditation

<p>| Accreditation Council for Pharmacy Education | The pharmacy professional degree program | Last Review: April 2014 |
| American Council for Construction Education | The B.S. and M.S. curriculum in construction science | Last Review: 2011 (B.S.) and 2012 (M.S.) |
| American Psychological | The clinical psychology program | Last Review: April/May 2015 |</p>
<table>
<thead>
<tr>
<th>Association</th>
<th>Description</th>
<th>Last Review</th>
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<tbody>
<tr>
<td>Association in the Department of Psychology</td>
<td>in the Department of Psychology and the counseling psychology and school psychology program in the Department of Educational Psychology</td>
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</tr>
<tr>
<td>American Veterinary Medical Association Council</td>
<td>The veterinary medicine degree program</td>
<td>Last Review: 2013</td>
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<tr>
<td>on Education</td>
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<tr>
<td>Association to Advance Collegiate Schools of Business (AACSB)</td>
<td>The business baccalaureate, master’s, and doctoral programs in Mays Business School</td>
<td>Last Review: Fall 2012</td>
</tr>
<tr>
<td>Commission on Accreditation for Dietetics Education</td>
<td>The dietetic track in the nutritional sciences curriculum and the dietetic internship program</td>
<td>Last review: January 2015</td>
</tr>
<tr>
<td>Commission on Accreditation of Athletic Training Education (caATe)</td>
<td>Athletic Training (College of Education)</td>
<td>Last Review: 2013</td>
</tr>
<tr>
<td>Commission on Accreditation of Healthcare Management Education</td>
<td>The Master of Health Administration</td>
<td>Last Review: Fall 2010</td>
</tr>
<tr>
<td>Commission on Collegiate Nursing Education and the Texas Board of Nursing</td>
<td>The nursing degree programs</td>
<td>Last Review: July 2013</td>
</tr>
<tr>
<td>Commission on Dental Accreditation. (CODA)</td>
<td>The degree programs in dentistry and dental hygiene and the certificate programs in the ten advanced dental graduate education programs</td>
<td>Last Review: August 2013</td>
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<tr>
<td>Commission on English Language Program Accreditation (CEA)</td>
<td>The English Language Institute</td>
<td>Last review: 2013</td>
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<tr>
<td>Computing Accreditation Commission of ABET</td>
<td>The computer science program</td>
<td>Last review: 2010</td>
</tr>
<tr>
<td>Council of the Section of Legal Education and Admissions to the Bar of the American Bar Association</td>
<td>Texas A&amp;M University School of Law</td>
<td>Last review: 2010</td>
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<tr>
<td>Council on Education for Public Health</td>
<td>The School of Public Health degree programs</td>
<td>Last Review: April 2011</td>
</tr>
<tr>
<td>Engineering Accreditation Commission of ABET</td>
<td>Undergraduate programs in aerospace, biological and agricultural, biomedical, chemical, civil, computer, electrical, industrial, mechanical, nuclear, ocean, petroleum and radiological health engineering</td>
<td>Last Review: 2010-2011 (College Station) and 2015 (Qatar)</td>
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<tr>
<td>Engineering Accreditation Commission of ABET</td>
<td>Maritime systems engineering (Offshore and Coastal Systems Engineering) – TAMU Galveston</td>
<td>Last review: 2010-11</td>
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<td>Accreditation Body</td>
<td>Program Description</td>
<td>Last Review:</td>
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<td>Engineering Technology Accreditation Commission of ABET</td>
<td>The electronic systems engineering technology program, the manufacturing and mechanical engineering technology program,</td>
<td>2013-2014 (College Station) and 2015 (Qatar)</td>
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<tr>
<td>Engineering Technology Accreditation Commission of ABET</td>
<td>marine engineering technology – TAMU Galveston</td>
<td>2013-14</td>
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<tr>
<td>Forensic Science Education Programs Accreditation Commission (FEPAC)</td>
<td>The forensics and investigative sciences program</td>
<td>Last Site Visit: October 2011 Accreditation dates: 1/2012-1/2017)</td>
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<tr>
<td>Institute of Food Technologists</td>
<td>The food science and technology curriculum</td>
<td>December 2011</td>
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<tr>
<td>Landscape Architectural Accreditation Board</td>
<td>The curriculum in landscape architecture</td>
<td>July 2015</td>
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<tr>
<td>Liaison Committee on Medical Education</td>
<td>The medical education degree program</td>
<td>August 2012</td>
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<tr>
<td>National Architectural Accrediting Board</td>
<td>The curriculum in architecture</td>
<td>March 2013</td>
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<tr>
<td>Network of Schools of Public Policy, Affairs, and Administration</td>
<td>The Master of Public Service and Administration degree in the Bush School of Government and Public Service</td>
<td>April 2014</td>
</tr>
<tr>
<td>National Recreation and Park Association</td>
<td>The curriculum in recreation, park and tourism sciences</td>
<td>June 2010</td>
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<tr>
<td>Planning Accreditation Board</td>
<td>The Master of Urban Planning curriculum</td>
<td>2013</td>
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<tr>
<td>Society for Range Management</td>
<td>The curriculum in rangeland ecology and management</td>
<td>2006</td>
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<td>Society of American Foresters</td>
<td>The curriculum in forestry</td>
<td>2013</td>
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<tr>
<td>State Board of Educator Certification Texas Education Agency</td>
<td>Programs in professional education and degrees conferred by Texas A&amp;M University</td>
<td>2011</td>
</tr>
</tbody>
</table>

