2022 Academic Program Review Self-Study Report
Department of Geosciences

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THE UNIVERSITY OF ARIZON
COLLEGE OF SCIENCE
Geosciences

MESSAGE FROM THE DEPARTMENT HEAD

I am happy to present our Academic Program Review for 2015-2021, which provides an opportunity for in-depth self-evaluation and for identifying areas of strengths, opportunities, and improvement for the Department of Geosciences. Starting in 2020, the COVID-19 pandemic, coupled with financial challenges at the University level and socio-economic and political unrest at the national level, have created unprecedented challenges for our community of faculty, students, and staff. These challenges have created new barriers but also provided new opportunities to increase resilience, success, and sense of belonging and inclusion. The mission of the Department of Geosciences is to conduct cutting-edge research and to educate new generations of scientists about relevant problems related to our planet including climate change, natural resources, and the fundamental physical, geochemical and biological processes controlling Earth from the core to the clouds. Our science is relevant, impactful and timely as it affects society in multiple ways.

The Department of Geosciences at the University of Arizona is at the forefront of the field and one of the top programs in the country and globally. Our program consistently ranks in the top 3 to 5 programs in Geology and top 10 in related fields. This reflects the caliber of our faculty and students and the commitment of our researchers and staff to the program. Excellence is what we strive for, and we recognize that we cannot be excellent without diversity and that there is no diversity without inclusion. This is why over the last 3 ½ years, we have implemented a series of social initiatives with the goal of increasing a sense of belonging and inclusion within the department.

A degree in Geosciences provides foundational knowledge for opportunities in different fields, including, but not limited to, environmental, water, energy, oil & gas, mining, policy, data science, remote sensing and geophysics. We continue to have a broad impact in geosciences by graduating talented Ph.D. students and postdoctoral scholars who accept academic positions throughout the U.S. and beyond. We value high quality, experiential learning. Our students gain an appreciation of the natural processes governing our planet through field and laboratory experience, experiments, and quantitative approaches we use to test hypotheses related to Geosciences. They also learn that Geosciences is at the core of many of the solutions our society needs to address some of the most pressing challenges of our time such as climate change and the future of natural resources. We feel privileged to be involved in such relevant fields of study that provide fundamental knowledge as building blocks for impactful solutions. The goal of the APR report is to convey the information that underpins our continuing quest for excellence.

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SELF STUDY SUMMARY

SECTION A: SELF STUDY SUMMARY

The purpose of this self-study is to describe and review the academic program in the Department of Geosciences. This report describes and evaluates our recent history, delineates our vision, mission, goals and accomplishments toward our strategic priorities, and presents a plan for future strategic initiatives.

A.1. Administrative Home

The Department of Geosciences is part of the College of Science at the University of Arizona and the School of Earth and Environmental Sciences and is hosted in the Gould-Simpson Building on the main campus of the University of Arizona. The current Department of Geosciences can be traced back to the 1950's when the Department of Geology and Geochronology were housed within the College of Mines. During the 1960's, these departments were merged into the Department of Geosciences within the newly established College of Earth Sciences.

We acknowledge that the University of Arizona sits on the original homelands of Indigenous Peoples who have stewarded this Land since time immemorial. Consistent with our core values as a diverse and inclusive community, it is our institutional responsibility to recognize and acknowledge the people, culture, and history that make up our campus community.

A.2. Faculty

As of FY 2021, the Department of Geosciences includes 33 regular faculty (including 2 split appointments and two administrative positions): 19 full; 2 associate, 9 assistant, 2 professor of practice and 1 senior lecturer (Table A.2). The department also includes 14 emeritus professors, 1 emeritus associate professor, 20 adjunct faculty and lecturers, and 13 joint appointments (https://www.geo.arizona.edu/faculty).

Table A.2.a. Geoscience Faculty Overview by Rank, Fall 2021

Position	Number	FTE	Names
Tenure-Track Faculty			
Full Professors 17.5	19		Carrapa, Barton (FTE .5), Beck, Bennett, Cohen, DeCelles, Ducea, Garzione, Gehrels, Holliday (FTE .25), Holt (FTE .5), Johnson, Jull, Kapp, Pelletier, Quade, Reiners, Ruiz, Russell
Assoc Professors	2	2	Tierney, Jianjun
Asst Professors	9	9	Harig, Ibanez-Mejia, Kiser, Lofverstrom, Mallik, McGuire, Rezeau, Thirumalai, Thompson
Subtotal	*30*	*28.5*	
Career-Track			
Senior Lecturer	1	1	Goodman
Assoc Professors	1	1	J. Kapp
Asst Professors	1	1	Hughes
Subtotal	*3*	*3*	
Total	33	31.5	

A.3. Lecturers, Adjunct Instructors, and Postdoctoral Fellows

As of Fall 2021, the department also includes a large and dynamic group of researchers (30) and post-doctoral fellows (11).

A.4. Academic Programs

As of Fall 2021, the Department of Geosciences includes an undergraduate program (176 students: 23

Freshman, 33 Sophomore, 57 Junior, 63 Seniors with emphasis areas in Geology, Geophysics, Earth-Ocean-Climate, and Gem Sciences; and a dynamic graduate program (67 students; 17 Master, 47 PhD, 3 PMS). We also have a Professional Master in Economic Geology - Lowell Program (3 students). The new emphasis in Gem Sciences started in Fall 2021.

UNIT DESCRIPTION AND GOALS

SECTION B: UNIT DESCRIPTION AND GOALS

B.1. Mission of the Department

We explore, discover, innovate, and teach integrative and interdisciplinary Earth Science, including tectonics, geophysics, climate and surface dynamics, and earth materials and geochemistry. Our goals are to maintain academic excellence in research and teaching by being dynamic and innovative, by providing experiential learning to our students, by actively engaging with the community and by tackling societal relevant issues with our science (https://www.youtube.com/watch?v=85fyqOyZHv4).

Per our code of conduct, we value diversity of race, ethnicity, gender, physical ability, religion, age, sexual orientation, socio-economic status and many other attributes which enhance the creativity, innovation, and impact of our department. Diversity and inclusivity strengthen our community and enrich the educational experience for our students. We are committed to maintaining an atmosphere that is open to differing perspectives, as well as creating and strengthening programs and policies that foster diversity and inclusion of people from historically excluded and marginalized groups. We aim to remove barriers and provide inclusive opportunities in the classroom, the laboratory, and the field. To create a diverse, positive, inspiring, and safe environment for all members of the Department, we are committed to: fostering a workplace climate that is intellectually engaging and free from harassment; treating our colleagues with respect and consideration; supporting and encouraging our students, providing clear expectations for research and academic performance and assisting them with career goals; making our classrooms, laboratories, and field trips accessible; working with the University of Arizona Disability Resources Center; being respectful of the power dynamics among tenured professors, junior professors, staff members, post-docs, and students; raising complaints and concerns through appropriate channels and only in good faith. We consider the following as unacceptable behavior: discrimination of any form, harassment, and retaliation intimidation and bullying, violations of academic integrity, and inappropriate interpersonal relationships that create conflicts of interest in instructional, supervisory, disciplinary, or evaluative contexts (per University of Arizona policy).

B.2. Geosciences Strategic Priorities

In the Department of Geosciences, our overarching goal is to lead the way in fundamental, cutting-edge research on Earth system processes and in innovative and effective training of pure, applied, and policy-making geoscientists. Our department is currently among the best in the nation, particularly among public institutions, and our sights are set on improving and expanding our capabilities to become even better. The strategy for future development/growth in the Department of Geosciences should be guided by four needs:

- Identify and pursue exciting and emerging opportunities in the rapidly expanding realms of geoscience research while maintaining strength in core sub-disciplines/programs.
- Excel in societally relevant research and leverage technological advances to remain at the forefront of research.
- Increase diversity in the Geosciences and within the department.
- Diversify and expand our curriculum.

We are one of the top ranked departments in the country (we consistently rank in the top #5 in Geology) and plan to maintain or improve our rankings. Our ranking contributes to the reputation of the College of Science.

The strategy for faculty hiring in the Department of Geosciences has been and will be guided by three needs: 1) to maintain strength in core sub-disciplines/programs, 2) to excel in societally relevant research, and 3) to leverage technological advances to remain at the forefront of research. Our reputation will remain strong if we continue to invest in areas of traditional strength, including tectonics, geochemistry/Earth materials, and solid-Earth geophysics research as well as our rigorous, field-based educational programs. A particular challenge is the need to maintain our core courses and educational programs given that 45% of the Geosciences faculty will be of average retirement age by 2024.

At the faculty retreat in January 2019, there was a consensus that it is necessary to strengthen sub-disciplines that are: 1) societally most relevant, 2) particularly likely to benefit from computational and other technological improvements, and that 3) provide an opportunity for our department to better integrate with other units across campus. Integration is particularly critical to any future cluster hires, as evidenced by our recent success in procuring new faculty as part of the interdisciplinary Earth Dynamics Observatory and Big Data cluster hires. Hiring proposals that dovetail with the university strategic plan, which includes a call for additional strength in environmental research, may be more likely to succeed. Climate, surface processes, natural hazards, and economic geology are all areas with a high degree of societal relevance in which added strength would allow the department to take a stronger leadership role across campus. Planetary geology, life science, computational sciences/big data, and deep time (e.g., >1 Gyr) processes and Earth history were also identified as broad themes worthy of investment. Fifteen specific positions were discussed, as follows: 1) climate data assimilation and near-term prediction, 2) ice-sheet modeling, 3) remote sensing (e.g., InSAR), 4) Planetary geology, 5) deep-sea sedimentology, 6) paleogenomics (proteins, DNA), 7) conservation paleobiology, 8) U-series geochronology, 9) non-traditional isotope systems, 10) economic geology, 11) geodynamics, 12) seismology, 13) surface exposure dating with cosmogenic radionuclides, 14) the interaction of surface processes and the cryosphere, 15) global-scale modeling of coupled climatic-tectonic-surficial processes.

The 2020 Geosciences Department hiring plan focused on three positions – petrochronology/petrochemistry, tectonics, and paleobiology/paleoecology – in the short term. The petrochronology position addresses the emergence of new techniques/applications that can be pursued by the Arizona LaserChron Center and the need to have additional faculty members who can teach mineralogy, petrology, and geochemistry courses. This position was filled with the hire of Dr. Mauricio Ibanez-Mejia in 2021. The tectonics position addresses the need to maintain our traditional strength in tectonics research and our field-based undergraduate curriculum in the face of significant likely faculty attrition (e.g., retirements) over the next several years. The paleobiology/paleoecology position recognizes the importance of understanding the relationship of life to Earth's changing climatic conditions, the need to have a faculty member teaching paleontology, and the need to broaden our interaction with other units on campus (e.g., Departments of Ecology and Evolutionary Biology and Molecular and Cellular Biology).

Four additional positions are viewed as high priority at the present time.

1. First, the future of the Lowell Program depends on the hiring of an economic geologist as soon as the opportunity arises. A search to fill the Lowell Chair in economic geology was approved in 2021 and the department is currently seeking a faculty member to fill this position starting in Fall 2022.

2. Second, a recurring theme among the positions listed above (especially 2, 14, and 15) is a faculty member that treats coupled climatic-tectonic-surficial processes at regional to global scales. There may be particular interest in hiring an expert on the coupled evolution of ice sheets, climate, and the solid Earth who seeks to better interpret the glacial geomorphic record and better understand Quaternary glacial/interglacial cycles.
3. Third, an expert in the application of existing isotope systems (e.g., U-series, cosmogenic radionuclides) to problems in Quaternary paleoclimate and surface processes or in the development of new isotope systems would collaborate with many people in the department and across campus and continue our traditional strength in geochemistry.
4. Fourth, an expert in data assimilation and near-term climate/natural hazard prediction would have great potential to collaborate across campus on many societally relevant problems.

The Department of Geosciences plans to grow and expand through the creation of a new major in Planetary Geosciences and a new BA in Geosciences. We are also planning to create a new professional certificate program in mineral resources, in collaboration with the School of Mineral Resources. These initiatives will grow our undergraduate program, add prestige and quality to our graduate program, and provide professional education to non-traditional students. These initiatives are described in sections below.

B.3. Relationship to University Strategic Plan

The goals outlined above and throughout this report have strong connections to all five pillars of the University of Arizona Strategic Plan (https://strategicplan.arizona.edu/overview-pillars). Examples of these connections are as follows:

1. **Wildcat Journey:** Efforts to enhance the educational experience of UofA students are built into all of our current goals. An excellent example is provided by current plans to create new B.A. in Geoscience and B.S. in Planetary Geoscience degrees.
2. **Grand Challenges:** Our efforts to continue building strengths in traditional areas of Earth Sciences and build new strengths in emerging fields are perfectly aligned with Grand Challenges related to space exploration, understanding natural environments, and creating sustainable built environments.
3. **Arizona Advantage:** Many of our research, educational, and outreach activities take advantage of our local setting and contribute to solving critical issues in Arizona and beyond.
4. **Arizona Global:** With research activities on every continent and in every ocean basin, the impact of our efforts is truly global in scale.
5. **Institutional Excellence:** The Department of Geosciences has a strong tradition of contributing to institutional excellence, for example, through the courses we teach which serve students in other majors and providing leadership on university initiatives and committees.

UNIT HISTORY

SECTION C: UNIT HISTORY

C.1. Major Changes Since Last Review

Since the last Academic Program Review in 2014, our program has hired 12 new faculty: Jessica Tierney 2015 (climate science-geochemistry), Amanda Hughes 2016 (structural geology), Eric Kiser 2016 (geophysics), Luke McGuire 2016 (surface processes), Chris Harig 2016 (geophysics-climate science), Jack Holt 2018 (60/40 with Lunar and Planetary Laboratory; Planetary Geoscience), Diane Thompson 2018 (climate science-geochemistry), Marcus Lofverstrom 2018 (climate modeling), Kaustubh Thirumalai 2019 (climate science-geochemistry), Ananya Mallik 2020 (petrology), Mauricio Ibanez-Mejia 2020 (geochemistry-petrochronology), Herve Rezeau – starts 2022 (mineral resources). Other major changes include:

- a dedicated effort toward Diversity, Equity and Inclusion with the creation of a DEI committee whose goal is to facilitate policies (e.g.; https://www.geo.arizona.edu/sites/default/files/data/roadmap_to_successful_and_diverse_faculty_hires_in_geosciences_final_sept_23.2.pdf) and targeted opportunities.
- the development of a strategic plan and vision, code of conduct and bylaws (https://www.geo.arizona.edu/code-of-conduct; https://www.geo.arizona.edu/sites/default/files/data/Bylaws%20of%20the%20Department%20of%20Geosciences_April%2024_2019_FINAL.pdf),
- an early-career mentoring program (https://www.geo.arizona.edu/early-career-faculty-mentoring-program), and
- better connections with industry and academia via our advisory board (https://www.geo.arizona.edu/geosciences-advisory-board).

In an attempt to provide a historical background for the department and to illuminate the pathway that led to the current configuration of faculty and resources, Professor George Davis has provided his long-term perspective of Geosciences within the larger University of Arizona enterprise. You can find his P*ersonal Reflections* at https://www.geo.arizona.edu/content/department-history. A short version of this document is provided below together with the chronology of our faculty hires.

C.2. Brief History of the Department of Geosciences

The current Department of Geosciences can be traced back to the 1950's, when Spencer Titley was one of the leaders in the Department of Geology, and Ted Smiley and Paul Damon founded the Department of Geochronology. These departments were housed within the College of Mines, and focused primarily on Economic Geology and Dendrochronology. During the 1960's, Larry Gould and George Gaylord Simpson were hired in an effort to raise the stature of research in the Earth sciences, and the departments of Geology and Geochronology were merged into the Department of Geosciences within the newly established College of Earth Sciences. Ed McCullough was the founding chair of the Department of Geosciences.

Faculty development during the 1960's continued to emphasize economic geology (with the addition of John Guilbert) and Dendrochronology (with the addition of Bryant Bannister), and also built new strengths in ecology/paleontology (George Simpson, Everett Lindsay, Paul Martin), geoarchaeology (Vance Haynes), geomorphology (Bill Bull), and geophysics (John Sumner). The 1970's saw continued growth of geophysics (Bob Butler, Mac Sbar, Randall Richardson), as well as new emphases on structural geology and tectonics

(George Davis, Peter Coney, Bill Dickinson) and petrology (Jibamitra Ganguly, Denis Norton, Tim Loomis). During the 1980's, new hires continued to emphasize ecology/paleontology (Andrew Cohen, Owen Davis, Judy Parrish) and geophysics (Terry Wallace, Clem Chase, Roy Johnson), and the department built new strengths in geochemistry/geochronology (Tim Jull, Chris Eastoe, Joaquin Ruiz, Jonathan Patchett, George Gehrels). The 1990's saw continued development of faculty strengths in geophysics (Susan Beck, George Zandt), economic geology (Mark Barton), tectonics/stratigraphy (Pete DeCelles), surface processes (Jon Pelletier), low temperature geochemistry (Jay Quade), and mineralogy (Bob Downs), and emergence of a new focus on paleoclimate (Jonathan Overpeck, Julia Cole). This time period also saw an important transition in our teaching, with the creation of a new University-wide General Education program that incentivized the development of large-enrollment courses for non-majors. Since then, many faculty members have been involved in developing and teaching these Gen Ed courses, and we have also hired several Professors of Practice, Adjunct Professors, and Lecturers (Jessica Kapp, Paul Goodman, Ji-Yeon Shin, Amanda Hughes, Pranabendu Moitra) to assist with these courses.

New faculty hires during the 2000's and 2010's have continued to build strengths in structural geology (Paul Kapp), tectonics/geochemistry (Mihai Ducea, Peter Reiners, Barbara Carrapa, Mauricio Ibanez-Mejia), economic geology (Eric Seedorff, Matthew Steele-Macinnis, Herve Rezeau), geophysics (Richard Bennett, Eric Kiser, Christopher Harig), paleoclimate (Joellen Russell, Jianjun Yin, Jessica Tierney, Diane Thompson, Marcus Lofverstrom, Kaustubh Thirumalai), geoarchaeology (Vance Holliday), and surface processes (Luke McGuire, Jack Holt), and we have recently established a new faculty position in Gem Science (Ananya Mallik).

C.3. Summary of Recommendations and Responses to Last APR and Geosciences Strategic Priorities (Recommendations from the 2014 APR are listed in blue below.)

University and College administrators should ensure that at all levels there is a clear understanding that, as was articulated in our meetings with administrators, UAs “Never Settle” strategic plan does accommodate future support for the mission and core strengths of this highly ranked Department. The College of Science has undergone significant reorganization.

After Dean Joaquin Ruiz stepped down in 2019, Interim Dean Elliott Cheu was in place until June 2021 when new Dean Carmala Garzione took office. The lack of continuity in leadership has prevented the College of Science from having a coherent vision and strategic plan in the last few years. Strategic planning at all institutional levels has also been challenging during the Covid-19 pandemic. The department is looking forward to working with our new Dean on developing strategies in line with our collective vision and university strategic plan. The College of Science has asked all units to create a short-term (2-year) strategic plan to be submitted in January 2022. See Appendix G.

The Department faculty should develop, and the administration should endorse, an integrated strategy for faculty hiring that addresses its near-term retirements, including, but not limited to, consideration of a cluster hire to ensure continued strengths in key areas while optimizing investments in start-up funds.

The department was able to hire three new faculty members during 2016 (Luke McGuire, Chris Harig, and Jack Holt) as part of a cluster hire initiative. Following hires were in line with a collective vision and strategic plan the department developed over the last four years in order to guide future hiring plans. A

dedicated committee was established in 2019 to help establish and write a strategic plan. A retreat in 2020 was focused on this effort and subsequent hiring plans (which the department submits to the College of Science each year) were developed following these efforts. Our strategic plan described in sections B.2. and Appendix G are the result of these efforts.

The Department should develop a more comprehensive and ambitious strategy to increase industry and philanthropic fund raising for faculty and student research support. A focused campaign should include an improved partnership with the College of Science Development Officer(s) leading to new opportunities for flexible department funds to enhance endowments for fellowships and chairs and to support other priority activities. The focus of the Departmental advisory board should be shifted to include strong engagement in development activities.

The department has been working with its advisory board to increase support for the department. New and more diverse members from different fields were added to the board and helped start new initiatives (https://www.geo.arizona.edu/geosciences-advisory-board). These include the creation of the new GeoDiscoveries fund (crowdfunding campaign) used to support faculty seed funding and strategic initiatives around instrumentation and facilities; the Mélange fellowship to support under-represented students; and the Marie Pearthree summer scholarship to support graduate student research with preference to applicants who demonstrate an interest in or commitment to the advancement of women in Geosciences and/or who demonstrate an interest in or commitment to the advancement of populations who are underserved or underrepresented in Geosciences.

Department faculty members should be encouraged to capture new research opportunities through large center-type or consortium-type grants, in particular through collaborations with SEES and the Institute of the Environment.

Faculty in the Department of Geosciences have been able to secure funding for several large and multidisciplinary projects in the last 7 years including: Southern Ocean Carbon and Climate and Observations and Modeling (SOCCOM) (J. Russell, PI; $2,428,271); Collaborative Research: TransANdean Great Orogeny (TANGO) (S. Beck, PI; $1,762,869) and Evolution of Crustal Paleofluid Flow Systems (P. Reiners, PI; $1,002,049). The department has also started a series of meetings (LightBulb Faculty Lunches) to bring faculty together and discuss larger scale scientific projects and collaborations.

Faculty and students should proactively engage and inform University Administration on the special resource requirements of geosciences for lab and field education. Faculty should continue to explore course options such as block scheduling that might provide additional flexibility for instructors and students, particularly to accommodate field-based education and research. The Department should develop an orientation program for new graduate students and appoint a faculty Director of Graduate Studies.