(2) If SACS Commission on Colleges is not your primary accreditor for access to USDOE Title IV funding, identify which accrediting agency serves that purpose.

Not applicable.

(3) List any USDOE recognized agency (national and programmatic) that has terminated the institution’s accreditation (include the date, reason, and copy of the letter of termination) or list any agency from which the institution has voluntarily withdrawn (include copy of letter to agency from institution).

None.
(4) Describe any sanctions applied or negative actions taken by any USDOE-recognized accrediting agency (national, programmatic, SACSCOC) during the two years previous to the submission of this report. Include a copy of the letter from the USDOE to the institution.

None.

6. **Relationship to the U.S. Department of Education.**

Texas A&M University does not have any limitations or suspensions, nor have we been terminated by the U.S. Department of Education in regard to student financial aid or other financial aid programs during the previous three years. We are not on reimbursement nor do we have any other exceptional status in regard to federal or state financial aid.
Appendix J. Publications
<table>
<thead>
<tr>
<th>FACULTY</th>
<th>PUBS</th>
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<tr>
<td><strong>PETROLEUM GEOSCIENCES</strong>&lt;br&gt; PRIMARY: EWING (SEDIMENTOLOGY), GIBSON (GEOPHYSICS), PEREZ (BASIN ANALYSIS), REECE J. (SEDIMENTOLOGY), SUN (GEOPHYSICS)</td>
<td>62</td>
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<tr>
<td><strong>WATER RESOURCES AND ENVIRONMENTAL GEOSCIENCES</strong>&lt;br&gt; PRIMARY: EVERETT (GEOPHYSICS), GIARDINO (GEOMORPHOLOGY), KNAPPETT (HYDROGEOLOGY), ZHAN (HYDROGEOLOGY)</td>
<td>162</td>
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<tr>
<td><strong>TECTONIC, DEEP CRUST AND MANTLE DYNAMICS</strong>&lt;br&gt; PRIMARY: CARLSON (GEOPHYSICS), CHESTER J. (TECTONOPHYSICS), CHESTER F. (TECTONOPHYSICS), DUAN (GEOPHYSICS), FULTON (GEOPHYSICS), KITAJIMA (TECTONOPHYSICS), KRONENBERG (MINERAL PHYSICS), LAMB (METAMORPHIC PETROLOGY), MILLER B. (GEOCHRONOLOGY), NEWMAN (STRUCTURAL GEOLOGY), REECE R. (GEOPHYSICS), SPARKS (GEOPHYSICS), TOMINAGA (GEOPHYSICS)</td>
<td>175</td>
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<td><strong>LIFE, CLIMATE AND EARTH HISTORY</strong>&lt;br&gt; PRIMARY: GROSSMAN (GEOCHEMISTRY), MARCANTONIO (GEOCHEMISTRY), RAYMOND (PALEONTOLOGY), TICE (GEOBIOLOGY), YANCEY (PALEONTOLOGY)</td>
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