The department has since appointed a Director of Graduate Studies (DGS), appointed a dedicated committee, and provides regular orientation sessions for our incoming graduate students. The DGS approves all paperwork for the graduate students, attends monthly meetings with the graduate college associate deans, and is chair of the department graduate policy committee. The DGS works with the graduate student program coordinator to monitor graduate student progress, assigns teaching assistants

(TAs) with input from faculty and makes sure all graduate students are supported. The DGS also coordinates the awarding of graduate student scholarships. The DGS is available to talk with graduate students about their concerns. The current DGS is Professor Susan Beck who is also on the University of Arizona Graduate Council as a COS representative. Graduate students are encouraged to reach out to their adviser and committee members for additional advice on current progress and future careers. The department is in the process of creating a mentoring program involving the Geosciences advisory board.

Faculty members should be encouraged to develop a systematic program of more direct involvement in advising undergraduate students in career and future education issues.

The department has initiated a series of initiatives aimed at improving undergraduate student mentoring, which includes meeting with faculty during social events, and offering a series of lectures dedicated to career opportunities for students. However, this has been discontinued for lack of interest and the department is looking for other career advising opportunities for students in collaboration with the advisory board. Faculty in the department are actively involving undergraduate students in research through experiential learning, fieldwork, and laboratory experience.

The expertise and professional connections of Department Advisory Board members should be leveraged to mentor students and connect them to opportunities in a variety of career paths beyond an academic career. The Department should deepen its relationships with professional colleagues, alumni, and employers.

Since 2018, the advisory board has seen significant changes. Eleven new and more diverse members were added to the board with the goal to provide broader expertise, better connect with various members of the department, and address different needs including better connections with potential employers. A service limit of 15 years is now specified in the new advisory board bylaws. New members include: Dr. Lisa Park Boush, Professor, University of Connecticut; Dr. Stacie Gibbins, ExxonMobil; Dr. Tekla Harms, Massachusetts Professor in Chemistry and Natural History, Amherst College; Mr. Rick LeVeque (ex-exploration manager for various oil and gas companies), Long Beach, CA; Mr. Anthony Murer Bakersfield, CA (ex-Innovation and Strategic Development Advisor for Aera Energy LLC); Ms. Marie Pearthree Central Arizona Project (Retired); Dr. Kenneth Ridgway, Professor, Department of Earth, Atmospheric, and Planetary Sciences Purdue University; Dr. Simone Runyon, Assistant Professor, Geology and Geophysics, University of Wyoming; Dr. Moira Smith ex-VP of Exploration and Geoscience Liberty Gold Corp; Dr. Kelly West, Deputy Director, UN Environment Programme Science Division, Nairobi, Kenya; Dr. Mark Zoback, Stanford University, Stanford, California. We are starting to explore a way by which advisory board members can be paired with graduate students to advise them through their time in the department.

Faculty, students, and advising staff should consider making presentations at national meetings of diverse professional societies, and perhaps at science academies at Hispanic/Latino-rich institutions in Texas, New Mexico, and Puerto Rico.

The hire of early career diverse faculty members (Mallik, Thirumalai, Ibanez-Mejia) in the last few years will allow for these opportunities in the future.

More frequent and open communication between the Dean, Department head and faculty members should be encouraged. Better communication would help facilitate progress on—and improve understanding of—key faculty concerns regarding potential impacts of the implementation of RCM.

Dean Garzione has significantly improved communication flow from and to the unit. The Department Head and the Dean are committed to engaging faculty on various aspects of academic affairs. A new budget model, AIB (Activity Informed Budgeting) is currently under development, and continuous communication and special informational sessions are provided to faculty and administrators to understand the impact of the new model on individual units.

OVERVIEW OF THE UNIT'S ACADEMIC QUALITY

SECTION D: OVERVIEW OF THE UNIT'S ACADEMIC QUALITY

D.1. Reputational and Outcome Indicators

The Department of Geosciences is at the forefront of the fields of Solid Earth-Tectonics, Geophysics, Geochemistry and Climate research. We are one of the top programs nationally (#3 in Geology, #8 in Earth Sciences, #11 in Geochemistry) and globally (#23 program in Geosciences). Our faculty members include numerous GSA, AGU, AAAS, Guggenheim and Packard Foundation Fellows.

- Faculty members in Geosciences have a diverse portfolio of extramural support, with funding sources including the National Science Foundation, US Geological Survey, the petroleum and minerals industries, NASA, NOAA, Defense Department, Keck and other foundations, as well as the American Chemical Society.
- Of the 25 faculty members with primary appointments in Geosciences, 80% have received significant extramural funding during the past seven years.
- Faculty members in Geosciences are productive and competitive as shown by Figure D1.
- Faculty members include recipients of the following:
    - Penrose Medal (Dickinson)
    - Arthur L. Day Medal (Gehrels, Quade)
    - Donath Medal (P. Kapp)
    - Farouk El Baz (Quade)
    - Lingren Award (Barton, Davis)
    - Kirk Bryan Award (GSA) (Jull)
    - Israel Russell Award (GSA), and International Limnogeology Association Wilmot H. Bradley Medal (Cohen)
    - GSA George P. Woollard Award in Geophysics, AGU Walter H. Bucher Medal, and Gutenberg Lecture (Beck)
    - Pettijohn Medal and the Lawrence L. Sloss Award (DeCelles)
    - GSA Career Contribution Award in Structural Geology & Tectonics (Davis)
    - Brian J. Skinner Award (Seedorff)
    - Pieter Schenck Award for early-career organic geochemists (Tierney)
    - Packard Science and Engineering Fellowship (Tierney)
    - Alexander von Humboldt post-doctoral Fellowship (Carrapa; Mallik) and research prize (Ganguly)
    - The Mineralogical Society of America Award (Barton),
    - NASA Technical Achievement Awards, NASA Group Achievement Awards, and Antarctic Service Medal (Holt)
    - Gladys Cole Award and the Fryxell Award for Interdisciplinary Research (Holliday)
    - Shell Faculty Career Initiation Award and ConocoPhillips Faculty Sponsorship Award (Johnson)
    - Ben Tor Award, Lady Davis Fellowship (Hebrew University), and Japan Society for the Promotion of Science Fellowship at University of Tokyo (Quade)
    - 2022 Dickinson Medal (Carrapa)

- Two members of the National Academy of Sciences (William Dickinson; Vance Haynes)

- Sixteen Geosciences faculty members are Fellows of the Geological Society of America (Baker, Barton, Beck, Carrapa, Cohen, G. Davis, DeCelles, Ducea, Flessa, Gehrels, Holliday, Jull, P. Kapp, Pelletier, Quade, Ruiz)
- Eight Geosciences faculty members are Fellows of the American Geophysical Union (Baker, Beck, Cohen, DeCelles, Gehrels, Quade, Reiners, Tierney, Zandt)
- NSF Career award (Thompson, Tierney, Ibanez-Mejia, Harig)
- Fellow of the Society of Economic Geologists (Ruiz)
- Fellow of the Mineralogical Society of America (Downs, Ganguly)
- Fellow of the Meteoritical Society (Jull)
- Fellow of the Geochemical Society (Quade)
- American Association for the Advancement of Science (Downs, Flessa)

University of Arizona Awards

Some of our most distinguished awardees include, but are not limited to:

- University Distinguished Professor (Cohen, Flessa, Gehrels, Russell)
- University Regents Professorship (Davis, Overpeck)
- Thomas R. Brown Distinguished Chair of Integrative Science (Russell)
- 1885 Society Distinguished Scholar Award (Russell)
- Provost's General Education Teaching Award (Gehrels, Russell)
- Excellence in Postdoctoral Mentoring Award (Gehrels)
- Richard Ruiz Outstanding Faculty Fellow in a Specialized Center (Bennett)
- The Faculty of Science Creative Teaching Award (Cohen, Flessa)
- The Faculty of Science Distinguished Advising Award (Gehrels)
- Bisgrove Scholar Award from Science Foundation Arizona (McGuire)
- College of Science Innovation and Teaching award (Gehrels, J. Kapp)
- Galileo Circle Marie Curie award (Tierney)
- Galileo Circle fellow (DeCelles, Gehrels)
- Gerard P. Kuiper Award (Russell
- RDI-TRIF-WEES Award (McGuire)

Our graduate students include several NSF, EPA, NASA, NSAS, ARCS fellows and Philanthropic Educational Organization (PEO) Scholars.

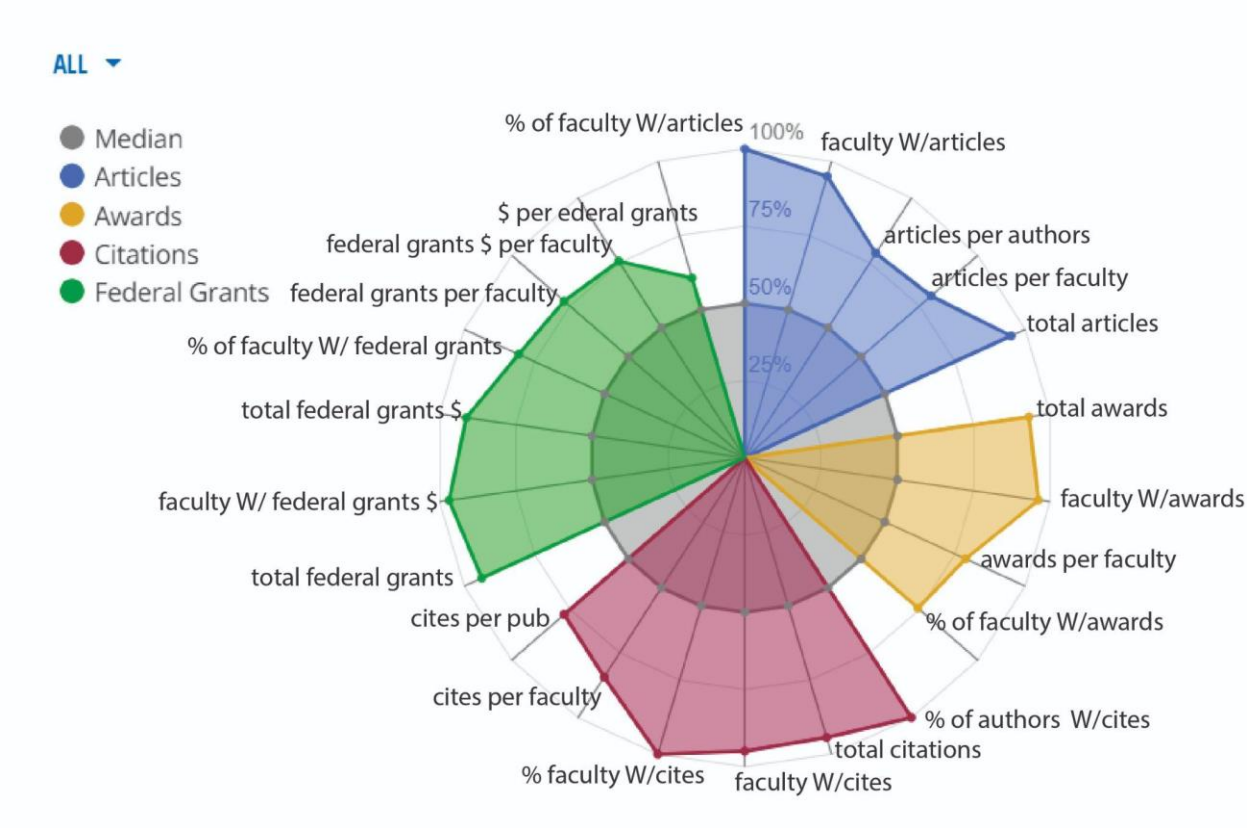


Figure D.1. Productivity

Productivity radar showing how our faculty compare to the peer group identified in section D.2 below, for the time frame 2016-2021, based on Research index, which includes articles (25%), awards (20%), citations (25%), books (10%), conference proceedings (5%), grants (25%). We note that funding from private foundations and companies are not included in these plots.

D.2. Comparison to Peer Institutions

We have identified 12 peer institutions based on rankings, size and similarity of programs: Arizona State University, University of California Berkeley, University of California, Davis; University of California, Los Angeles (UCLA); Stanford University, University of Southern California, University of Colorado Boulder, University of Minnesota, Twin Cities; Pennsylvania State University, University of Texas at Austin, University of Washington, University of Wisconsin, Madison. These institutions have been selected on the basis of similarities with our department and ranking. In the following, we present a comparison of our program (using Academic Analytics) against this peer group.

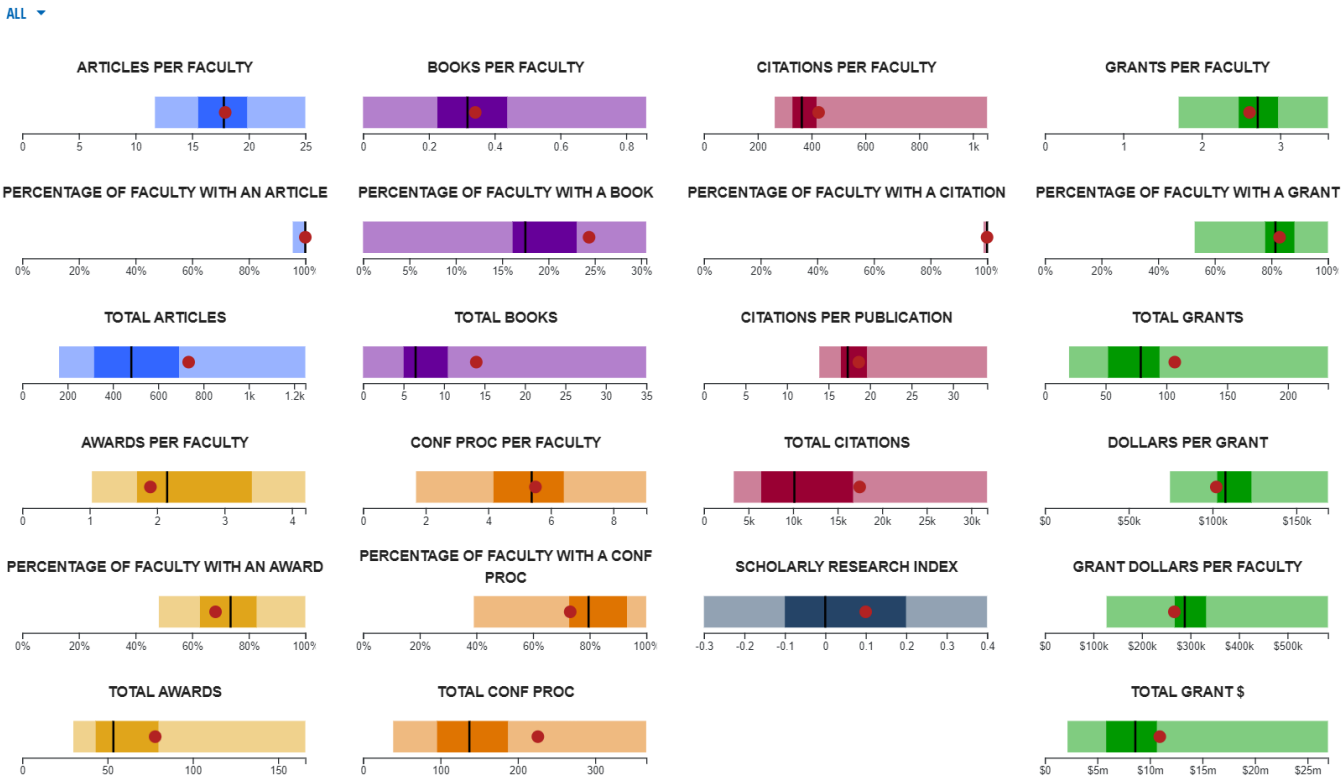


Figure D.2. Geosciences Benchmarking

Geosciences benchmarking plots, for the time frame 2016-2021, showing comparisons of our faculty with respect to faculty in the peer group defined above. Larger colored boxes represent 75-100 percentile, darker boxes represent the 25-50 percentile; red dots represent where the Geosciences faculty plot compared to the peer group. We note that funding from private foundations and companies are not included in these plots

FACULTY

SECTION E: FACULTY

E.1. Nature and Breadth of Faculty Research

Our faculty members in Geosciences investigate an extraordinary range of processes and timescales to better understand the interactions between the deep Earth, the surface, the atmosphere and the oceans and the implications of these interactions for physical processes and phenomena observed on Earth and other planets, mineral resources, ecosystems and human life. Topics covered across our research program are described below. TT: tenure track faculty, CT: career track faculty. Only TT faculty (including joint faculty) are included in the academic analytics analysis in section E.

E.1.a. PETROLOGY-MINERALOGY, GEOCHEMISTRY AND MINERAL RESOURCES

Mark Barton (TT, Full Professor) is an expert in economic geology and geochemistry related to how materials are distributed and transported in Earth's crust, as well as their practical consequences. Research topics range from ore deposit types, to regional metallogeny and tectonics, to the general mass and energy transfer processes associated with magmatism and metamorphism.

Bonner Denton (TT, Full Professor - Joint Faculty, Chemistry and Geosciences) has interests in numerous areas of chemical analysis and contributed to the development of high performance "scientific mode" array detectors (CCD and CIDS) to optical spectroscopy. He and his team are on the verge of accomplishing much the same thing in mass spectrometry with development of the first array- based commercial isotope ratio mass spectrometer.

Robert Downs (TT, Full Professor Emeritus - Retired) works on mineral evolution and planetary mineralogy. He has been heavily involved in NASA missions such as the Curiosity Rover on Mars.

Mihai Ducea (TT, Full Professor) studies large-scale tectono-magmatic processes that led to the differentiation of the continental lithosphere on Earth. A key focus is on the evolution of continental magmatic arcs and their role in crustal growth and differentiation, and the advancement of radiogenic isotopic measuring techniques. [Mihai also has a Tectonics focus.]

Jibamitra Ganguly (TT, Full Professor - Retired) is an expert in quantitative understanding of the thermal evolution of terrestrial rocks and meteorites, by studying the mineralogy, petrology, and diffusion kinetic properties of mineralogical systems. Major projects have included: subduction and recycling of oceanic slabs, petrological geodynamics of Earth's mantle, experimental determination of diffusion kinetic properties of key minerals, and kinetics of selected hydration reactions and implications for the accretion of water during the condensation of solar nebula. [Jibamitra also has a Geochemistry and Geochronology focus.]

Mauricio Ibañez-Mejia (TT, Assistant Professor) focuses on the application of geochemical techniques, particularly isotope geochemistry, to elucidate the timing and mechanisms of high-temperature processes in the Earth's crust and mantle. To achieve this, Ibañez-Mejia's group is developing new methods of 'non-traditional stable isotopes' applied to the study of magma petrogenesis, crustal evolution, and sediment provenance. [Mauricio also has a Tectonics focus.]

Timothy Jull (TT, Full Professor) explores various applications of accelerator mass spectrometry (AMS) to radiocarbon dating and to measurements of other cosmogenic radionuclides such as ^{10}Be and ^{26}Al. A

recent focus of the 14C work is identifying excursions in the ^{14}C record in tree rings, which are associated with solar flare and other cosmic-ray events. He also studies ^{129}I from nuclear sources, as a tracer in the oceans. His research includes the study of both terrestrial and extraterrestrial material, such as meteorites.

Ananya Mallik (TT, Assistant Professor) is interested in using experimental petrology to understand the evolution and differentiation of the Earth and planetary bodies. She is interested in terrestrial deep volatile cycling, investigating feedbacks between the surface and interior reservoirs using volatile elements such as nitrogen and carbon as proxies. She is also studying the evolution of the lunar interior and the distribution of hydrogen in the Moon, in an effort to constrain how wet the Moon is.

Jay Quade (TT, Full Professor) is an expert in geochemical aspects of soils as ecologic and paleoecologic indicators; weathering; radiocarbon dating; stable isotopic and trace element geochemistry of soils and natural waters; and geoarcheology. His recent work has included studying the paleoaltimetry of large orogens, lake records of global climate change, and Neolithic garbage. [Jay also has a Tectonics, an Earth Surface Processes, and a Climate Science and Paleoclimatology focus].

Peter Reiners (TT, Full Professor) applies geochemical and geochronologic techniques, especially those related to thermochronology, to understanding a wide range of geologic problems. His recent work includes understanding He diffusion kinetics in zircon; and dating of clays and secondary oxide minerals to understand paleofluid flow and bedrock alteration over long timescales. [Pete also has a Tectonics focus.]

Hervé Rezeau (TT, Assistant Professor – Lundin Chair in Economic geology - starting Jan 2022) has expertise in petrography, geochemistry and geochronology and his research interests include the behavior of metals and volatiles during magmatic differentiation; magmatic-hydrothermal relationships applied to the mineral exploration (porphyry-epithermal Cu-Mo systems, orogenic gold deposits) and gemology.
Joaquin Ruiz (TT, Full Professor) uses radiogenic and heavy stable isotopes to study the evolution of the crust and mantle through time, the genesis of ore deposits, and environmental and archaeological problems. His work includes studying genesis of the goldfields of the Witwatersrand basin of South Africa using Os isotopes; mantle metasomatism and crustal contamination in arc magmatism in Chile, Mexico, and the Cascades of the western U.S., using Sr, Nd, and Os isotopes; and tracing archeological objects in Mesoamerica using Pb and Os isotopes. [Joaquin also has an Earth Materials and Ore Deposits focus.]
Eric Seedorff (TT, Associate Professor Emeritus - Retired). Eric's interests and expertise include economic geology and structural geology.

Timothy Swindle (TT, Full Professor, Retired- Joint Faculty, Lunar and Planetary Sciences, and Geosciences) uses noble gases in extraterrestrial materials (lunar samples and meteorites) to study the evolution of the solar system. His research has been focused on ^{40}Ar-^{39}Ar dating of lunar samples and meteorites, particularly samples affected by impacts, to determine the collisional history of the inner solar system.

E.1.b. TECTONICS, STRUCTURAL AND SEDIMENTARY GEOLOGY

Barbara Carrapa (TT, Full Professor) is interested in sedimentary geology and in innovating and applying low-T thermochronology to a variety of geologic questions. These include, for example, understanding past tectonic and climatic variations, and how sedimentary basins and exhumation respond to lithospheric-scale processes and long-term climate changes. A particular focus has been on the tectonics, paleoclimate, and paleoaltimetry of large orogens like the Andes and Himalaya. [Barbara also has a Tectonics and a Geochemistry/Geochronology focus.]

George Davis (TT, Full Professor Emeritus - Retired) uses detailed geological mapping and analysis to address problems at the interface of structural geology and regional tectonics. His current projects involve geoarchaeology and tectonics within the Pindos fold and thrust belt (Greece), investigating controls for strain localization in metamorphic core complexes, and evaluating the structure-tectonic evolution of the Colorado Plateau region of northern Arizona and southern Utah.

Peter DeCelles (TT, Full Professor) is interested in understanding the history of collision and convergence of large mountain belts, including Indo-Asian tectonic collision, the history of the Nepalese Himalayan thrust belt and of Cordillera-type systems like the Andes and North America. He led the COSA project, a major collaboration with ExxonMobil aimed at understanding tectonic and magmatic processes at work in Cordilleran orogenic systems as exemplified by the central Andes. [Pete also has an Earth Surface Processes focus.]

George Gehrels (TT, Full Professor) is interested in the stratigraphic, structural, and geochronologic analyses of the Coast Mountains of southeast Alaska; detrital zircon provenance studies of accreted terranes in the western U.S. and Canada; and analysis of the uplift and erosional history of the Tibet Plateau. [George also has a Geochemistry and Geochronology focus.]

Amanda Hughes (CT - Assistant Professor of Practice) integrates geophysical, geological, and rock mechanics data with numerical modeling techniques to characterize the physics governing the formation and growth of geologic structures in the Earth's crust. This process-based understanding of geologic structures is then applied to solve problems in seismic hazard assessment, subsurface resource characterization, and regional tectonics.

Jessica Kapp (CT, Associate Professor of Practice) focuses on teaching and learning, and curriculum development for both geosciences and general education at the University of Arizona. Her specialty is active learning in large lecture classes. She also teaches Historical Geology for geoscience majors, Teaching Geosciences for preceptors, an honors seminar that focuses on women in science, and is working on developing two new honors courses (one on speaking to the public about science, and one on podcasting). She has developed and hosts/produces two podcasts.

Paul Kapp (TT, Full Professor) is an expert in continental tectonics, regional geology, and structural-stratigraphic analysis, with a heavy emphasis on field research. His research interests include tectonic evolution of Asia, with emphasis on the Himalaya-Tibet-Pamir orogenic system. [Paul also has an Earth Surface Processes focus.]

E.1.c. GEOPHYSICS

Susan Beck (TT, Full Professor) uses seismology to understand mountain belts, earthquakes, and faulting. She is interested in the evolution of the North and South American Cordilleras and Tethyan subduction systems. Beck works with seismic tomography and receiver function methods to image volcanic arcs, continental lithosphere and the mantle associated with active deformation.

Richard Bennett (TT, Full Professor) is interested in global challenges in Earth Sciences. His main area of expertise is the field of high precision satellite geodesy for measurement of deformation and gravity, with application to studies of natural hazards.

Christopher Harig (TT, Assistant Professor) uses time-variable gravity and geodynamic numerical models to study large ice sheets and glaciers, and how their changes impact the solid Earth. He is interested in

how the Greenland and Antarctic ice sheets respond to climate change, as well as past ice such as the Laurentide ice sheet.

Jack Holt (TT, Full Professor - split appointment with LPL) uses geophysics to study ice and ice-related processes on Earth and other planetary bodies. He has led numerous airborne geophysical campaigns in Antarctica and field studies of mountain glaciers using airborne and surface-based methods, with a recent focus on Alaska. He is on the Science Team for Mars Reconnaissance Orbiter, leading studies of mid-latitude glaciers and polar caps using orbital radar.

Roy Johnson (TT, Full Professor Emeritus- Retired) is an expert in the application of multichannel seismic reflection and refraction techniques to problems of crustal structure, tectonics, resource exploration, and groundwater and environmental investigations.

Eric Kiser (TT, Assistant Professor) uses seismology to understand earthquakes, magmatic systems, and associated geohazards. He is particularly interested in the magmatic system of Mount St. Helens, the source properties of deep earthquakes, and coseismic landslides.

Randall Richardson (TT, Full Professor Emeritus - Retired) research involves Science Education: science for non-science majors, curricular reform at the university level and service at the national level.

George Zandt (TT, Full Professor Emeritus - Retired) studies the geodynamic processes and geologic evolution of major continental mountain systems in North and South America. The main tool he employs is passive-source seismology, i.e., utilizing naturally occurring earthquakes to image large-scale lithospheric structures.

E.1.d. CLIMATE AND SURFACE PROCESSES

Andrew Cohen (TT, Full Professor) investigates modern biotic and physical processes in lakes and their signatures in the stratigraphic record from sediment cores to understand both the history of lacustrine and terrestrial (watershed) ecosystems. He applies this knowledge on various time scales to understand the history of human impacts on lakes, the evolution of lacustrine organisms, and the implications of paleoclimate records from lakes for understanding the environmental context of human origins.

Paul Goodman (CT, Senior Lecturer) has been teaching and/or co-teaching two of the largest Geosciences undergraduate classes online and in person for over 5 years. In 2020, this included 1,158 students and 3474 student credit hours, and he has taught or co-taught over 15,000 students in 6 different classes since 2009. Though primarily an instructor, he has maintained an active research profile assessing global climate and earth system models and mentoring students and has served on several University and departmental committees.

Vance Holliday (TT, Full Professor - joint appointment with Anthropology) analyzes the landscapes and paleoenvironmental conditions associated with early human occupation sites in North America. Improving our understanding of the chronology of human settlement and demographic expansion in the Americas across the Pleistocene and Holocene.

Marcus Lofverstrom (TT, Assistant Professor) uses numerical models to study the coupled climate system, with foci in atmospheric circulation, dynamical oceanography, and cryosphere-Earth-system interactions under past, present, and future climates. His research uses a hierarchy of modeling strategies from

idealized simulations to fully-coupled state-of-the-art Earth system models to understand mechanisms of climate change, its impacts across all parts of the Earth system, and how these factors vary across space and time.

Luke McGuire (TT, Assistant Professor) combines numerical modeling and field-based methods to understand landscape evolution and landslide hazards. He works to understand the role of land cover and disturbance events, specifically wildfire, on soil erosion and debris-flow hazards and developing landscape evolution models that incorporate erosion associated with infrequent, extreme events, such as debris flows, as well as the broader interactions between drought, fire, flooding and debris flows as they impact the southwestern U.S.

Jon Pelletier (TT, Full Professor) quantifies and models landform evolution from time scales of individual storm events to mountain building and topographic decay. He aims to understand the feedbacks among topography and fluid flow to predict processes and rates of sediment transport and deposition. He models sediment transport, erosional and weathering processes in a wide range of environments, from wind-driven processes on Earth and Mars, to hillslope and river transport, to changes in the Earth's Critical Zone.

Joellen Russell (TT, Full Professor) uses robot floats, satellites, and supercomputers to observe and predict the ocean's role in the climate and carbon cycle of the past, the present and the future, with the overarching goal of understanding the Southern Ocean and the role of the Southern Hemisphere westerly winds in the global carbon cycle, the global climate, and their response to anthropogenic forcing.

Kaustubh Thirumalai (TT, Assistant Professor) is an expert in paleoclimatology, paleoceanography, and climate dynamics who generates "out of sample" tests for climatic hypotheses surrounding regional and global change mechanisms by reconstructing past variations using stable isotope and trace elemental chemistry in carbonate archives across geological time. He addresses past changes in the hydrologic cycle and monsoon as well as in systems of oceanic currents to help discern how dynamical ocean-atmospheric circulation systems respond to external climate forcing.

Diane Thompson (TT, Assistant Professor) brings the fields of ecology, paleoecology, and paleoclimatology to investigate climates and reef systems of the past. Her research spans a range of scales from local (e.g., reef-scale circulation) to global (e.g., climate variability and change) and capitalizes on a blend of field and laboratory, observational and modeling, and experimental and theoretical approaches to improve our ability to preserve coral reef resilience under current and future climate change.

Jessica Tierney (TT, Associate Professor) investigates past climates (paleoclimatology) using organic geochemical biomarkers for ocean temperatures and the hydrological cycle. She develops new calibration and statistical methods including Bayesian modeling and data assimilation, and climate modeling output to improve our quantitative inferences about past climates on a wide range of time scales. She uues past climate states, such as the Early Eocene Climatic Optimum, to better inform our understanding of likely future climate states in a warming earth.

Jianjun Yin (TT, Associate Professor) uses global coupled climate models to understand climate change and sea level rise, including delineating the relationship between sea-level rise in specific oceanic basins and surging global surface temperatures. He Investigates the role of Atlantic Ocean circulation in sea level rise along the East Coast of the U.S. and its impact on extreme weather and climate events.

E.1.e. New Research Initiatives

We work at the forefront of scientific discovery on fundamental science in challenging and remote places including Tibet, Pamir, Himalaya, South America, Africa, Alaska, Antarctica, the Southern Ocean and Mars. These projects are commonly conducted in a collaborative mode, involving several faculty members, graduate students, and undergraduate students, and commonly include researchers at other institutions. Our faculty and students receive several million dollars of funding from sources such as NSF, Keck Foundation, NASA, NOAA, industry, and foundation and private funds. In the following, we list examples of some of the most significant contributions to advancing the field or discipline.

The Hominin Sites and Paleolakes Drilling Project (HSPDP), PI: Andrew Cohen. The Hominin Sites and Paleolakes Drilling Project (HSPDP) is an international consortium of geoscientists and paleoanthropologists engaged in using drill cores collected from six sites in Kenya and Ethiopia to better constrain the environmental context of human origins in Africa. This ~$10M project (3 major NSF awards totaling ~$7.5M, plus additional funding from ICDP, and the German and UK national science funding organizations) has involved over 150 scientists from 11 countries. The drill sites are all located in the East African Rift Valley, primarily focused around lacustrine depocenter targets. Drilling was conducted for all HSPDP sites from 2012-2014. To date, the project has resulted in 46 peer reviewed publications (many in high profile journals), over 200 abstracts presented at national and international meetings, 11 PhD dissertations, 10 MS theses, and 11 BS theses. It has generated major new findings about African paleoenvironments and paleoclimate, and possible impacts of those events on human evolution and dispersal in and out of Africa.

Subsurface paleofluid history of the Paradox Basin in the Colorado Plateau (KECK); lead PI: Peter Reiners, co-PI: Mark Barton. In 2017, a team of ten University of Arizona researchers were awarded a $1M W.F. Keck Foundation Grant for their project "The Evolution of Crustal Paleofluid Flow Systems." This three-year interdisciplinary study characterized the complex 300-million-year evolution of subsurface paleofluids, their dynamic sources and forcings, and the record of fluid-rock reactions in the Paradox Basin, a ~100,000 square-km region hosting diverse fluids and paleofluid flow manifestations. This project integrated geologic, geochemical, geochronologic, and hydrogeologic observations, analyses, and modeling to elucidate the emergent properties of long-lived paleofluid flow to establish a new benchmark of understanding subsurface fluid-rock systems.

The Southern Ocean Carbon and Climate Observations and Modeling program (SOCCOM)-NSF-NASA-NOAA. In 2014, Distinguished Professor Joellen Russell and her colleagues cofounded the $22M Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) project funded by NSF's Office of Polar Programs, with Russell as the lead of the modeling theme, overseeing both the assimilative and predictive modeling efforts. SOCCOM was launched with a vision to enable a transformative shift in scientific and public understanding of the role of the Southern Ocean in the global carbon cycle, climate change and biogeochemistry. SOCCOM2, a $13M, 4-year extension that began in 2021, continues the original SOCCOM project to obtain a decade of integrated Southern Ocean observations and modeling projections, providing increased understanding and reduced uncertainty. The Southern Ocean accounts for virtually all the global heat uptake by the ocean and ½ of the oceanic uptake of anthropogenic carbon emissions. SOCCOM scientists have published over 135 manuscripts on SOCCOM technology and results.

Predicting erosion rates in formerly mined lands in Arizona (BHP); PI Jon Pelletier. Mining companies are tasked with preventing mine waste from eroding and entering waterways downstream. To do this, they cover the waste material with soil and rock armor and often lower the slope angles and otherwise modify the topography to reduce erosion. The mining industry has few predictive tools for assessing the likely erosional performance of such reclamation designs. As a result, reclamations can fail to achieve erosional stability, resulting in costly maintenance. This project aims to fill that gap. PI Pelletier and his team are measuring water and sediment discharge at unprecedented accuracy and resolution in order to predict the shear stresses exerted on cover materials during extreme rainfall events.

TANGO (NSF-FRES): TransAndean Great Orogeny (University of Arizona lead PI: Susan Beck; co-PIs: Carrapa, DeCelles, Kiser): Continental mountain belts form Earth's highest topography play a major role in global atmospheric and oceanic processes, chemistry, and evolution; biosystems are directly controlled by orogenic belts. Nevertheless, one of the outstanding scientific questions remains: How does plate tectonics produce mountains? PIs in the Department of Geosciences and collaborators have been funded for Collaborative Research: TransAndean Great Orogeny or TANGO for short, by the NSF Frontier Research in Earth Science program (~$2.9M). TANGO is a project to study how the Andes in South America formed and produce an integrated Earth systems (mantle-lithosphere-surface) 3D model of mountain building based on the Andes as a natural laboratory, led by S. Beck with B. Carrapa, P. DeCelles, M. Ducea and E. Kiser and national and international collaborators.

Climate-change vulnerability in the Marshall Islands: learning from the past & inspiring a new future NSF-CAREER, PI: Diane Thompson. Low-lying islands of the Republic of the Marshall Islands (RMI) are projected to become uninhabitable by 2040 due to seawater flooding of their drinking water supply. The research goal of this study is to use climate data from corals, sediments, and models to document the response of the tropical Pacific to past natural climate change. The integrated education and research aspects of this CAREER program will build on existing partnerships with the Biosphere 2 (B2), Tucson Unified School District (TUSD), and the Marshall Islands Marine Resource Authority (MIMRA). This study will improve our understanding of the risks of drought and salt-water flooding in the Marshall Islands, train the next generation of scientists, and inspire solutions for an improved future.

Community Facility Support for the Arizona LaserChron Center (PI's Gehrels and Ibanez-Mejia): The Arizona LaserChron Center (ALC) has been funded by the National Science Foundation to serve as a national facility for U-TH-Pb geochronology since 2006, and funding has recently been awarded through 2024. ALC research contributes to our understanding of processes such as the growth of continents, formation of mountain systems, generation and transport of sediments, formation of essential mineral and hydrocarbon resources, causes of extinctions, and linkages between climate and tectonics. Each year, the ALC supports the research of ~160 faculty members, ~120 graduate students, and ~80 undergraduate students who represent ~100 different academic institutions. ~60 of these researchers (mostly students) belong to under-represented minority groups.

Our department has some of the best laboratories in the world. Geochronology remains an area of emphasis, as it has been at the University of Arizona for over 50 years. Our geochronologic facilities focus on Re-Os, Rb-Sr and Sm-Nd (by ID-TIMS), U-Th-Pb (by LA-ICPMS), $^{40}Ar/^{39}Ar$, (U-Th)/He, fission track, cosmogenic isotopes, and dendrochronology and we have considerable strengths in stable isotope and

organic geochemistry. We have a state-of-the-art organic geochemistry lab dedicated to paleoclimate studies and active laboratories in climate modeling and physical oceanography.

We recently hired three new faculty members in the general field of climate dynamics and paleoclimate and three in the field of solid earth, and we are very excited to add new strengths to the department. Geosciences has been involved in the design of the new University of Arizona Gem & Mineral Museum, which is the anchor tenant in the Old Pima County Courthouse in downtown Tucson. The RealReal company has supported funding of an endowed chair in Gem Science in the Department of Geosciences. The Institute for Mineral Resources bridges pure and applied science to provide professional education and multidisciplinary research on responsible stewardship and development of mineral resources.

E.2. Current and Pending Grants

Our external funding portfolio (from July 1, 2017 - June 30, 2025) has reached $21,741,167.00 with approximately $5,946,162 in external funding as pending per Table E.2.1 below.

Table E.2.a Current External Funding (following page)

CURRENT EXTERNAL FUNDING						
Lead Investigator Name	**Award Title**	**Sponsor Name**	**Project Start Date**	**Project End Date**	**Total Obligated Amount (Award)**	**Total Anticipated Amount (Award)**
Abell,Jordan Tyler	Unraveling Southern Hemisphere Westerly Wind Variability Through the Last ~150 KY Using Tasman Sea Sediment	National Science Foundation	09/01/2021	08/31/2023	$280,721.00	$280,721.00
Beck,Susan L	Collaborative Research: HIPER - 3D Onshore-Offshore Imaging of Controls on Subduction Zone Megathrust Rupture and Slip Behavior	National Science Foundation	01/15/2020	12/31/2021	$253,012.00	$253,012.00
Beck,Susan L	Collaborative Research: TransANdean Great Orogeny (TANGO)	National Science Foundation	08/15/2020	07/31/2024	$1,762,869.00	$2,204,385.00
Carrapa,Barbara	Collaborative Research: Rapid Climate Change During the Miocene as a Benchmark to Understand Future Climate Change	National Science Foundation	08/01/2020	07/31/2023	$301,654.00	$301,654.00
Carrapa,Barbara	Rapid Response to Possible Metals Contamination from Legacy Mines in the Patagonia Mountains Region-Future Mineral Environmental Emergency Response and Cuba Mineral Resource Assessment Project	United States Geological Survey	11/01/2016	10/31/2021	$210,000.00	$210,000.00
Carrapa,Barbara	Timing Of Cooling And Exhumation Of Laramide Uplifts Informs Models Of Flat-Slab Subduction	National Science Foundation	08/01/2019	07/31/2022	$398,013.00	$398,013.00
Carrapa,Barbara	USGS, Geology, Minerals, Energy, and Geophysics Science Center and the University of Arizona	United States Geological Survey	10/01/2020	06/30/2025	$247,285.00	$247,285.00
Carrapa,Barbara	University of Arizona, Water Resources Research Center - US Geological Survey, Arizona Water Science Center, Geologic and Water-Resource Programs	United States Geological Survey	10/01/2020	06/30/2025	$579,298.33	$2,249,306.00
Decelles,Peter G	Are Remnants Of The Tibetan Plateau Preserved In the Southern Himalayan Thrust Belt	National Science Foundation	08/01/2018	07/31/2022	$521,188.00	$521,188.00
Decelles,Peter G	Are Remnants Of The Tibetan Plateau Preserved In the Southern Himalayan Thrust Belt	National Science Foundation	08/01/2018	07/31/2022	$51,408.00	$51,408.00
Dettman,David L	Collaborative Research: Improving and Calibrating A Tunable Infrared Laser Direct Absorption Spectroscopy (TILDAS) System For Clumped Isotope Analysis Of CO2	National Science Foundation	03/15/2020	02/28/2022	$449,322.00	$449,322.00
Downs,Robert T	16-MATISE16_2-0005 Mapping X-ray Fluorescence Spectrometer (MapX)	NASA Ames Research Center	12/01/2017	11/30/2021	$104,235.00	$104,235.00
Downs,Robert T	Successor Award to Cooperative Agreement NNX17AK78A for Support for the CheMin Mineralogical Instrument During the Mars Science Laboratory (MSL 'II) Mission - Phase II: Experiment Planning Data...	NASA Ames Research Center	11/01/2019	12/31/2021	$804,187.00	$807,058.00
Flessa,Karl W	Minute 323 Monitoring Plan for the Colorado River Delta	International Boundary and Water Commission	08/01/2018	12/31/2021	$1,123,220.00	$1,123,220.00
Gehrels,George E	Community Facility Support for Geochronology and Thermochronology at the Arizona LaserChron Center	National Science Foundation	06/01/2021	05/31/2024	$590,058.00	$885,087.00
Gehrels,George E	Jura-Cretaceous Sinistral Displacement of Terranes Along the Northern Cordilleran Margin	National Science Foundation	12/01/2018	11/30/2022	$237,138.00	$237,138.00
Holt,John W	A New Regional View of Alaskan Glaciers: Bed Elevation, Ice Thickness and Flux	NASA Headquarters	09/01/2019	08/31/2022	$135,000.00	$135,000.00
Holt,John W	Collaborative Research: The Demise Of The World's Largest Piedmont Glacier	National Science Foundation	09/01/2020	08/31/2023	$299,706.00	$299,706.00
Hughes,Amanda Nicole	Quantitative Seismic Interpretation and Structural Geology Analysis of the Northern Paradox Unconventional Oil Play	Utah Geological Survey	07/01/2021	06/30/2023	$65,277.00	$65,277.00
Ibanez Mejia,Mauricio	Caught in the Act - The Petrology of Modern Lower-Crust Formation and Foundering in the North Andean Arc	National Science Foundation	05/01/2021	08/31/2022	$254,710.00	$294,796.00
Ibanez Mejia,Mauricio	Collaborative Research: The Zirconium Isotope Composition and Variability of theSilicate Earth - A Pilot Study	National Science Foundation	05/01/2021	11/30/2021	$125,320.00	$309,532.00
Jull,Anthony John T	Internal Decadal Anomalies in Atmospheric 14C Quantified with Tree-Ring Proxies and Implications for Long-Term Variability of the Sun-Climate System	NASA Headquarters	07/16/2021	07/15/2025	$165,548.00	$445,328.00
Kapp,Paul A	Lithospheric Dripping in Central Tibet: Underappreciated Factor In Orogenic Plateau Development?	National Science Foundation	06/15/2021	05/31/2024	$443,185.00	$443,185.00
Kapp,Paul A	PIRE: Dust Stimulated Draw-Down of Atmospheric CO2 as a Trigger for Northern Hemisphere Glaciation	University of Rochester	10/01/2015	09/30/2022	$547,985.00	$547,987.00
Kiser,Eric Daniel	Large Landslides and Landslide/Glacier-Dammed Himalayan and Karakoram Rivers and the Potential for Transboundary Disruptions	Planetary Science Institute	01/19/2018	01/18/2022	$564,236.00	$564,236.00
Loefverstroem,Marcus C	Collaborative Research: P2C2--Unravelling the Signals in Tropical Pacific Lake Archives: Towards Improved Holocene Hydroclimate Reconstructions	National Science Foundation	07/01/2020	06/30/2023	$547,191.00	$547,191.00
Mcguire,Luke A	Collaborative Research: Steepland Dynamics and Steady-State Forms Resulting from Debris Flows	National Science Foundation	05/01/2020	04/30/2023	$315,385.00	$315,385.00
Mcguire,Luke A	Expanding Monitoring and Modeling to Assess the Role of Drought in the Persistence of Post-Fire Debris-Flow and Flood Hazards in the Western US	Desert Research Institute	09/01/2021	08/31/2023	$47,163.00	$92,508.00
Mcguire,Luke A	IPA for Luke McGuire	United States Geological Survey	02/01/2020	01/31/2022	$139,950.00	$139,950.00
Mcguire,Luke A	Improved Situational Awareness Of Impactful Post-Fire Debris Flows	Desert Research Institute	06/01/2019	05/31/2022	$143,850.00	$143,850.00
Mcguire,Luke A	Post-Fire Watershed Impacts In Low Desert Areas	Salt River Project	08/01/2021	07/29/2022	$81,883.00	$81,883.00
Moitra,Pranabendu	Collaborative Research: Experimental Constraints On The Solidification Time Scales And Fragmentation Of Submarine Lava Flows	National Science Foundation	08/01/2021	07/31/2024	$380,380.00	$380,380.00
Pelletier,Jon D	Monitoring And Assessment Of Closure Design Performance at BHP sites	BHP Copper, Incorporated	08/01/2018	06/30/2022	$950,359.75	$950,359.75
Quade,Jay	Developing Quantitative Methods to Address Sediment Modification	National Science Foundation	09/01/2021	08/31/2025	$182,143.00	$182,143.00
Russell,Joellen L	Collaborative Research: P2C2: Reconstructing Holocene Climate Change in the Southern Hemisphere from Southern Alps Mountain Glaciers and Tree Rings	National Science Foundation	09/01/2019	08/31/2022	$47,244.00	$47,244.00
Russell,Joellen L	Collaborative Research: Timing of the Termination in Southernmost South America	National Science Foundation	09/01/2020	08/31/2023	$31,191.00	$31,191.00
Russell,Joellen L	Southern Ocean Carbon and Climate Observations And Modeling (SOCCOM2)	Princeton University	08/15/2019	07/31/2023	$458,946.00	$923,294.00
Sundell II,Kurt Eric	NSF GEO-NERC: Collaborative Research: Impact of the Plio-Pleistocene Transition on Provenance and Sediment Routing from the Himalaya to the Deep-Sea Bengal Fan	National Science Foundation	08/15/2020	07/31/2023	$104,657.00	$104,657.00
Thirumalai,Kaustubh	Collaborative Research: P2C2 - Variability, Impacts and Extremes of the ENSO-Asian Monsoon Relationship over the Common Era	National Science Foundation	09/01/2021	08/31/2023	$45,970.00	$45,970.00
Thirumalai,Kaustubh	Collaborative Research: P2C2--Subdecadal Pleistocene Indian Monsoon Variability: A Dual Archive Perspective	National Science Foundation	09/01/2021	08/31/2023	$416,602.00	$416,602.00
Thirumalai,Kaustubh	Collaborative Research: Testing The Indian Ocean El Nino Hypothesis	National Science Foundation	08/01/2019	07/31/2022	$394,545.00	$394,545.00
Thirumalai,Kaustubh	Geochemical Reconstructions of Tropical-to-Subtropical Atlantic Ocean Climate Variability	United States Geological Survey	11/19/2019	11/18/2024	$55,000.00	$349,600.00
Thompson,Diane M	CAREER: Climate-Change Vulnerability In The Marshall Islands - Learning From The Past & Inspiring A New Future	National Science Foundation	06/01/2020	05/31/2025	$487,273.00	$891,119.00
Thomson,Stuart N	Collaborative Research: East Antarctic Glacial Landscape Evolution (EAGLE): A Study Using Combined Thermochronology, Geochronology and Provenance Analysis	National Science Foundation	09/15/2016	08/31/2021	$562,462.00	$562,462.00
Thomson,Stuart N	Collaborative Research: Ice Sheet Erosional Interaction with Hot Geotherm in West Antarctica	National Science Foundation	08/01/2019	07/31/2022	$135,490.00	$135,490.00
Thomson,Stuart N	Collaborative Research: Subduction below Extreme Sedimentation - A Multidisciplinary Transect from the Ganges-Brahmaputra Delta to the IndoBurma Backarc	National Science Foundation	09/01/2017	08/31/2021	$112,123.00	$112,123.00
Tierney,Jessica E	Collaborative Research: A Paleoclimate Perspective on the Response of Southwest North American Rainfall to Elevated Greenhouse Gases	National Science Foundation	08/15/2019	07/31/2022	$62,899.00	$62,899.00
Tierney,Jessica E	Collaborative Research: Anatomy of a Greenhouse World: The Early Eocene in the Green River Basin, Wyoming	National Science Foundation	08/15/2018	07/31/2023	$203,536.00	$203,536.00
Tierney,Jessica E	Collaborative Research: Quantifying the Sea-Surface Temperature Pattern Effect for LGM and Pliocene Constraints on Climate Sensitivity	National Science Foundation	06/01/2020	05/31/2023	$122,779.00	$122,779.00
Tierney,Jessica E	Determination Of Ancient Depositional Environments Via Mulitvariate Analyses Of Glycerol Ether Lipids	American Chemical Society	01/01/2020	08/31/2022	$110,000.00	$110,000.00
Tierney,Jessica E	Molecular Views Of Past Changes in the North American Monsoon	National Science Foundation	05/15/2017	04/30/2022	$504,971.00	$504,971.00
Tierney,Jessica E	paleoCAMP: A Multidisciplinary Summer School For Graduate Students In Paleoclimatology	Heising-Simons Foundation	01/01/2021	12/31/2024	$425,166.00	$425,166.00
Yin,Jianjun	Drivers Of Coastal Sea Level Change Along The Eastern US	National Oceanic and Atmospheric Administration	09/01/2020	08/31/2023	$35,791.00	$35,791.00
TOTAL EXTERNAL FUNDING					**$17,619,525.08**	**$21,741,167.75**

PENDING EXTERNAL FUNDING						
Lead Investigator Name	Award Title	Status	Sponsor Name	Project Start Date	Project End Date	Total Anticipated Amount (Award)
Cohen,Andrew S	REU Site: From the clouds to the core: A place-based REU for southwestern US community/tribal college students to increase under-represented group recruitment to the geosciences	Pending	National Science Foundation	12/01/2021	11/30/2024	$195,687
Cohen,Andrew S	Annual meeting of the Hominin Sites and Paleolakes Drilling Project to be held in Nairobi, Kenya in June-July, 2022	Pending	Smithsonian Institution	03/01/2022	12/31/2022	$29,573
Downs,Robert T	Successor Award to Cooperative Agreement 80NSSC19M0024 for Support for the CheMin mineralogical instrument during the Mars Science Laboratory (MSL'11)	Pending	NASA Headquarters	01/01/2022	12/31/2023	$914,367
Gehrels,George E	Collaborative Research - A new appraisal of tectonic mobility in the northern Cordillera using connections between the Coast Mountains batholith and Alberta foreland basin	Pending	National Science Foundation	01/01/2022	12/31/2024	$121,349
Gehrels,George E	Upgrade of the Scanning Electron Microscope Lab at the Arizona LaserChron Center	Pending	National Science Foundation	01/01/2022	12/31/2022	$133,748
George,Sarah	Collaborative Research - A new appraisal of tectonic mobility in the northern Cordillera using connections between the Coast Mountains batholith and Alberta foreland basin	Pending	National Science Foundation	01/01/2022	12/31/2024	$121,349
Herig,Christopher T	CAREER - Inversion of Localized High-Resolution Polar Gravity Fields to Estimate Mass Change	Pending	National Science Foundation	02/01/2022	01/31/2027	$638,156
Hughes,Amanda Nicole	ADVANCING STRUCTURAL MODELING WORKFLOWS IN FAST	Pending	Aramco Services Company	05/01/2021	04/30/2023	$133,790
Ibanez Mejia,Mauricio	Upgrade of the Scanning Electron Microscope Lab at the Arizona LaserChron Center	Pending	National Science Foundation	01/01/2022	12/31/2022	$133,347
Ibanez Mejia,Mauricio	CAREER: Redefining the high field strength element systematics of subduction systems using non-traditional stable isotopes	Pending	National Science Foundation	02/01/2022	01/31/2027	$679,590
Kilam,Daniel	Reconstructing paleo-insolation and paleo-pH from giant clam shells	Pending	National Science Foundation	05/01/2022	04/30/2024	$0
Kiser,Eric Daniel	Controls on explosive basaltic eruptions within the San Francisco Volcanic Field: Constraints from seismic imaging and multiphase magma ascent modeling	Pending	National Science Foundation	05/01/2022	05/31/2025	$451,651
Lochbroom,Marcus C	A paleoclimate reanalysis of the coupled Greenland Ice Sheet-climate evolution during the Last Interglacial	Pending	National Science Foundation	05/01/2022	04/30/2025	$127,890
Malik,Ananya	Hydrogen Partitioning During Lunar Magma Ocean Crystallization	Pending	NASA Headquarters	01/01/2022	12/31/2024	$488,167
Meguire,Luke A	Expanding monitoring and modeling to assess the role of drought in the persistence of post-fire debris-flow and flood hazards in the western US	Pending	University of California, San Diego	08/01/2021	07/31/2022	$75,405
Michels,Zachary David	Upgrade of the Scanning Electron Microscope Lab at the Arizona LaserChron Center	Pending	National Science Foundation	01/01/2022	12/31/2022	$133,347
Mishra,Pranabendu	Controls on explosive basaltic eruptions within the San Francisco Volcanic Field: Constraints from seismic imaging and multiphase magma ascent modeling	Pending	National Science Foundation	05/01/2022	05/31/2025	$301,100
Osman,Matthew Burton	A paleoclimate reanalysis of the coupled Greenland Ice Sheet-climate evolution during the Last Interglacial	Pending	National Science Foundation	05/01/2022	04/30/2025	$131,766
Russell,Joellen L	Collaborative Research: The Role of Seasonality in Abrupt Climate Change - a Test by Reconstructing Fluctuations of a Late-Glacial Ice Mass in Eastern North America	Pending	National Science Foundation	09/01/2022	08/31/2025	$54,822
Thirumalai,Kaustubh	REU Site: From the clouds to the core: A place-based REU for southwestern US community/tribal college students to increase under-represented group recruitment to the geosciences	Pending	National Science Foundation	12/01/2021	11/30/2024	$195,687
Thirumalai,Kaustubh	What happens when runoff stops? Reconstructing Paleomonsoon Dynamics During Heinrich Events in the Bay of Bengal	Pending	National Science Foundation	09/01/2022	08/31/2024	$157,256
Thompson,Diane M	Reconstructing paleo-insolation and paleo-pH from giant clam shells	Pending	National Science Foundation	05/01/2022	04/30/2024	$193,420
Thompson,Diane M	COLLABORATIVE RESEARCH: A novel multivariate method for reconstructing sea surface temperature and vital effects in scleractinian corals	Pending	National Science Foundation	05/01/2022	05/31/2025	$146,476
Tierney,Jessica E	A paleoclimate reanalysis of the coupled Greenland Ice Sheet-climate evolution during the Last Interglacial	Pending	National Science Foundation	05/01/2022	04/30/2025	$127,890
Tierney,Jessica E	Collaborative Research: Constraining cloud and convective parameterizations using paleoclimate data assimilation	Pending	National Science Foundation	07/01/2022	06/30/2025	$250,331
TOTAL PENDING EXTERNAL FUNDING						$5,848,182

E.3. Faculty Leadership and Influence in the Academic Profession

Faculty in Geosciences are actively involved in several professional organizations, and many of our faculty play prominent leadership roles in the field and make significant contributions at the local, national, and international level. These roles include service on national and international committees such as NSF, IPCC, NASA, NOAA, UNAVCO, AGU, GSA, and review service for many peer reviewed and high profile journals such as Science, Nature, Earth and Planetary Science Letters, Geophysical Research Letters, Tectonics, Geology, Geological Society of America Bulleting, etc. The biosketches in Appendix A and table in Appendix B provide more detailed information and examples on individual faculty leadership roles.

E.4. Teaching Load and Activities

The regular **teaching load** for faculty includes 3 classes per year (including a seminar). In Appendix C, we present a description of the teaching load for the main faculty in the Department of Geosciences. Teacher Course Evaluation/Student Course Survey TCE/SCS Outcomes are aggregated over the entire department for the period 2014-2021 and provided in Table E.4.a. below. These results (1=lowest, 5=highest) for the three principal questions on the end-of-course survey concerning amount learned, overall rating of the instructor's effectiveness,and overall rating of the course indicate a high degree of satisfaction among our students, at both the undergraduate and graduate student levels. Furthermore, for all three questions, and at both the undergraduate and graduate level, our department ranked higher than the means for all courses in the College of Science.

Table E.4.a. Teacher-Course Evaluation/Student Course Survey Outcomes.

(We note that percentages >100% are the result of an issue with University of Arizona analytics, which provides the data).

Department of Geosciences

	Graduate					Undergraduate				
Question Category	Total Enrolled	Respondents	Response Percent	Mean	Std. Dev	Total Enrolled	Respondents	Response Percent	Mean	Std. Dev
Amount learned	1,317	858	65.15%	3.91	0.95	28,695	16,185	56.40%	3.97	0.94
Overall rating of teaching effectiveness	1,317	1,359	103.19%	4.36	0.79	28,695	20,322	70.82%	4.37	0.85
Overall rating of the course	1,317	859	65.22%	4.03	0.92	28,695	16,179	56.38%	4.09	0.98

College of Science

	Graduate					Undergraduate				
Question Category	Total Enrolled	Respondent Count	Response Percent	Mean	Std. Dev	Total Enrolled	Respondent Count	Response Percent	Mean	Std. Dev
Amount learned	25,075	15,674	62.51%	3.83	0.99	525,181	316,455	60.26%	3.78	1.02
Overall rating of teaching effectiveness	25,075	19,275	76.87%	4.31	0.85	525,181	343,983	65.50%	4.10	1.02
Overall rating of the course	25,075	15,653	62.42%	3.90	1.01	525,181	316,486	60.26%	3.70	1.14

E.5. Faculty Recruitment and Planned Directions

Our plan for future recruiting and hiring of faculty follows our vision and hiring plan. Below, we describe faculty gains and losses (hires, resignations and retirements) in Table E.5.a. and a Summary of Faculty Gains, Losses, and Promotions in Table E.5.b.

Table E.5.a. Summary of Faculty Hires, Resignations, and Retirements

	Academic Rank	Tenure Status	2015	2016	2017	2018	2019	2020	2021	**Total**
Hires	Assistant Professor	Tenure Track			3		2	1	2	8
	Instructor	Non-Tenure Track		1						1
	Lecturer	Non-Tenure Track	1		1					2
	No Academic Rank	Non-Tenure Track	1	1						2
Hires Total			**2**	**2**	**4**		**2**	**1**	**2**	13
Involuntary Resignations	Professor	Non-Tenure Track						1		1
	Instructor	Non-Tenure Track	1		1		1			2
	Lecturer	Non-Tenure Track	1							1
Involuntary Resignations Total			**2**		**1**		**1**	**1**		4
Retirements	Professor	Tenure Track	1	2			2		2	7
	Associate Professor	Tenure Track							1	1
Retirements Total			**1**	**2**			**2**		**3**	8
Voluntary Resignations	Professor	Tenure Track				1				1
	Assistant Professor	Tenure Track				1				1
	Lecturer	Non-Tenure Track						1		1
Voluntary Resignations Total						**2**		**1**		3
Grand Total			4	4	5	2	5	3	5	24

Table E.5.b. Faculty Gains, Losses, and Promotions

Summary of Faculty Gains, Losses, and Promotions	
Hires	
2014-2015	Jessica Tierney, Associate Professor
2015-2016	Matthew Steele-MacInnis, Assistant Professor
2016-2017	Eric Kiser, Luke McGuire, Christopher Harig (Assistant Professors) Amanda Hughes (Research Scientist), Ji-Yeon Shin (Lecturer)
2017-2018	Jack Holt, Professor
2018-2019	Diane Thompson, Marcus Lofverstrom (Assistant Professors)
2019-2020	Kaustubh Thirumalai, Assistant Professor
2020-2021	Ananya Mallik, Mauricio Ibanez-Mejia (Assistant Professors)
Resignations	
2017-2018	Jonathan Overpeck, Julia Cole (Professors) Matthew Steele-MacInnis (Assistant Professor)
2019-2020	Ji-Yeon Shin, Sr. Lecturer
Retirements	
2014-2015	George Zandt, Professor
2015-2016	Owen Davis, Jibamitra Ganguly (Professors)
2018-2019	Randall Richardson, Karl Flessa (Professors)
2019-2020	George Davis (Regents' Professor Emeritus)
2020-2021	Robert Downs, Roy Johnson (Professors Emeritus) Eric Seedorff (Associate Professor Emeritus)
Promotion and Tenure	
2014-2015	Richard Bennett (approved for promotion to Full Professor)
2015-2016	Jianjun Yin (approved for promotion to Associate Professor) Barbara Carrapa (approved for promotion to Full Professor)
2017-2018	Jessica Kapp (approved for promotion to Associate Professor of Practice)
2018-2019	Joellen Russell (approved for promotion to Full Professor) Paul Goodman (approved for promotion to Sr. Lecturer) Ji-Yeon Shin (approved for promotion to Sr. Lecturer)
2019-2020	Amanda Hughes (approved for promotion to Assistant Professor of Practice)
Third-year Retention Review (Assistant Professor)	
2016-2017	Matthew Steele-MacInnis (approved for retention)
2018-2019	Eric Kiser (approved for retention) Luke McGuire (approved for retention)
2019-2020	Christopher Harig (approved for retention)
2020-2021	Diane Thompson (approved for retention) Marcus Lofverstrom (approved for retention)
Tenure Granted	
2018-2019	Jessica Tierney (granted tenure)

E.6. Faculty Compensation and Comparison with Peer Institutions

Table E.6.a. Faculty Compensation Range and Average Comparisons By Rank with AAU Peer Programs

FACULTY RANK	AAU PEER LOW SALARY	AAU PEER MEDIAN SALARY	AAU PEER HIGH SALARY	GEOSCIENCES FACULTY AVERAGE COMPENSATION
Assistant Professor	$87,025	$90,949	$95,852	$89,808
Associate Professor	$98,353	$107,288	$118,799	$102,155
Professor	$131,895	$160,826	$204,824	$143,679

E.7. Gender and Race/Ethnicity of Faculty

In the last several years, the department has made concerted efforts to recruit, mentor and retain faculty for under-represented groups. These efforts include:

- putting in place a policy ("roadmap to successful and diverse faculty hires in Geosciences; https://www.geo.arizona.edu/sites/default/files/data/roadmap_to_successful_and_diverse_faculty_hires_in_geosciences_final_sept_23.2.pdf), which describes the process for recruiting diverse faculty;
- creating a well-structured mentoring program for our early career faculty to provide mentoring and support throughout their path to tenure. Our newly established mentoring program is described in Appendix G.

Table E.7.a. Percentage of geosciences faculty by gender.

Sex	2015	2016	2017	2018	2019	2020	2021
Female	21.4%	24.1%	25.8%	24.1%	22.6%	22.6%	22.6%
Male	78.6%	75.9%	74.2%	75.9%	77.4%	77.4%	77.4%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table E.7.b. Percentage of geosciences faculty by race/ethnicity.

IPEDS Race/Ethnicity	2015	2016	2017	2018	2019	2020	2021
Asian	10.7%	6.9%	9.7%	10.3%	6.5%	9.7%	6.5%
Hispanic or Latinx	3.6%					6.5%	
International		3.4%	3.2%		3.2%	3.2%	6.5%
Not Reported	10.7%	13.8%	16.1%	17.2%	16.1%	16.1%	16.1%
White	75.0%	75.9%	71.0%	72.4%	74.2%	64.5%	71.0%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

E.8. Faculty Activities to Enhance Diversity, Equity, and Inclusion

One of our main goals is to grow scientific excellence through increased diversity in the department by promoting inclusivity and equity. We have invested significant efforts directed towards making our department more inclusive and to increase representation of students, faculty and staff who belong to groups that have been traditionally underrepresented in academia in the United States. These efforts include:

- Establishment of an official Diversity, Equity, and Inclusion (DEI) Committee consisting of faculty members and a graduate representative to discuss and advance DEI policies within the department.
- Removal of potential barriers for underrepresented students to be admitted into the Department of Geosciences. This includes for example:
    1. establishment of a codified set of best practices for interactions with prospective students (particularly, students of color);
    2. removal of the Graduate Record Examinations (GRE) as a requirement for admission starting in Fall 2020 (this was done on the basis of recent literature which demonstrates that the GRE is a flawed indicator of academic success, and that it additionally provides significant barriers to the entry of students of color and those from socioeconomically challenged backgrounds); the institution of fellowships specifically dedicated to recruit undergraduate and graduate students from historically excluded and underrepresented backgrounds
- Establishment of a clear code of conduct (https://www.geo.arizona.edu/code-of-conduct) which values diversity and inclusion and new guidelines for successful and diverse hires in the department.
- Establishment of fellowships/scholarships targeted to increasing representation of students belonging to historically underrepresented groups in the department (e.g., Mélange fellowship; Marie Pearthree summer research scholarship).

- A new graduate level class offering: “UA-AGREED-Allies for Gender/Sexuality, Racial and Ethnic Equality & Diversity- taught by Dr. Diane Thompson, which focuses on DEI issues in academia and bystander intervention.

- Mélange Book Club designed around reading relevant literature around DEI issues. This group meets once every two months to discuss a particular book that highlights issues related to social justice and racial representation in academia. We plan to offer this as a 1hr credit seminar moving forward to incentivize student attendance.

- The department continues to support the Association for Women Geoscientists Southern Arizona Chapter (composed of students and faculty) through faculty participation in AWG events and financial support through institution membership and support for gatherings. AWG sponsors a breakfast with all women colloquium speakers to hear their stories, mentors undergraduate students in applying for graduate school and has social hours that faculty attend.

- The establishment of the GEOS-BHAM (Black, Hispanic, Asian Minority ethnic) group for graduate students in the Department of Geosciences was created in an effort to allow for at least one non-white space in our department, wherein graduate students and faculty of color could co-mingle and have candid discussions on academic life as minorities. This effort has brought about policy changes such as establishing an informal yet codified discussion platform between GEOS-BHAM members and prospective applicants of color.
- The department is actively pursuing target opportunity hires in order to increase the number of minority faculty in Geosciences through programs such as SPFI (https://facultyaffairs.arizona.edu/strategic-priorities-faculty-initiative-spfi).
- The Department is committed to increasing representation of minority faculty in our colloquium series and job talks as shown by table E.8.a below.

Table E.8.a. Representation of speakers at Geosciences talks.

All Talks	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Men	22	22	19	16	14	COVID	14	13
Women	8	17	8	13	13	COVID	9	9
Total	30	39	27	29	27	COVID	23	22
% Women	26.67%	43.59%	29.63%	44.83%	48.15%	COVID	39.13%	40.91%
% Non-White	7%	5%	4%	17%	11%		22%	14%

Last 5 years:	
Total	101
Men	57
Women	44
% Women	44%
% Non-White	16%

Job Talks Only	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Men	-	8	2	3	1	COVID	2	-
Women	-	5	1	6	3	COVID	2	-
Total	-	13	3	9	4	COVID	4	-
% Women	-	38%	33%	67%	75%	COVID	50%	-
% Non-White		8%	0%	22%	25%		25%	

All Job talks	
Total	33
Men	16
Women	17
% Women	52%
% Non White	16%

Several of our faculty members are involved in a proposal submitted and now recommended for funding by the NSF led by PI Andrew Cohen and Co-PI Kaustubh Thirumalai to establish a new REU program at the Department of Geosciences. This program will specifically cater to BIPOC (Black, Indigenous, People of Color) students and those with socioeconomically challenging backgrounds from community colleges and tribal colleges across the state of Arizona. The proposed program intends to house students from these colleges for an 8-week summer research experience, with the hope that we build the right scaffolding and inclusive environment for them to ultimately matriculate into a 4-year geoscience program at the University of Arizona. This proposal has been recommended for funding.

E.9. Biographical Sketches

Biographical sketches are included in **APPENDIX A** that summarize research interests, honors and awards, publications, current grant funding, invited lectures, and major service and committee assignments.

UNIT ADMINISTRATION

SECTION F: UNIT ADMINISTRATION

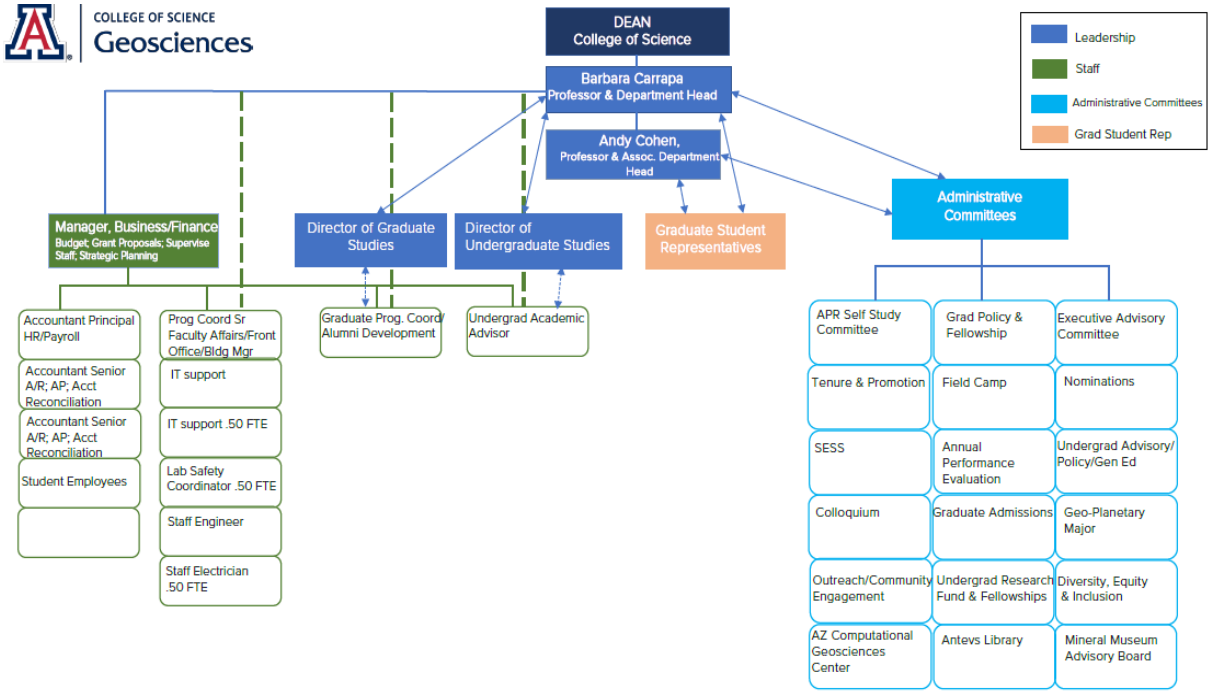
F.1. Department Organization

The Department is led by the Department Head who is appointed by and serves at the direction of the Dean of the College of Science. The Department Head is responsible for leadership, strategic planning, policy implementation and oversight of the entire department and its mission as well as management of all associated resources. The Department Head and the Associate Head work closely with the Director of Graduate Students, the Director Undergraduate Studies, graduate student representatives and with the administrative committees to ensure students, faculty and staff are well represented. Table F.1 below shows the collaborative nature of the leadership of the Department.

All faculty members contribute to the department's mission by joining administrative committees and participating in faculty meetings. The purpose of these committees is to allow faculty a voice in governance and to provide a collaborative space for decisions to be made on key departmental needs. Faculty meetings are scheduled on a monthly basis during the academic year and serve as an opportunity for faculty to vote on various business issues including faculty hires, committee issues, policy updates, etc. Additionally, there is a faculty retreat at the beginning of each academic year. The annual faculty retreat provides a mechanism by which faculty and leadership work together to identify strengths, weaknesses, opportunities and threats to the department.

The Department Head hosts monthly brownbag lunch meetings with staff as a means to discuss any University related issues affecting staff.

Table F.1.a. Organizational Chart



F.2. Classified and University Staff

Table F.2 shows a breakdown of all employees in the Department by appointment type. We have not experienced unusual annual turnover rates in the years since the last APR.

Table F.2.a. Employees by Appointment Type

ABOR Code	2015	2016	2017	2018	2019	2020	2021
Academic Professional	15	13	11	13	13	13	
Administrative	1	2	2	1	1	1	1
Classified Staff	35	29	33	37	31	25	13
Service Professional	8	7	6	8	8	10	
University Staff							35
Grand Total	**59**	**51**	**52**	**59**	**53**	**49**	**49**

F.3. Gender and Race/Ethnicity of Staff and Appointed Personnel

Table F.3.a. Percentage of Staff by Gender

Sex	2015	2016	2017	2018	2019	2020	2021
Female	33.9%	37.3%	48.1%	42.4%	43.4%	40.8%	38.8%
Male	66.1%	62.7%	51.9%	57.6%	56.6%	59.2%	61.2%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table F.3.b. Percentage of Staff by Race/Ethnicity

IPEDS Race/Ethnicity	2015	2016	2017	2018	2019	2020	2021
American Indian or Alaska Native	1.7%	2.0%	1.9%	1.7%	1.9%	2.0%	2.0%
Asian	5.1%	5.9%	7.7%	5.1%	9.4%	6.1%	6.1%
Black or African American	1.7%	2.0%	1.9%	1.7%	1.9%		
Hispanic or Latinx	6.8%	9.8%	11.5%	10.2%	9.4%	14.3%	16.3%
International	1.7%	2.0%		1.7%	1.9%	4.1%	6.1%
Not Reported	15.3%	7.8%	11.5%	13.6%	9.4%	6.1%	8.2%
Two or more races	3.4%	2.0%		1.7%		2.0%	2.0%
White	64.4%	68.6%	65.4%	64.4%	66.0%	65.3%	59.2%
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

F.4. Staff Roles and Adequacy of Staff Support

For the 2021-2022 Fiscal Year, the staffing for the Department of Geosciences is adequate. At present, we have 11 full time staff and 1 part time student employee working in the administrative office. Administrative Staff provide services in the following areas:

Academic Program Support

- Graduate Degree coordinator/advising = 1.00 FTE
- Undergraduate student advising = 1.00 FTE

Business Office/Operations Support

- Business Office = 5.00 FTE plus 1 student
- IT Support = 1.00 FTE
- Facilities/Lab Safety = 2.00 FTE

Academic Program Support

Administrative support for our academic programs comes from two key individuals: Graduate Degree Coordinator/Advisor (Rocina Garcia) and our Undergraduate student advisor (Shawna Matteson). This lean and dedicated administrative team works diligently to guide our undergraduate and graduate students to not only meet their educational requirements but to thrive as young adults. Our Graduate degree coordinator/advisor (Rocina Garcia) supports both the Master's and Ph.D. degree programs by providing academic advising to all graduate students (monitoring and assisting graduate student progress until degree is earned); coordinating the schedule of classes with DGS, DUS; maintaining a graduate applicant database; providing administrative support to admissions committee; collecting applications,

corresponding with applicants, process admission decisions, coordinating registration and housing for incoming class; coordinating assignments & funding for RA & TA appointments; managing TA & scholarship budget, assigning and monitoring fee waivers; coordinating field camp web pages, summer course fees and summer admissions; coordinating graduate student orientation and recruitment visits annually and recommending efficient processes for improvement. This position is crucial in the oversight of graduate student matriculation in relation to the documentation of progress toward meeting all of the graduation requirements set by the University.

Our Undergraduate Advisor (Shawna Matteson), Academic Advising Professional II, assists with undergraduate curriculum related issues, including, but not limited to: paperwork associated with the creation of new classes and modification of existing classes, class scheduling, data collection and analysis (benchmarking) for new sub-plans,, programs in the major, and new majors; helping establish protocols for students with Geosciences degree requirements, providing administrative support to the Director of Undergraduate Studies; serving as the liaison between graduate and undergraduate students; helping the graduate program coordinator with GradPath when necessary. This position is crucial in the oversight of undergraduate student matriculation in relation to the documentation of progress toward meeting all of the graduation requirements set by the University.

Adequacy: Currently the workload demands of the two advisors are not manageable. With the addition of a new major and should our undergraduate and graduate student population increase, an additional full-time (1.00 FTE) advisor would be recommended. Additionally, a full-time administrative assistant would be beneficial to assist the advisors with administrative tasks. An administrative assistant could provide support to our academic programs by helping with questions about our degree programs, scheduling student appointments, assisting with data collection-benchmarking analysis, marketing, etc.

Business Office/Operations Support

The Manager of Business-Finance (Christine Duddleston) oversees the administrative staff of the department, the department budget, extramural funding from various sources and all designated accounts. She works closely with the Department Head regarding budget planning and financial oversight for the Department. This position is also responsible for the pre-award grant proposal routing for the entire department. The Manager of Business-Finance serves as a vital role of ensuring compliance with University policies and procedures and provides training as needed for staff development.

The Program Coordinator, Senior (Michelle Garcia) provides administrative support to the Department Head, serves as the building manager and provides administrative support for faculty affairs (including promotion and tenure; annual performance reviews etc). This position is also responsible for event planning and overall oversight of the front office.

The Accountant Principal (Denise Carrillo) serves as the primary Human Resources contact for the Department. Her responsibilities include entry of job postings, processing all payroll and hiring documents, processing of VISA needs for international faculty and scholars, and processing official designated campus colleague requests. This position also serves as a backup to the Manager of Business and Finance.

Adequacy: At the time of this APR, there are approximately 171 active employees actively employed in the department (Graduate students, faculty, staff and undergraduate student employees). A 1.00 FTE is not adequate in managing the daily work associated with ensuring HR compliance, etc.

The Accountant Senior (Heather Alvarez) manages all of the department's accounts receivables transactions; manages all travel for the department (graduate students, faculty, staff, undergraduate students) including pre-trip authorizations and post trip expense reimbursements. In addition this position is responsible for managing the invoicing and payments received for all of the service labs in the department.

The second Accountant Senior position (Patricia Waters)manages all departmental Foundation funding (gifts and endowments and scholarships); handles foundation related transactions, foundation travel, payments, transfers, etc.; submits scholarships in UAccess Student; serves as the P-card approver for the department (insuring purchases align with FSO compliance). This position also is responsible for Post award account reconciliation for assigned PIs/KFS Accounts; serve as backup for pre-award. Additional duties as assigned.

Our undergraduate student employee works part time and provides administrative support to all our business office staff. The student employee is responsible for sending and receiving various packages; checking and distributing office mail and other duties as assigned.

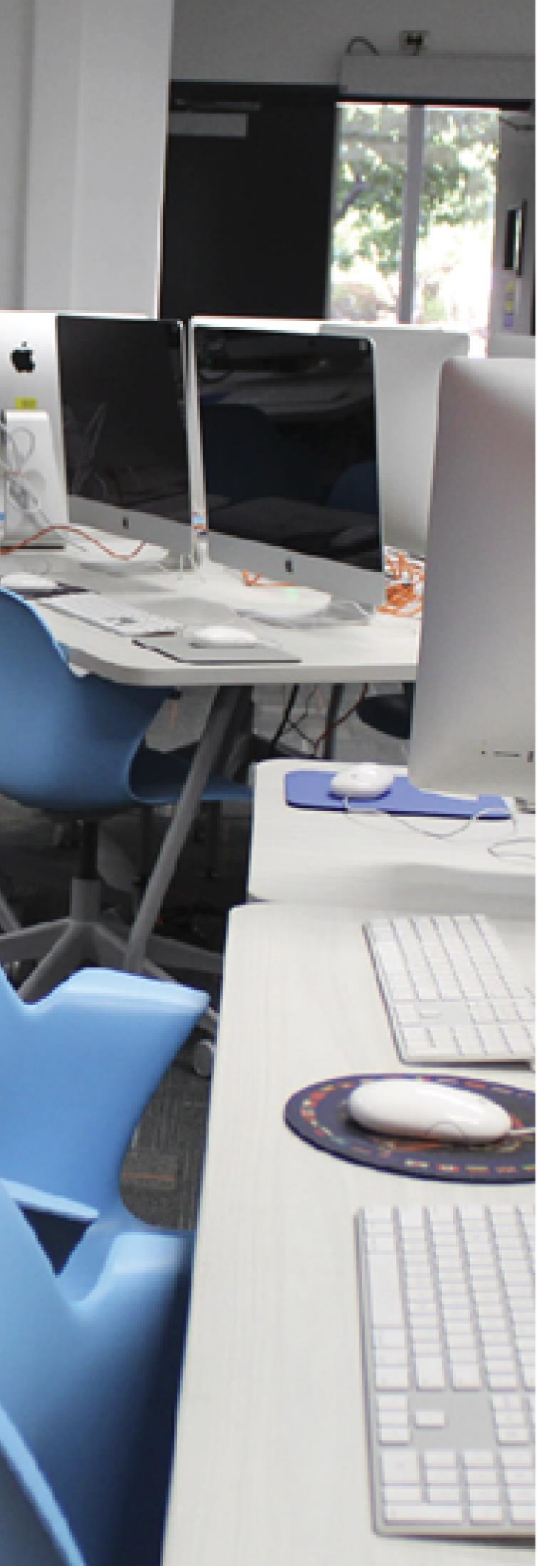
Adequacy: Overall the Department of Geosciences Business office is minimally staffed. As our department grows, our staffing levels will also need to increase. Budget cuts, however, affect our ability to maintain staffing at the present level.

Our IT support person (Kiriaki Xiluri-Lauria) is responsible for management of all servers; troubleshooting IT issues; managing all computing inventory for the department; classroom IT support; website management and creation.

Adequacy: Currently the workload for our IT support person is not manageable.

Our Facilities/Lab Safety staff (David Steinke, Ben McElhaney, Mark Baker, and Todd Lange) provide electrical and mechanical repair to our approximately 14 service center laboratories and their corresponding lab equipment. They also coordinate lab safety training; new lab setup; manage field gear inventory; facilities maintenance, etc. for all of our offices and laboratories. At present, we have 1.00 FTE (Steinke), .50 FTE (McElhaney), .50 FTE (Baker) and .50 (Lange) for a total of 2.5 FTE.

Adequacy: The number and type of equipment that the department is responsible for cannot be supported by the current staff. This equipment includes: 23 mass spectrometers in Gould Simpson and 4 others which are "co-owned" elsewhere on campus which normally Geosciences has to deal with, 2 scanning electron microscopes, 4 liquid scintillation counters, 2 x-ray diffraction, 2 running piston cylinder systems, and various portable seismic and GPS stations. This does not include all the sample preparation ovens, saws, polishers, crushers, mixers, water chillers, cryo chillers, and miscellaneous equipment. When David Steinke (our staff engineer) started in 1979 with a staff of 3 full time electronics staff individuals, we had 2 mass spectrometers, 1 cryo magnetometer, 1 piston cylinder, 8 smoked drum seismic recorders, 1 x-ray fluorescence, and 1 x-ray diffraction machine; and a total of 3 computers. Hence the technical staff to support our facilities and equipment in Geosciences is highly inadequate.



UNIT RESOURCES

SECTION G: UNIT RESOURCES

G.1. Support for Instruction and Learning

The Department of Geosciences provides several classrooms for our major classes. Classes larger than ca. 35 students are taught in other classrooms on campus. All laboratories are run within the department and are equipped with the necessary technologies (e.g. microscopes, computers) to meet student's needs. Faculty in the Department of Geosciences are fully responsible for providing teaching support to students, outreach service and community service. The Department would benefit from someone dedicated to outreach but due to continuous budget cuts, this position cannot be supported at this time. Central Support for Instruction and Learning includes:

- The University Libraries provide a broad range of support across a number of contexts; Geosciences faculty and students mostly take advantage of the science library. Although the University libraries offer excellent support, faculty, staff, and students take primary advantage of materials via electronic access. Remote access via VPN login allows the full range of electronic services; the fully accessible platform has allowed relatively uninterrupted services, even during the pandemic.
- The University Information Technology Services (UITS) provides centralized support for all employees and students, which includes 24/7 access to help via phone or on-line. Beyond email, on-campus wifi, software and security support, UITS offers online and in-person workshops that are relevant for teaching and research, such as training in special skills, including video-editing, data management programs (e.g., Access), and website management (e.g., Drupal). The on-line tutorial training library is extensive and of high quality.
- UITS provides the classroom material platform Desire to Learn (D2L) to support classroom instruction and fully distance-delivered courses and programs. D2L includes interfaces with Zoom and Panopto software. During the COVID pandemic, all Geosciences courses were offered in remote or hybrid mode through the D2L platform.
- The Office of Academic Affairs supports Faculty Learning Communities (FLC) that provide a context to learn from one another.
- The Office of Instruction and Assessment (OIA) is a campus resource that supports all faculty, instructional personnel, and researchers to integrate technology into academic activities. For example, they provide services on course and curriculum design, online course development, program and classroom assessment and evaluation, instructional strategies and learning technologies. OIA also provides workshops, training, and online support for learning management systems and web-based tools. During COVID-19 time, OIA has provided continuous remote support to faculty and students through webinars, on-line resources, consulting services.
- Centrally scheduled classrooms are coordinated by the university through the registrar's office. For large enrollment classes, Geosciences classes are scheduled in other locations across campus. Scheduling large classes across campus and finding appropriate space can be challenging.
- Collaborative learning spaces have been supported by the Office of the Provost over the past ten years, and as of Fall 2019, provide the University with 32 collaborative learning spaces.

Departmental Support for Instruction and Learning includes:

- Teaching spaces. We have six department-scheduled classrooms (capacity ~30) with an average 700 sq. ft. that are used for the majority of our upper level major and graduate-level classes.
- To improve effectiveness/efficiency of our teaching the department was able to upgrade 228A (1,000 sq. ft.) to include new movable chairs and tables, a new computer system (PC and Mac), camera and speaker to increase flexibility, and movement within the classroom and facilitate remote learning. This room is used for instruction but also for our weekly seminars.
- Geosciences was successful in receiving funds from a cost-sharing grant from the Provost's office to convert rooms 213, 215 and 219 into the new computational laboratory (1,400 sq. ft.) which can now host ~50 students and includes 26 Imacs, 18 PCs, and a state of the art presenter station with dedicated camera and speakers.
- Course fees accommodate student needs in the classroom, including teaching and laboratory materials and fieldwork expenses. Discretionary funds are often used to cover additional fieldwork and laboratory expenses including new microscopes, computers and other instruction material.
- All class material is provided to students by instructors before classes start.
- The department offers opportunities to undergraduate students to help with instruction and gain teaching experience through graded preceptorships.
- Graduate Teaching Assistants (GTAs): Teaching assistants are an important support for faculty, particularly for large classes and classes with laboratory experiences. The typical GTA assignment is .25 FTE (10 hours/week) for a given class, with allocation determined by course enrollment (1 GTA/50 students). The allocation of GTA funds depends on enrollment which has been declining. Additional detail regarding Graduate Teaching Assistants is provided in Section I.

G.2. Research Support

Department Support for Research - Research Space

Although space is always in high demand, with 64,972 square feet of total usable space (including space off campus) we have been able so far to meet basic faculty needs for separate office and research spaces. Space is allocated to all faculty in line with the nature of the work but in general each regular faculty has an office (ca. 500 sq. ft.) and a lab space (~700 sq. ft.). Every faculty is also provided shared office space for graduate students and postdoctoral scholars. Faculty often share research space and faculty collegiality is paramount in these circumstances. We have also been able to repurpose an office space (~800 sq. ft.) which is now dedicated to host visiting scholars (e.g., sabbatical professors).

Staff Support for Grants

The Department of Geosciences provides support for research for pre-award activities (e.g., budget preparation, submission) and post-award needs including budgetary oversight and personnel. We have made significant improvements in support for the procedural aspects of grant submission over the years by increasing efficiency, and we have revised business office tasks to best address faculty needs. However, given the number of grant activities in the department, the current support is often not enough. In particular, the department would benefit from additional support from the College of Science and Office for Research, Innovation, and Impact (RII) for preparation and submission of larger grants.

G.3. Changes to Increase Efficiency

Operationally, due to the impacts of COVID-19, the Business Office has made the transition to electronic filing and reporting which reduces operational costs on paper, toner/ink. The Business Office has also streamlined business processes and have realigned duties amongst staff. We will initiate cross training across various subject areas to ensure ample coverage of tasks for all staff.

G.4. Other Changes and Efforts to Increase Non-State Funding

The Department of Geosciences has worked closely with the advisory board to increase donations dedicated to supporting undergraduate and graduate student research and education and faculty research. These efforts (e.g. Mélange fellowship and GeoDiscoveries fund) have created new opportunities within the department. In particular, a new computational lab ("Stacie Gibbins Computational Geosciences Center"; described above) was created in 2019 thanks to the generosity of many of our alumni and donors. This lab allows for state of the art, cutting edge technology to be applied to the classroom.

UNDERGRADUATE STUDENTS, DEGREE PROGRAMS AND OUTCOMES

SECTION H: UNDERGRADUATE STUDENTS, DEGREE PROGRAMS AND OUTCOMES

H.1. Undergraduate Degree Program

The department currently offers four undergraduate degree sub-plans leading to a Bachelor of Science in Geosciences: Geology; Geophysics; Earth, Oceans, and Climate; and Gem Science (launched fall 2021). All four of these degree sub-plans are offered in-person. We currently do not offer any certificates or online degrees. Table H.1. (Active Academic Plans by Academic Year) reflects this information.

Table H.1.a. Active Academic Plans by Academic Year (Fall Census Dates in AY 2014-2022)

Degree Level	Academic Plan Type	Academic Plan Code	Academic Plan Code	2015	2016	2017	2018	2019	2020	2021
Bachelors	Major	GEOSBS	Geosciences	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Major (Secondary)	Geosciences 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The Geosciences B.S. Program is identified by **CIP Code 40.0601**. This CIP code is described as: A program that focuses on the scientific study of Earth; the forces acting upon it; and the behavior of the solids, liquids and gasses comprising it. It includes instruction in historical geology, geomorphology, and sedimentology, the chemistry of rocks and soils, stratigraphy, mineralogy, petrology, geostatistics, volcanology, glaciology, geophysical principles, and applications to research and industrial problems.

University of Arizona Geosciences students and faculty are involved in everything from forecasting earthquakes to finding and extracting minerals from mines to monitoring coral reefs, to studying processes on Mars. We work outside, in laboratories, and on computers. Our course offerings give our undergraduates a rich menu of geological content to choose from, after completing Physical Geology, our required foundational geosciences course. Students can focus on a variety of subjects as described in Table H.1.b. While all of our students have a common core of courses, the four sub-plans that lead to our BS degree provide variety that reflects the extremely diverse interests and problems of geoscientists in today's modern world. We aim to produce graduates who have strong content knowledge, are familiar with the process of scientific research, are scientifically literate across many disciplines, feel a connection to the scientific community, understand the importance of ethical and sound science practices, and feel a responsibility to propagate scientific knowledge.

The University of Arizona Geosciences Department provides a consistently top-ranked program with exciting and unique field-based and research-based learning opportunities for students, through coursework and beyond. All major sub-plans require students to participate in a rigorous capstone experience in which they put their skills to work, either in the form of a Summer Field Camp that provides hands-on experience, or research alongside one of our world-renowned faculty members. Tucson's proximity to several mountain ranges and its location in an exceptionally diverse desert allow us to study Earth and its interconnected systems by driving minutes in any direction. Tucson is also less than a day's drive from the Gulf of California, the Grand Canyon, and White Sands National Monument. Many of our courses expose students to these and other local geological wonders, and provide them with immersive experiences in mapping and field interpretation. We invite our undergraduates to also participate in research, provide support for those endeavors, and encourage them to present on their findings at both local and national symposia and meetings, via oral presentations and/or poster presentations. Our students and faculty work closely with many other departments, such as Planetary Sciences, The Laboratory of Tree Ring Research, Hydrology and Atmospheric Sciences, Chemistry, and Physics. Field,

research, and collaborative experiences are highly valued, not just within our program but also once our students graduate and seek entry into the workforce. As such, we work hard to provide pathways for our undergraduates to participate in all of these. (GEOS BS Description @ https://www.geo.arizona.edu/UndergraduateStudents).

The geosciences undergraduate curriculum is designed to provide undergraduate geoscience majors with a strong foundation in physical sciences, mathematics, and core geological knowledge, while providing options that reflect the interdisciplinary nature of geosciences via our four sub-plans. As described above, our department has a long history of providing students with rich field and laboratory experiences, which are integral in preparation for careers in geological fields or graduate studies in geological sciences, and all of our sub-plans reflect our commitment to this rigorous geological foundation.

All majors must meet the education requirements for the 120-unit degree. Curriculum requirements are dictated by the sub-plan a student declares. Table H.1.b. (Geosciences B.S. Sub-plan Curriculum Comparison) shows a comparison of all curriculum requirements for each of the four sub-plan options: Geology (GEO); Geophysics (GEOPH); Earth, Oceans, and Science (EOC); and Gem Science (GEMSCI). The curriculum requirements include university foundation courses and 52 units of geosciences foundations, core, and advisor approved emphasis courses. The advisor approved emphasis course options include mostly geosciences courses at the 300-400 level, but may include interdisciplinary science courses as well as up to 6-units of a combination of research, internship, and/or one preceptorship. All geosciences majors, regardless of sub-plan, must complete a 6-unit Core Capstone Experience that is designed to enhance the student's geological education beyond the classroom. All majors have opportunities to take free electives as well, the exact number of units and number of elective courses of which are dependent on the specific sub-plan and whether the student has exam or transferrable credits. We also strongly encourage our majors to participate in internships, research (besides the capstone experience), preceptorships, and the undergraduate Society of Earth Science Students Club, which offers professional development and outreach opportunities.

Table H.1.b. Geosciences B.S. Sub-plan Curriculum Comparison

REQUIREMENTS	GEO	GEOPH	EOC	GEMSCI
UA Foundations				
English Composition: 1-semester minimum, depending on placement, AP or Transfer Credits	X	X	X	X
Substantial Math Strand: Calculus I and Calculus II	X	X	X	X
General Education: 21-23-units required depending on AY requirements	X	X	X	X
Second Language: Second Semester Proficiency	X	X	X	X
GEOS Foundations				

Math: *Calculus I* and *Calculus II*	X	X	X	X
Additional Math, number of courses based on declared sub-plan	X	X		X
Chemistry: *General Chemistry I* (Lecure & Lab)	X	X	X	X
Chemistry: *General Chemistry II* (Lecure & Lab)	X		X	X
Physics: *Introductory Physics I* (Lecure & Lab)	X	X	X	X
Physics: *Introductory Physics II* (Lecure & Lab)	X	X	X	X
Common Core				
Computer Application: Choose 1 from GEOS 280 *Matlab* or GEOS 285 *Python*	X	X	X	X
GEOS 251 *Physical Geology* (Lecture & Lab) *pre-requisite to all 300-400-level GEOS Core courses	X	X	X	X
GEOS 300 *Earth Surface Processes*	X	X	X	X
GEOS 302 *Principles Stratigraphy and Sedimentation* (Lecure & Lab)	X	X	X	X
Sub-plan specific Core				
GEOS 304 *Structural Geology* (Lecure & Lab)	X	X		
GEOS 306 *Mineralogy (Lecure & Lab)*	X	X		X
GEOS 308 *Paleontology*	X	X	X	
GEOS 322 *Introduction to Geophysics* (Lecure & Lab)	X	X		
GEOS 356 *Petrology* (Lecure & Lab)	X	X		X
GEOS 419 *Physics of the Earth*		X		
GEOS 432 *Introduction to Seismology*		X		
GEOS 434A *Introduction to Exploration Seismology*		X		
GEOS 260 *Introduction to Gem Science*				X
GEOS 400 *Intro to Geochemistry* or GEOS 474 *Geochronology-Thermochronology*				X
GEOS 462 *Petrology of Gems*				X
MSE 480 *Advanced Characterization Methods in Materials Science and Engineering*				X
GEOS 342 *The History of Earth's Climate*			X	
GEOS 412A *Ocean Sciences*			X	
GEOS 478 *Global Change*			X	
GEOS 479 *Climate Dynamics*			X	

Advisor Approved Emphasis				
Choose from a variety of pre-approved course options based on declared sub-plan	15 units	9 units	17 units	13 units
Capstone Experience				
Field Camp (6-unit experience)	X	X		
Field Camp, Research, or Internship (6-unit experience)			X	X

The University of Arizona has a thriving Honors program, and the Department of Geosciences participates in the program in several ways. Some geosciences courses offer honors sections specifically designed for honors students, which are co-convened with non-honors sections of those courses. Courses with honors sections provide enhanced learning opportunities and in-depth experiences for students enrolled in the honors section. Honors students may also enter into an "Honors Contract" in any course, with approval of the instructor, and receive honors credit. In this case, the instructor and student devise an enhanced course of study, often culminating in a contribution to the course in the form of a project or other deliverable. We also have courses in which the honors section students act as preceptors in the course, so their enhanced experience not only provides them with more in-depth study of course material, but also allows them to develop leadership skills through leading collaborative learning exercises with their peers. Independent Study research experiences and preceptorships are both available for honors credit. Juniors and Seniors who are earning a 3.0 Cumulative GPA or higher may, with the instructor's and their major advisor's permission, enroll in 500-level courses for Honors credit. Geosciences majors who are honors students commit to writing an honors thesis under the direction of geosciences faculty. In addition, some geosciences faculty teach Honors Colloquia for 1st year students (.e.g "Science and Society" by. Dr. Carrapa). These 1-hour-credit courses are intended to provide a connection with a professor early in a student's college career, and to explore intellectual topics of interest and relevance, often by interacting with landmark and current research. In doing so, the students also come to know some of the resources of the University of Arizona, and potentially find their own research opportunities.

The Department of Geosciences would like to increase the number of our majors who are enrolled in the honors college, although we currently have representation in the honors college on par with the university. Eighteen percent of our undergraduates are honors students, which is comparable to the percentage of honors student enrollment within the College of Science (19%). Geosciences has made a concerted effort to recruit honors students, and to encourage honors students in geosciences to complete an honors degree (including an honors thesis), through departmental advising and personal communication with faculty mentors. Several of our faculty have offered honors seminars (including Barbara Carrapa, Joellen Russell, and Jessica Kapp). Dr. Carrapa also developed a field-based 200-level geosciences course open to all honors students entitled "National Parks: A Window through Earth's Geological Processes," which she and other faculty have taught for several years now. Jessica Kapp is beginning work on two new honors courses that will serve not only geoscience majors but any honors student interested in gaining more public speaking and science communication experience. More faculty are taking initiative with honors students, advising them in independent study, directed research and through the process of completing an honors thesis or senior capstone thesis for non-honors students.

We have updated our website to include an Honors in Geos page, which connects students to the Honors College website, where they can find the requirements of an honors degree. We are working as a department to develop a clearly articulated geosciences honors degree plan for our students.

H.2. Contributions to General Education

The Department of Geosciences offers seven courses that contribute to the university general education curriculum in the study area of natural sciences (Table H.2.a. General Education Courses AY 2019-2020 and 2020-2021). Two of these regularly serve 300 - 600 students at a time (Geos 170A1 Earth: From Birth to Death, and Geos 212 Oceanography). Table H.2.b. shows all General Education courses that were offered by the Geosciences Department for AY 2019-2020 and 2020-2021. A list of course syllabus can be found here: GEOS Syllabi | Geosciences (arizona.edu).

Table H.2.a. General Education Courses, AY 2019-2020 and 2020-2021

Tier One Natural Science General Education Courses	Course Title	Units	Instructors
GEOS 170A1	Earth: From Birth to Death	3 units	Jessica Kapp, Marcus Lofverstrom, Martin Pepper
GEOS 170Cl	Life on Earth	3 units	Ji Yeon Shin
Tier Two Natural Science General Education Courses	**Course Title**	**Units**	**Instructors**
GEOS 212	Intro To Oceanography	3 units	Joellen Russell, Paul Goodman, George Gehrels
Geos 216	Dinosaurs	3 units	Ji Yeon Shin, Derek Hoffman
GEOS 218	Geologic Disasters & Society	3 units	Paul Goodman, Martin Pepper
GEOS 220	Environmental History of the Southwest	3 units	Paul Sheppard
GEOS 222	The Beauty of Landscapes	3 units	Jon Pelletier (Not Offered 2019-21)

Table H.2.b. General Education Student Learning Outcomes Assessment, AY 2019-2020 and 2020-2021 provides an assessment of how Geosciences General Education courses align with the University of Arizona General Education Program Student Learning Outcomes. Syllabi for each of the following GEOS Gen Ed courses can be found at GEOS Syllabi | Geosciences (arizona.edu), excluding GEOS 222 *The Beauty of Landscapes*. GEOS 222 has not been offered since Fall 2018, but it is currently planned for Fall 2022.

GEOS Tier One and Tier 2 Natural Science General Education Coursese	Think Critically	Communicate Effectively	Understand and value differences	Use Information Effectively
GEOS 170Al	I, P, A (exam questions, assignments, in-class activities)	I, P, A (rubric-scored writing assignments, in-class activities)	I, P, A (assignments)	I, P, A (exam questions related to data analysis, assignments, in-class activities)
GEOS 170Cl	I, P, A (exam questions)	I, p	I	I, P, A (exam questions, in-class activities)
GEOS 212	I, P, A (homework, class project, exam questions)	I, P, A (class project, rubric-scored writing assignments, exam questions)	I	I, P, A (class project)
Geos 216	I, P, A (in-class activities, class project, exam questions)	I, P, A (class project, exam questions)	I	I, P, A (in-class activities, exam questions)
GEOS 218	I, P, A (homework, writing assignment, exam questions)	I, P, A (writing assignment, homework)	I	I, P, A (writing assignment, homework)
GEOS 220	I, P, A (writing assignment, lecture assessments,	I, P, A (writing assignment, activities)	I	I, P, A (writing assignment)
GEOS 222	I, P, A (assignments, exam questions)	I, P, A (writing assignment)	I	I, P
(I=Introduced, P=Practiced, A=Assessed)				

Table H.2.c. Enrollment in Geosciences General Education Courses, AY 2019-2020 and 2020-2021. Table captures student enrollments in our primary general education courses in AY 2019-2020 and 2020-2021. (Note: not all of our general education courses are offered every semester or even every year.)

Campus	# of Students Enrolled Fall 2019	# of Students Enrolled Spring 2020	Total Enrolled 2019-20 AY	# of Students Enrolled Fall 2020	# of Students Enrolled Spring 2021	Total Enrolled 2020-21 AY
UA Main	276	631	709	337	250	587
Arizona Online	Not Offered	Not Offered	Not Offered	Not Offered	8	8
Arizona Global Direct	Not Offered	Not Offered	Not Offered	Not Offered	9	9
Campus	**# of Students Enrolled Fall 2019**	**# of Students Enrolled Spring 2020**	**Total Enrolled 2019 -20 AY**	**# of Students Enrolled Fall 2020**	**# of Students Enrolled Spring 2021**	**Total Enrolled 2020- 21 AY**
UA Main	1,233	631	1,864	769	585	1,354
Arizona Online	Not Offered	Not Offered	Not Offered	Not Offered	47	47
Arizona Online	Not Offered	Not Offered	Not Offered	37	24	61
Arizona Global Direct	Not Offered	Not Offered	Not Offered	5	Not Offered	5
	1,509 F19 Enroll ment Total	1,064 Spr20 Enrollment Total	2,573 2019-20 AY Enrollment Total	1,148 F20 Enrollment Total	923 Spr21 Enrollment Total	2,071 2020-21 AY Enrollment Total

Our general education courses explore topics meant to hold broad appeal to undergraduate students regardless of their major. They focus not just on content knowledge, but on the development of critical thinking skills, the ability to reason like a scientist, and the application of general science knowledge to issues that are relevant in society today. An understanding of the process of scientific study and how scientific progress advances knowledge, both in general and in geosciences, is related to our responsibility to be scientifically literate citizens. Geology courses attract non-science majors because of topics such as volcanoes, earthquakes, dinosaurs, tsunamis, and others that often draw peoples' interest from a young age. As such, we tailor our general education courses to expose students to these topics as well as the unique perspectives geologists bring to solving important scientific problems, such as the causes and effects of climate change, responding to natural disasters, and protecting our water resources.

Geos 170A1, Earth: From Birth to Death (new title is Earth Stories: Interpreting our Dynamic Planet starting in spring 2022), takes students through Earth's history from the Big Bang and formation of basic elements to our current situation in the midst of human-induced global warming. Throughout the class, students are asked to consider the questions geologists ask when interpreting geologic information captured in minerals, rock layers, landscapes, oceans, coral reefs, ice cores, etc. Geos 170C, Life on Earth, explores the intricate inter-relationship between the Earth and the many forms of life that have (and do) inhabit the planet. Geos 212-Oceanography, provides students with both a geological and climate science perspective on Earth's oceans, and the important roles they play in relation to Earth dynamics. Students are exposed to current research in climate science, and how efforts to understand the oceans are critical in creating solutions to address global warming. Geos 216-Dinosaurs, gives students an in-depth look at the study of paleontology, what makes dinosaurs unique, their history on Earth, their form and function, and their connection to modern birds. Geos 218-Geological Disasters and Society, focuses on the natural hazards generated by geological phenomena such as earthquakes and volcanoes, as well as hazards being influenced by Earth's oceans and atmosphere, and the ways in which these hazards affect humans and societies. Geos 222-The Beauty of Landscapes, weaves together geomorphology, mathematics, and art, to allow students to explore the way we understand and interpret the extremely varied surface of Earth.

Geos 170A1, Geos 212, and Geos 218 are extremely popular and serve over 2,000 students per academic year, with both large in-person sections and a combination of iCourses and UArizona Digital Learning fully online offerings. Geos 216 is also extremely popular, but cannot be regularly offered as an in-person or online class due to faculty retirements/loss. Geos 170C has not been offered in person since 2019 due to faculty loss, but is under development as a U of Arizona Digital Learning fully online course. If we are able to hire new faculty in paleontology, both Geos 216 (Dinosaurs) and Geos 170C (Life on Earth) would be offered regularly as in-person courses. Geos 222, The Beauty of Landscapes, is currently being considered for approval in the new general education curriculum (soft roll-out spring 2022), as well as an Honors College General Education course that would serve honors students.

In addition to our general education courses, Geos 251, Introduction to Physical Geology, has 30 - 50% enrollment of non-majors. Students often indicate that they take this course because of an interest in geology or as a way of exploring geosciences as a major. This course is also either required or suggested as a laboratory science course option for several other majors including Computer Science, Environmental Science, Hydrology and Atmospheric Sciences, and Mining Engineering. Geosciences is often discovered as a major by students taking a general education geoscience course, or through the Geos 251 course. Both the general education and the introductory geology courses are generally fully enrolled.

H.3. Undergraduate Program Description

H.3.a. Enrollment Trends for Each Undergraduate Degree Program

We note that there is no minimum GPA or grade criteria for admission into GEOS BS other than what is stipulated for UA Admissions. We do not have a separate admission process for GEOS BS. The only grade/GPA criteria we have is a 3.0 cumulative GPA for students who are applying for Readmission back into GEOS BS. These students also have to show evidence of completing a minimum of 24-units of relevant

coursework taken at another institution since they left the University of Arizona, and should demonstrate satisfactory progress toward Geosciences degree requirements.

- UA Admission: https://www.arizona.edu/admissions
- GEOS Readmission Policy: https://www.geo.arizona.edu/sites/default/files/data/readmission_policy_geos_rev10072019_0.pdf

Table H.3.a.1 Total Undergraduate Enrollments, Fall Census Dates in AY 2014-2021

	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Headcount	188	225	226	229	230	193	195	179

H.3.b Undergraduate Curriculum

The undergraduate curriculum supports our goal to provide students with a high quality, rigorous geosciences education that will prepare them for jobs and/or post-graduate programs in fields such as geology, climate science, mining, oil and petroleum exploration, gemology, seismology, etc. There are four sub-plans (Geology; Geophysics; Earth, Oceans, and Climate; Gem Science) that all lead to a BS degree in Geosciences (see descriptions below). Every sub-plan requires the same four Common Core GEOS courses: Physical Geology (4-unit lab-based), Earth Surface Processes (3-unit lecture-based), Principles of Stratigraphy and Sedimentology (4-unit lab-based with writing emphasis), and one Computer Applications course. All of these sub-plans are offered in person on Main Campus. We currently do not offer any degrees or certificates via UA South or other distant campuses.

Geosciences: Geology Emphasis

Students in this sub-plan develop an understanding of the composition and processes of the solid Earth, including the nature and origin of rocks and minerals, the distribution of sedimentary environments, the significance of structures such as folds and faults, the processes of mountain formation, and the nature and origin of mineral and hydrocarbon resources on Earth. Students in the geology sub-plan experience a strong lab and field-based curriculum, with many opportunities for hands-on geological work. This sub-plan will prepare students who are interested in entry-level geologist jobs, consultants, jobs in mining and mineral resources or oil and petroleum resources, as well as post graduate studies in geological fields.

Geosciences: Geophysics Emphasis

Students in this sub-plan develop an understanding of Earth's interior and its connection to surface processes, including geodynamics, seismology, tectonics, geomagnetism, and volcanism, and apply quantitative skills to describe and model various Earth systems. These students also develop strong quantitative skills, completing 18 units of mathematics, which provides them with a math minor in addition to their geosciences degree. This sub-plan will prepare students for jobs in mining and mineral resources, oil and petroleum exploration, seismology and earthquake studies, volcanology, as well as post graduate studies in geological fields.

Geosciences: Earth, Oceans, and Climate Emphasis
Students on this sub-plan develop an understanding of Earth's climate – past, present, and future – and the important connections between the solid Earth, oceans, and atmosphere, and how they influence modern climate dynamics. Students on the EOC sub-plan combine a strong geoscience foundation with exploration of the interplay of Earth systems, and how humans affect and are affected by global change. This sub-plan will prepare students for jobs in consulting, climate science, as well as post graduate studies in climate related fields.

Geosciences: Gem Science Emphasis
Students on this sub-plan develop an understanding of the geology of minerals and gems, analytical techniques useful for prospecting and characterizing gemstones, and will acquire skills required to meet the demands of the gem industry and scientific gem research. Students on the Gem Science sub-plan build their ability to work in the field of gemology on a foundation of geological science, advanced mineralogy and petrology, and research practices. This sub-plan will prepare students for jobs in prospecting and characterizing gemstones and the jewelry industry, as well as post graduate studies in geological and gemological fields.

All four of our sub-plans lead to the same BS degree in Geosciences. As such, we assess our program with learning outcomes that apply to all four sub-plans, focused on the geosciences foundation upon which each sub-plan builds. Geosciences Program Learning Outcomes are listed below:

1. LO1 (Earth Materials): Graduates will have a working knowledge of common Earth materials including their composition, origin, and uses. (i.e. working with/identifying rocks and minerals, soils, resources and economic geology topics.)
2. LO2 (Surface Processes): Graduates will have a working knowledge of Earth surface processes and how humans affect and are affected by the processes. (i.e. sedimentary systems, interaction of earth surface with oceans and atmosphere, geomorphological processes, climate and climate change, environmental geology)
3. LO3 (Earth Interior): Graduates will have a working knowledge of processes in the Earth's interior. (i.e. the major geophysical and geochemical properties of the Earth's interior; their genesis and role in tectonics, earthquakes, magmatism, and other Earth properties)
4. LO4 (Geologic Time): Graduates will have a working knowledge of the geologic time scale and major Earth events. (i.e. determining absolute and relative time, the major timescale divisions and geologic and biologic events in Earth history)
5. LO5 (Geologic Materials): Graduates will acquire specific skills required for the study and interpretation of geological materials, history, and features. (i.e. Capstone Experience: map reading, field methods and observations, analytical methods, quantitative methods)
6. LO6 (Scientific Process): Graduates will have a working knowledge of the scientific process; the ability to make observations and measurements, perform experiments, and be able to formulate and test scientific hypotheses, including the ability to read and critically evaluate primary Earth science literature and data and to effectively communicate geologic information both orally and in writing.

At the time of our last APR, we were in the midst of a ~400% increase in geoscience majors at University of Arizona. It was a welcome development, and anecdotal evidence suggested that it was influenced by

our top national ranking in geology, which attracts undergraduates as well as graduate students. Since then, our enrollment numbers have leveled off, reflecting the graduation of the large bubble of students we were serving from that last surge. Back then, we often had to increase class sizes and/or offer once-per-year classes every semester, to accommodate the large numbers of majors requiring our courses. Today, our core courses still fill consistently, but we have been able to reduce some course offerings to once a year, freeing up faculty to teach more graduate level courses, general education courses, or develop new courses.

H.3.c. Accreditation

An accrediting body does not prescribe our curriculum. The geosciences curriculum has been developed by our faculty, and when curricular changes are proposed they are discussed and approved by our faculty. The letter from our most recent analysis can be found in the appendix.

H.3.d. Comparison of Our Degree to Similar Programs Nationally

Our Geosciences BS degree program is similar to other geology BS programs around the country, in that it requires foundational sciences (chemistry and physics), calculus level mathematics, and courses in physical geology, sedimentology and stratigraphy, and surface processes. We are unique in that our four distinct sub-plans allow students to choose the emphasis area most appealing to them, providing more flexibility in how our students complete their BS. Our newly launched Gem Science sub-plan is one-of-a-kind nationally. Unlike professional certification in gemology, this sub-plan not only provides the skills to work in the gemological and jewelry industries, but also a strong scientific education that can prepare students for post-graduate studies, if they choose that path.

Unlike many geology programs around the country, our program continues to require summer field camp for the majority of our students, which we regard as a key capstone experience for our graduating seniors. While students in the EOC and Gem Science sub-plans have the option of doing research or internship(s) in lieu of a traditional summer field camp, many of them opt to participate in a summer field experience. We offer an introductory field methods class to improve the preparation of our majors for their summer field course. Our graduate and undergraduate students are frequently hired by mining and petroleum companies, and their training in field geology is often cited as the reason. This sets us apart from many of our peer institutions, and our undergraduate students overwhelmingly report that their field camp or course field trip experiences were the most formative parts of their undergraduate education. While other departments may continue to lessen or remove field camp requirements, we are committed to continued rigorous field requirements for our majors.

In an effort to serve students of all physical abilities and disabilities, Richard Bennett created Geos 405/505: Accessible Earth. The first of its kind, this is a summer course that provides an alternative to field camp that meets our capstone requirement. In this course, students spend five weeks overseas, gaining international research experience, working with large geological and geophysical data sets, and participating in short, accessible field excursions.

With the loss of both of our paleontology faculty in recent years, two of our faculty members (Andrew Cohen and Kaustubh Thirumalai) have refreshed the paleontology curriculum to reflect a broader and more modern approach, to better serve the needs of our students and integrate with multiple sub-plans

of our degree program. Dr. Thirumalai is a climate scientist, and brings a climatological perspective to understanding the importance of changes in life on Earth. It has become increasingly evident that our students need a strong computational foundation as they enter the workforce or graduate studies, and as such we created two highly applied geosciences programming courses (one in Matlab and the other in Python), and require our students to take at least one of them before they graduate. With the hiring of several faculty in the area of climate sciences over the past several years, we have added offerings in introductory climate modeling, physical and dynamical oceanography, and organic geochemistry.

The University has approved a new general education curriculum, effective Spring 2022, and geosciences is well on the way to having all of our regularly offered general education courses converted and approved into the new general education program. Three of our general education courses, Geos 170A1: Earth: From Birth to Death (renamed Earth Stories: Interpreting our Dynamic Planet), Geos 218: Geological Disasters and Society, and Geos 222: The Beauty of Landscapes) are already approved or submitted and pending approval in the new system. Once approved in the new system, these courses will also count for students on the old Tier system of general education, and as such we can continue to serve all UA students with our general education courses. Geos 212 will be submitted for review by the end of fall 2021.

While we are committed to providing a rigorous BS degree experience that prepares our graduates for jobs and graduate studies in geoscience areas, we recognize that there is another type of student who is interested in the Earth but does not want to go the traditional geologist route. We believe that having a working knowledge of the Earth, its history, and the processes that shape it, is important for all types of jobs, including those where our graduates may be shaping policy relevant to global change, educating young people, working on new laws that will apply to how we allocate and use resources, and speaking to the public about the problems we face as global citizens. As such, the Undergraduate Policy Committee, along with the help of department chair Barbara Carrapa and the College of Science Interim Associate Dean for Student Success Rebecca Gomez, are in the process of creating a new Bachelor of Arts degree in geosciences, the goal of which is to serve students who have an interest in Earth Science but may not want to be geologists. The BA degree we are crafting is meant to provide the geosciences knowledge a student interested in the Earth needs to pursue a job or post graduate studies in areas such as environmental law, public policy, science journalism, science communication, primary or secondary education, or business. As it is drafted, the degree will require students to take courses from other UA programs that fall into one of three sub-plan areas: Law; Journalism and Writing; or Policy. Each of the emphasis areas will lead to the same BA degree (Name TBD). We are looking into ways to partner with other popular programs on campus, such as Eller College of Business, to provide pathways for double majors or minors that give students both a strong science and business background. This BA degree will look quite different from those of our peer institutions, in that it is not “geosciences light,” and is not meant as a default for students who are struggling with the BS degree sub-plan. Nor is it focused on environmental or climate science, another popular variety of BA degree offered by other geology departments. Instead, we hope to attract students with broader interests who can be ambassadors for change when it comes to how we craft policy and law, how we talk to the public, and how we educate young people. After completing market research this fall, and then opening discussion about the BA degree to our full faculty, we hope to be ready to submit a proposal for the BA degree in fall of 2022.

H.3.e. Course Availability

One challenge we face with course availability is due to the loss or retirement of key faculty who teach general education and/or geology core courses. We have two general education courses (Geos 170C-Life on Earth, and Geos 216-Dinosaurs) that we can no longer offer regularly due to the loss of both of our paleontology faculty in the last few years. These losses have required us to recruit other faculty from within our department to teach paleontology, a core course required in two of our sub-plans, taking them away from other courses they need to teach. The department is planning to hire a Lecturer to teach these classes and we plan to hire a faculty in paleontology in the future to alleviate these teaching and research challenges in this fundamental area of geology. As a policy, we ensure that all of our required core courses are offered at least once per year to serve our students, and we will increase class size if needed to accommodate students who need them to graduate. In addition, we have converted some of our courses to a Monday/Wednesday/Friday schedule, to reduce overlap of core course offerings (most of which are offered on a Tuesday/Thursday schedule), and ensure students can take multiple geosciences courses in a semester.

H.3.f. Course Consistency

All faculty are provided with a syllabus template that asks for their course learning outcomes. Faculty are required to include learning outcomes in their syllabi. Courses with multiple sections have one common lecture but various laboratory sections, all of which use the same syllabus with the same learning outcomes. Some of our courses are taught by different faculty over different semesters, and while specific topics, activities, assignments, emphases, and course objectives may change from instructor to instructor, intended learning outcomes change very little. All programmatic learning outcomes are required for the courses they correspond to, and these do not change.

H.3.g. Active Learning Strategies

Our Geosciences BS degree requires students to engage in many hands-on and active learning experiences. From laboratory based courses to field trips to research experiences, all of our majors have ample opportunities for engaged learning. All geoscience majors regardless of degree sub-plan are required to take at least three laboratory courses in geosciences, and a capstone field or research experience (e.g., field camp). Many of our courses include laboratory sections, practicums, and/or field trips, so most of our students get more than the minimum required.

Required laboratory classes are:

- Geos 251 Physical Geology includes a laboratory experience focused on hands-on training with earth materials, as well as required field trips.
- Geos 302 Sedimentology and Stratigraphy includes a laboratory experience focused on identifying and understanding the origin of sedimentary rocks and deposystems, as well as required field trips.

Geoscience majors in the Geology and Geophysics sub-plans are also required to take the following additional laboratory classes:

- Geos 304 Structural Geology includes a laboratory experience focused on the mechanics of rock deformation, the interpretation of geologic maps and associated geologic structures, and presenting mapping results from required field trips, including numerous field trips focused on active structural analysis.
- Geos 306 Mineralogy (required in three sub-plans) includes a laboratory experience focused on the identification of minerals, their properties, crystallography, and recognizing minerals in common rocks.
- Geos 322 Geophysics includes a laboratory experience focused on how basic geophysical tools can be used to understand the earth, as well as interpretation of geophysical data and information.
- Geos 356 Petrology includes a laboratory experience focused on the properties of common rocks, how these rocks form and behave under different conditions within the Earth, and how to identify minerals in thin sections using petrographic microscopes.

Geoscience majors in the Earth, Oceans, and Climate sub-plan are required to take Geos 412: Ocean Sciences, which has a complementary one-unit optional research field experience that can count toward advisor approved emphasis requirements.

All geoscience majors are required to take Geos 280 Programming and Data Analysis in the Geosciences, with a focus on either Matlab or Python. This course does not have a separate laboratory section, but is highly engaged, with each class acting as a practicum in which students work with data.

Non-required courses that are extremely popular with our majors, such as Geos 255-Historical Geology, Geos 346-Mineral and Energy Resources, Geos 408/508-Tectonic Petrology, Geos 423/523-Regional Structural Geology, Geos 425/525-Regional Tectonics, and Geos 477/577-Active Tectonics, all offer field experiences. The field trip for Geos 255 to the Grand Canyon at the end of the spring semester is often referred to by our graduates as one of their favorite memories, and for many of them is their first time seeing the Grand Canyon, learning its stratigraphy, and camping overnight! Geos 425/525 is built almost entirely around several multi-day field trips to locations around Arizona, during which students are able to practice their mapping skills as well as interpretation of large-scale geologic features. Our department is committed to getting our students out into the field to look at rocks, geological formations, and features in situ, in order to put their knowledge into practice.

In addition to laboratory course offerings, our faculty use many active learning strategies in classes that do not have separate laboratory or discussion sections, including our general education courses that serve hundreds of students per semester. These evidence-based techniques include the use of technology such as clickers, Google Earth exercises, and virtual field trips, as well as low-tech techniques such as group work and peer learning (e.g., group projects, in-class tutorials, think-pair-share). Some of our faculty follow the practices of universal design, providing students with multiple, accessible ways to engage with course material, offering plenty of low-stakes formative and summative assessments, and being flexible with deadlines and submission options for graded work. Since Covid-19 protocols required all of our faculty to convert teaching materials to online platforms, many of them still utilize these materials as

supplements to their in-person strategies, providing students with even more ways to access instructional information (e.g., posting pre-recorded lectures online, giving quizzes and other assessments online, allowing students to turn in assignments online, and in some cases giving exams online). Our primary pathway for such activities is the University's online learning platform D2L - Desire to Learn, which has tools for creating, delivering, and collecting educational materials.

All undergraduates are encouraged to get involved in research with faculty who have ongoing research projects. These research opportunities are offered as directed research or independent studies. This experience is a high priority for our majors. Many of our faculty participate in advising and mentoring undergraduates in research projects, and provide guidance and support as students learn research methods and practices. In most cases, undergraduates who participate in research present their research at our local GeoDaze symposium in the spring, and/or at other local or national meetings such as GSA or AGU. In some cases, our undergraduates have co-authored papers with faculty as a result of their research.

Undergraduates have the opportunity to participate in the department colloquium, which is a weekly presentation by an invited speaker who is an expert in their field. In addition to attending their talk, undergraduates are often provided with the opportunity to meet with the speaker outside of their scheduled presentation, during which they can ask questions and learn more about the speaker's career pathway and research interests.

The department also encourages students to participate in the undergraduate geology club, the Society of Earth Science Students (SESS). The SESS club is extremely active in connecting undergraduates with faculty, providing outreach opportunities for students, getting undergraduates involved in research projects, and generating a sense of community among geoscience undergraduates. They go on self-organized field trips to geologically interesting and relevant locations such as local mines and mountains. Every year, they host a Junior Education area at the world renowned Tucson Gem and Mineral Show. This event serves thousands of kids every year.

H.3.h. Instructional Technology

The use of instructional technology is a highly personal choice, and our faculty utilize different technological strategies to varying degrees. The department does not require faculty to use any specific technology except for D2L, which is the required online platform for all faculty as mandated by the university, and which they must, at minimum, use to post student grades.

- D2L is the required online platform at UArizona and is therefore used by almost all of our faculty in some way in their courses. How D2L is utilized varies from faculty to faculty. Our general education courses often rely heavily on D2L for content delivery (via posted lecture videos and/or slides in addition to extra resources such as articles and other readings), receiving student work (in the form of quizzes, assignments, and discussion posts), and compiling student grades so they can track their progress anytime. In some cases, exams are offered on D2l as well, with students able to choose when they take exams in a way that fits their schedules. Other courses may only use D2L as a place to compile grades and post announcements. While we only require our faculty

to minimally use the D2L gradebook, we encourage them to provide as much course information and material as possible via D2L, to give students easy access to what they need to succeed.

- Response devices, such as clickers, are also used at the discretion of the faculty teaching the course. They are more popular in our large general education courses, as a way of providing attendance monitoring, and in some cases, credit. Some faculty even use them for exams, allowing students to see their exam scores instantly upon submitting their test. Other interactive technologies used on students' personal devices (e.g. Socrative, Poll Anywhere) have been utilized by a few faculty in smaller courses.
- Podcasting has not become widely used in our courses as of yet. However, one of our faculty, Jessica Kapp, has created two podcasts that are relevant to courses she teaches: *Plucky Ladies* - a podcast in which she interviews women from across UArizona, from all different backgrounds and disciplines, and learns about their personal journeys to their chosen fields and the work that they currently do; and *Storybook Earth* - a podcast in which she weaves together science and storytelling, giving narrative descriptions of various geological features and processes appropriate for the non-scientist to enjoy, while still providing factual science relevant to geologic studies today. She provides students access to both podcasts as part of her general education course. Plucky Ladies was inspired by her desire to highlight more women in science, as geosciences (like many STEM fields) is still underrepresented by women in geoscience professions (although some of her guests are non-scientists, their voices are still relevant in the effort to elevate the work that women do). In the future, she will require some episodes of Plucky Ladies in her honors seminar on women in science, after which the interviewees will visit the class to speak about their work and entertain student questions. She is also in the early stages of co-developing a course on podcasting for the Honors College. Jess is also working with Kaustubh Thirumalai on creating and leading a Podcasting Internship, in partnership with Mike Osborne at University of Texas at Austin. This 3-unit internship will run like a regular semester-long class, providing students with instruction on all aspects of creating and producing a podcast, as well as offering them opportunities to create their own podcast segments for possible distribution to media outlets. Student work will be featured on one of Jess's podcasts, and the hope is that their culminating work will end up featured on Mike Osborne's *Generation Anthropocene* podcast (supported by Stanford University and PRI).
- GEOS has a YouTube site where supplemental recordings are posted from faculty or administrators (i.e. Career Prep Webinar recordings, Ambassador Spotlight, A day in the life of a GEOS PHD student). These are not course content videos, but are videos providing Career Prep Development, GEOS as a viable field, student accomplishments.
  https://www.youtube.com/results?search_query=ua+geosciences

Also, several of our faculty appear on the College of Science Youtube channels: The UA Science Lecture Series channel, found here:
https://www.youtube.com/channel/UC355-T8uh5sTnW9V_QdiSgw

The Science Cafe Series can be found here:
https://www.youtube.com/channel/UCT0K6H30gWR6-0sQKFrCsKA/playlists

Geosciences provides links to broadcast media our faculty have participated in, including television appearances, talks, interviews, and podcast spots. (https://www.geo.arizona.edu/broadcast).

- Since Covid-19 protocols required us to teach largely or exclusively online in the last year, almost all of our faculty utilize Zoom as an instructional tool, either for holding online class sections, online office hours, or individual advising of students. While we are largely back to fully in-person classes, many of our faculty still use Zoom as a supplementary tool to provide students who are ill or must miss class for other reasons to participate in class activities.
- Many of our faculty use Panopto either to pre-record lectures, or during class to record lectures, to make these materials available to students outside of class.
- The use of interactive media is a highly personal choice, and most of our faculty do not use social media platforms or other interactive media when it comes to delivery of course material. Some of our faculty have used or do use platforms such as Twitter to communicate with students in an informal way, primarily to provide links to interesting news pieces and other current geological events. The department does have a Twitter account, an Instagram account, and a Facebook page, all meant to connect with our current students and alumni, in an engaging way. These accounts are maintained by graduate students.
- Most of our faculty prefer to offer exams in-person. However, several have tried or continue to provide opportunities for students to complete exams online, via D2L. Some are proctored and some are not. Non-proctored exams are created in ways that aim to minimize violations of academic integrity, and tools to do so are provided by the UA Office of Instruction and Assessment. Our graduates take an exit survey/exam, used for programmatic assessment purposes, that is offered online via our departmental D2L site.

H.3.i. Online Education

None of our required courses are offered fully online (except for Geos 251, which is sometimes offered as an online class during our summer sessions). We do not have any plans to offer full undergraduate degrees online. Geosciences is a hands-on field, and we fully believe our students need laboratory and field based experiences to prepare them for jobs and/or graduate studies in geosciences. We offer several of our general education courses fully online, however, these courses are not required for our majors.

H.3.j. Undergraduate Student Handbook

GEOS Handbook (Fall 2021), which includes the Tiered General Education program requirements:
https://www.geo.arizona.edu/sites/default/files/data/geos_handbook_2021-22-fall_only_rev02112022.pdf

GEOS Handbook (Spring 2022), which includes the new General Education program requirements:

https://www.geo.arizona.edu/sites/default/files/data/geos_handbook_2021-22-spring_only_rev02112022.pdf

H.4. Undergraduate Students

H.4.a. Quality of Undergraduate Students

Data on the quality and time-to-graduation of students in Geosciences versus other majors on campus is represented by the tables below.

Geosciences B.S. students are admitted into our program based on the University of Arizona Admissions criteria for specific applicant populations, which have slightly different admission criteria (i.e. First-Year, Transfer, International). Admission standards for each population can be viewed at https://www.arizona.edu/admissions. Standardized test scores (SAT/ACT) are no longer required for general admission to the university. Therefore, there is no quantitative measure for determining "quality of students" admitted into the Geosciences program. However, we present results prior to 2021 in Table H4.a.1.

Table H.4.a.1. Student Quality Comparison Prior to 2021 Based on Standardized Tests

GEOSBS							
Admit Term Description	Headcount	High School Admission GPA	GPA Headcount	ACT Composite Score	ACT Headcount	SAT Composite New	SAT Headcount
Fall 2017	23	3.48	16	26	11	1256	8
Fall 2018	37	3.57	15	26	9	1215	28
Fall 2019	38	3.83	32	26	9	1265	19
Fall 2020	35	3.81	35	28	3	1187	31
College of Science							
Admit Term Description	Headcount	High School Admission GPA	GPA Headcount	ACT Composite Score	ACT Headcount	SAT Composite New	SAT Headcount
Fall 2017	1563	3.37	1490	25	839	1216	681
Fall 2018	1785	3.41	1659	25	976	1214	975
Fall 2019	2041	3.47	1985	25	1005	1261	1099
Fall 2020	1789	3.48	1777	26	854	1253	878
University of Arizona							
Admit Term Description	Headcount	High School Admission GPA	GPA Headcount	ACT Composite Score	ACT Headcount	SAT Composite New	SAT Headcount
Fall 2017	7417	3.30	7116	24	3882	1194	2930
Fall 2018	7795	3.35	7429	24	4168	1191	4093
Fall 2019	7740	3.41	7581	25	3843	1231	3947
Fall 2020	7449	3.42	7406	25	3617	1222	3401

The total retention and graduation rates for the Geosciences B.S. degree between Fall 2008 and Fall 2019 are shown in Table H.4.a.2. Geosciences B.S. Retention & Graduation Rates. The combined retention and graduation percentage rates for all majors within the College of Science between Fall 2008 and Fall 2019 are shown in Table H.4.a.3. College of Science Retention & Graduation Rates.

Table H.4.a.2. GEOS Retention-Graduation Rates, AY 2008-2019

	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019
Entry Cohort Headcount	7	15	22	19	24	26	31	72	23	25	33	34
One-Year Retention Rate	100.0%	86.7%	86.4%	94.7%	79.2%	80.8%	83.9%	88.9%	95.7%	84.0%	87.9%	91.2%
Four-Year Graduation Rate	71.4%	53.3%	68.2%	63.2%	54.2%	46.2%	51.6%	63.9%	73.9%	52.0%		
Six-Year Graduation Rate	85.7%	66.7%	77.3%	84.2%	70.8%	73.1%	77.4%	76.4%				

Table H.4.a.3. College of Science Retention-Graduation Rates, AY 2008-2019

	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019
Entry Cohort Headcount	927	1,126	1,165	1,259	1,313	1,198	1,349	1,460	1,164	1,332	1,381	1,584
One-Year Retention Rate	79.9%	78.5%	79.3%	80.6%	79.5%	81.9%	80.4%	82.1%	83.8%	81.5%	83.0%	85.0%
Four-Year Graduation Rate	40.6%	46.2%	45.5%	42.3%	44.9%	45.2%	48.8%	49.3%	51.6%	49.8%		
Six-Year Graduation Rate	60.3%	62.8%	62.6%	60.9%	61.5%	63.1%	64.5%	64.2%				

H.4.b. Gender/Race/Ethnicity of Undergraduate Students

Table H.4.b.1. Total Undergraduate Enrollment by Sex, Fall Census Dates in AY 2014-2022

Sex	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Female	32.4%	26.2%	24.3%	31.0%	34.3%	36.3%	40.0%	44.7%
Male	67.6%	73.8%	75.7%	69.0%	65.7%	63.7%	60.0%	55.3%

Table H.4.b.2 Total Undergraduate Enrollments by IPEDS Race/Ethnicity, Fall Census Dates in AY 2014-2022 (see below)

IPEDS Race/Ethnicity	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
American Indian or Alaska Native	0.5%	1.3%	1.3%	1.3%	0.4%		0.5%	0.6%
Asian	1.1%	1.3%	1.3%	0.9%	0.9%			0.6%
Black or African American	1.6%	0.4%	0.4%	1.3%	0.9%	0.5%	0.5%	1.1%
Hispanic or Latinx	12.2%	10.2%	11.1%	9.2%	10.0%	9.3%	8.2%	6.7%
International	22.3%	35.1%	38.9%	43.2%	45.7%	46.6%	36.9%	44.7%
Not reported	1.6%	0.9%	1.3%	0.4%	1.3%	0.5%	10.3%	
Two or more races	3.7%	2.2%	3.1%	3.5%	4.8%	6.2%	4.6%	2.8%
White	56.9%	48.4%	42.5%	40.2%	36.1%	36.8%	39.0%	43.6%

H.4.c. Honors Undergraduate Students

We are in the process of working toward attracting and maintaining more honors undergraduates. Since our last APR, we have created a landing page entitled Honors in Geos that includes information for our students on what they need to do to complete an honors degree. It provides a link to the UArizona Honors College. We have initiated discussion with the Associate Dean of the Honors College to get a link to Geosciences added to their main webpage and work out the specific details of what is required for a program to be included on their website as a viable pathway through honors. One of our biggest challenges is that it is costly to be an honors student, and many of our students struggle to see the benefit of participating in honors due to the cost. The department is exploring ways to make an honors degree more appealing to our majors, including potential honors scholarships to cover honors college fees. We are also encouraging more faculty to provide honors experiences in their classes, as opposed to requiring honors contracts. While we try to offer honors contracts to any students who request them, some students will choose not to take a course as honors if it does not have an honors section or honors experience in place.

			Honors courses and contracts															
Honors Type	Subject	Catalog	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
		Number	2014	2015	2015	2016	2016	2017	2017	2018	2018	2019	2019	2020	2020	2021	2021	2022
Contract	GEOS	216			Yes						Yes				Yes	Yes		Yes
		255		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
		299H						Yes		Yes								
		300								Yes		Yes		Yes		Yes		Yes
		421								Yes		Yes		Yes			Yes	
		434A	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
		436									Yes		Yes		Yes			
		474A				Yes				Yes			Yes					Yes
Course	GEOS	170A1	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes
		170C1						Yes	Yes	Yes	Yes	Yes		Yes				
		212	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		216						Yes	Yes	Yes	Yes	Yes	Yes		Yes			
		240							Yes								Yes	
		251	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		299H	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		304		Yes														
		346	Yes															
		394													Yes	Yes		
		397A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		399H	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		436																Yes
		498H	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		499H	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Figure H.4.c. Geosciences honors courses and contracts

H.4.d. Undergraduate Advising

The department has employed its own advisor for many years, and since our last APR we were able to institute a program fee that pays for a second part-time advisor. The College of Science does not provide our department with an advisor but provides some centralized undergraduate advising in their offices. We do not often refer students to this service, however, as our departmental advisors understand the nuances of navigating the paths to a degree within all of our sub-plans, in particular the special challenges for international and transfer students. Our advisors not only advise undergraduates but also coordinate our undergraduate and graduate programs. Even though they are spread extremely thin, our students routinely praise the level of advising they get within the Department of Geosciences. Our advisors meet with almost all of our majors one-on-one (or virtually during 2020-2021) to help them map out their path to degree completion, complete their course schedules, and give them advice on how best to meet degree requirements. Many of our students are transfer students, and therefore, they cannot simply follow the path to degree completion that would work for a student declaring geosciences as a major their freshman year. Our advisors have to be able to counsel them on transfer credits and how to make up for gaps in their academics. We also have a high percentage of international students who require a significant amount of advising to ensure that they stay compliant with immigration and sponsor requirements, as well as their Geosciences degree requirements.

Prior to requesting permission to institute a program fee, we asked the University to directly fund a part-time advisor for our department in light of our rapidly growing numbers and the quality of advising we strive for. This request was denied. Consequently, costs for expanding our advising support are fully incurred by our students by means of the proposed program fee. In addition to departmental advisors, several of our faculty act as faculty mentors to our students. This is not required, and students must reach

out to a faculty on the mentor list if they want to initiate faculty mentorship. A small percentage of our students follow through on this, and while it seems to be extremely useful for those who do participate, we do not have enough faculty mentors to serve all of our majors.

Students who participate in our undergraduate geology club, the Society of Earth Science Students (SESS), get further advice from their peers, as well as access to many professional development opportunities, such as talks by professionals in various fields, meetings with those professionals, career fairs, workshops, and resume building activities.

The majority of majors (54-71%) meet with their advisor more than once per academic year. Prominent discussion topics include academic planning and challenges, graduation, and graduate school plans. Students report being very satisfied with their interactions with advisors. Most students also speak favorably about their interactions with faculty, both in and out of the classroom.

H.4.e. Views of the Program

Students were asked how much more knowledgeable they feel about the topics covered by our programmatic learning outcomes, and the majority of students said that they are moderately to much more knowledgeable about the content. Students overall felt that the curriculum provides a solid foundation in geosciences, and that the curriculum and engagement experiences prepared them for entry into the workforce and/or graduate education. Some highlights from student responses:

> *"They covered a lot of the geologic foundation bases, and allowed for branching out into specific fields with their upper coursework units."*
>
> *"I felt that I gained a well-rounded understanding of the Earth and could easily apply that knowledge within the workforce."*
>
> *"I will be continuing into graduate level education, and I feel very prepared for future work in the geosciences based on my prior coursework. I feel like the classes- especially the core classes and those under the EOC core- have given me a very strong base."*
>
> *"In addition to the course material, I have also learned a number of computer skills and had some research experience. In addition, I had the opportunity to network with the faculty in my fields of interest."*
>
> *"All of the classes I completed for the GEOS BS curriculum increased my knowledge and taught me how to think critically about geoscience topics. Research experience that I participated in helped me with conference prep, scientific reading/writing, and overall technical skill."*
>
> *"Many of my instructors helped me establish connections in the industry I was interested in."*

Many of our students talk about field work and field trips as the most meaningful and useful experiences they had as geosciences majors. They also talk about laboratory work, research opportunities, and mentoring by faculty as key to their success and overall satisfaction in the program. About 50% of our students indicate that they plan to pursue full-time employment after graduation. About 36% of our

students indicate that they plan to continue pursuing their education after graduation. The majority of these students (over 60%) plan to pursue a Masters degree.

We have no quantifiable data on graduation outcomes, as alumni are generally not responsive to requests for information about where they end up after graduation. However, during exit interviews the Department head asks graduating students about future career opportunities. Virtually all students who leave the program have indicated they have jobs already secured in academia or industry.

H.5. Undergraduate Program Learning Outcomes Assessment

Degree Program: Geosciences B.S.:
https://www.taskstream.com/ts/bsgeosciences/ProgramAssessment

The Department of Geosciences offers a Bachelor of Science in Geosciences in which students choose to follow one of four different sub-plans: Geology, Geophysics, Earth, Oceans, and Climate (EOC), or Gem Science. The Geosciences department developed six learning outcomes for the BS in Geosciences which has been mapped into our curriculum for many years.

1. Graduates will have a working knowledge of common Earth materials including their composition, origin, and uses. (Examples: working with/identifying rocks and minerals, soils, resources and economic geology topics.)
2. Graduates will be able to describe how Earth surface processes operate and how they impact humans. (Examples, sedimentary systems, interaction of earth surface with oceans and atmosphere, geomorphological processes, climate and climate change, environmental geology.)
3. Graduates will be able to describe processes in the Earth's interior. (Examples: the major geophysical and geochemical properties of the Earth's interior; their genesis and role in tectonics, earthquakes, magmatism, and other Earth properties).
4. Graduates will know the geologic time scale and major Earth events. (Examples: determining absolute and relative time, the major timescale divisions and geologic and biologic events in Earth history.)
5. Graduates will acquire specific skills required for the study and interpretation of geological materials, history, and features. (Examples: map reading, field methods and observations, analytical methods, quantitative methods).
7. Graduates will be able to use scientific process (able to make observations and measurements, perform experiments, and be able to formulate and test scientific hypotheses), including being able to read and critically evaluate primary Earth science literature and data, and effectively communicate geologic information both orally and in writing.

The program learning outcomes have been integrated into two assessment tools that have been used since Fall 2019: an Exit Exam and an Exit Assessment Survey. Effective Fall 2019, we developed these indirect and direct measures of the degree to which graduates have achieved the intended learning outcomes of the BS in Geosciences. The indirect measure is a survey that our graduating seniors complete, which asks students about the degree to which they feel they have mastered each of our learning outcomes. The survey is completed through Qualtrics, and results are anonymous unless the student chooses to provide their contact information for alumni related events and communications. The direct measure is a multiple-choice exam that is taken by graduating seniors that consists of 25 multiple choice

questions drawn randomly from a test bank of 127 questions drawn from two courses required by all majors sub-plans; Physical Geology and Principles of Stratigraphy and Sedimentation. The exam is completed and graded through D2L, and results of the exam remain anonymous. Results of the Exit Exams and Exit Assessment Surveys are uploaded annually into the Taskstream system, which is an online assessment/evaluation tool that the University uses to evaluate learning program outcomes. For each of our core courses, we designate whether a particular outcome is introduced, practiced, assessed, or not considered (Table H.5.). Instruments to assess the outcomes in specific courses remain under development.

Table H.5.a. Map of Geos BS Outcomes, Core Courses, and Assessment Instruments

Learning Outcomes	Geos 251	Geos 302	Exit Survey	Exit Exam
1	I&P	P	A	A
2	I&P	P	A	A
3	I&P	NC	A	A
4	I&P	P	A	A
5	I&P	P	A	A
6	I	P	A	A

NC = Not Considered; I = Introduced; P = Practiced; A = Assessed

Our 2019 assessment plan was designed to evaluate the degree to which students have mastered the skills and learned the information that we consider essential for a graduate from our department, and to then use this information to modify our instructional activities. The exit exam has been taken by F19, S20, F20, and S21 cohorts, with response rates of 93% in F19, 67% in S20, 59% in F20, and 93% in S21. Scores on the exams have been 70% in F19, 66% in S20, 62% in F20, and 72% in S21. At present, we are concerned about both the relatively low overall exit exam scores and the low response rates for two semesters. Unfortunately, it is not clear whether the low scores are a result of shortcomings with our instructional activities or have more to do with Covid-19 related issues with learning and/or test-taking. The Undergraduate Policy Committee plans to continue evaluating the exit exam performance of future cohorts, and will be responsible for making future recommendations for actions related to any findings from this Assessment Survey and Exam.

Given the potential impact of Covid-19 on exam scores and response rates, we have not attempted to identify any performance differences with respect to student demographics. The Undergraduate Policy Committee will continue to evaluate exam results from future cohorts and use the results to explore possible implications for our curriculum, likely connections with Covid-19 related issues (e.g., course modality), and potential impacts on certain demographic groups (e.g., first-generation students, members of under-represented minority groups, etc.).

GRADUATE STUDENTS, DEGREE PROGRAM(S) AND OUTCOMES

SECTION I: GRADUATE STUDENTS, DEGREE PROGRAM(S) AND OUTCOMES

I.1. Graduate Program Description

The Department of Geosciences (CIP code 40.0601) at the University of Arizona is one of the top graduate programs in the country, and we value excellence, creativity, enthusiasm, a strong work ethic, and diversity. Our recent graduate students include several NSF, EPA, NASA, NSAS, ARCS fellows, and PEO Scholars. Geoscience graduate students and faculty work in field areas across the globe. Our department also has some of the best laboratories in the world. We have state-of-the-art geochemistry and geochronology labs. Figure I1 shows the range of graduate students in each discipline in the department. Geosciences graduate students can choose between a two-year MS and a four to five-year PhD program. Both programs are research-based and have coursework requirements, as well as a final requirement of an MS thesis or a PhD dissertation that can consist of publications or pre-publications (Figure I2 and I3). In addition, we have a Professional Science Master in Economic Geology (as part of the Lowell Professional Programs - EPMS)**.** We also offer a minor in Geosciences for students majoring in another discipline. We have a total of 68 graduate students (PhD, MS, and PSM) majoring in Geosciences as of Fall 2021 in all our programs (Figure I.2). Our PhD and MS degrees are in-person. The total number of graduate students in our PhD and MS programs has decreased from 85 to 64 between 2013 and 2020 (not counting students with a minor in Geosciences). PhD students majoring in another department with a minor in Geosciences ranged from 5 to 17 students each year between 2013 and 2021.

I.1.a. Master of Science Degree in Geosciences

The Department of Geosciences Masters of Science (MS) graduate program is intended to train students for careers across a vast array of integrative and interdisciplinary opportunities in geoscience, including research and education in geochemistry, tectonics, climate, surface processes, geodesy and seismology, energy and mineral resource exploration, and many other areas. MS level education is intended to include both coursework and research. In all cases our goal is both to provide high level training in key subject areas and an understanding of how a professional scientist needs to approach analyzing geoscience problems from both technical and ethical standpoints. Given this broad and rapidly evolving array of career opportunities our goal is to provide great flexibility in course work and research opportunities for our MS students, tailoring the specific requirements for each student to their own specific needs, rather than prescribing a set list of course work. The number of MS graduate students overall has not changed much with 22 students in 2013 and 23 students in 2020.

I.1.b. Doctorate of Philosophy in Geosciences

The Department of Geosciences PhD graduate program is intended to train students in careers in geoscience across all disciplines in the department with in-depth training in their subfield and broad knowledge of Geosciences. We provide flexibility in course work and research opportunities for each student based on their interests, background, and goals for the future. Our graduate students are studying a wide range of topics including geochemistry, tectonics, climate, surface processes, geodesy and seismology, energy and mineral resource exploration, and many other areas. The number of PhD graduate students has decreased from 54 in 2013 to 37 in 2020, in large part due to financial concerns and our policy for providing financial support for all graduate students. We have admitted fewer PhD students so that we can guarantee financial support. The drop in the number of PhD degrees in 2021 reflect in part the number of PhD students that started the program in 2016 and 2017 of 7 and 5

students respectively. In addition, one PhD student that entered the program in 2016 changed to the MS program and graduated in 2021.

I.1.c. Professional Master Program in Economic Geology

The Professional Science Masters program in economic geology is a 1-year program that is in transition with both in-person and on-line courses and is part of the Lowell Professional Programs. The PSM degree and Lowell Program in Economic Geology (LPEG) were created in 2004 (following Eric Seedorff's hire in 2002) to provide applied graduate training for industry and other geologists. The Lowell Professional Program is designed to accommodate working professionals in the mineral resources industry. The focus is on continuing education, non-thesis master's degrees, practical and intensive field courses, and distance learning, both live and on-demand. The Professional Master Program offers a mix of geology, engineering, business, and environmental coursework. This is a small program with 1-5 students per year in the full 1-year professional program. The short courses (10-14 days) and field courses are offered to professionals outside the program and are well attended by working professionals in the minerals industry. To date 30 masters-level students have enrolled in the PSM, 24 students have graduated, 3 students are in progress, and 3 students did not finish. PSM students receive no departmental support; rather they come with their own funding (company or personal) or are supported via LPEG RA and staff positions. About 1/3 of the PSM students have been employed part-time or full time in the Arizona mining industry while working on their degrees. Another 50 regular MS and PhD students in economic geology have benefited from LPEG.

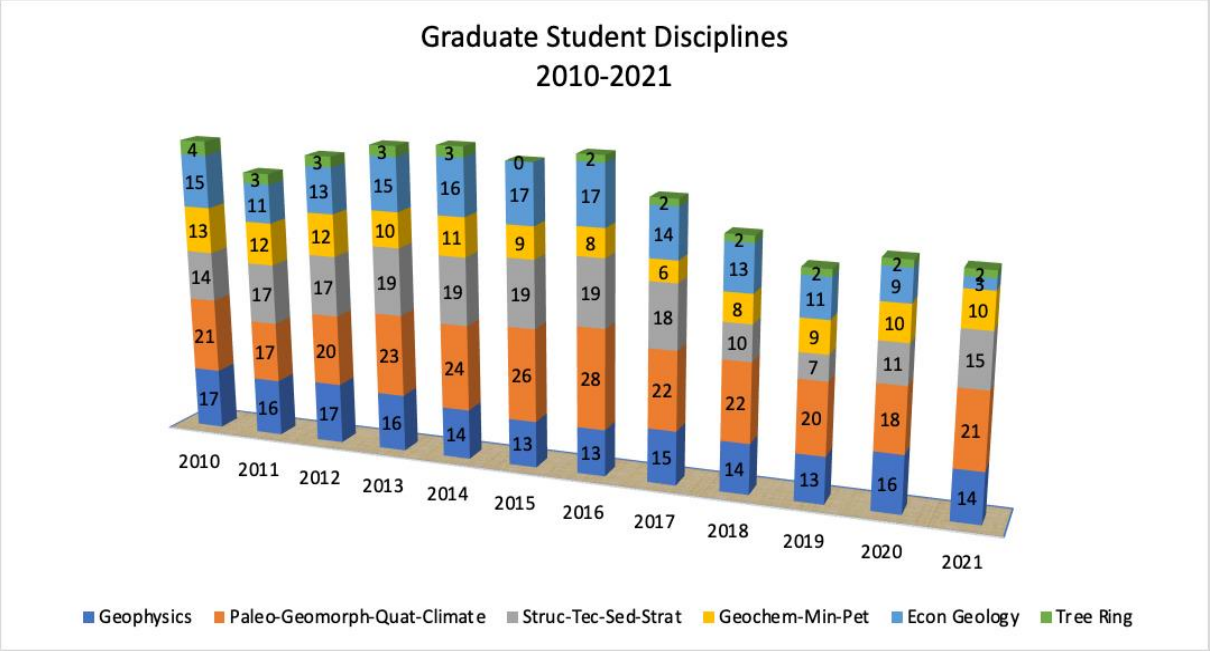


Figure I.1.1. Graduate students in the Department of Geosciences by discipline from 2010 to 2021. This chart includes PhD and MS graduate students (does not include PSM students).

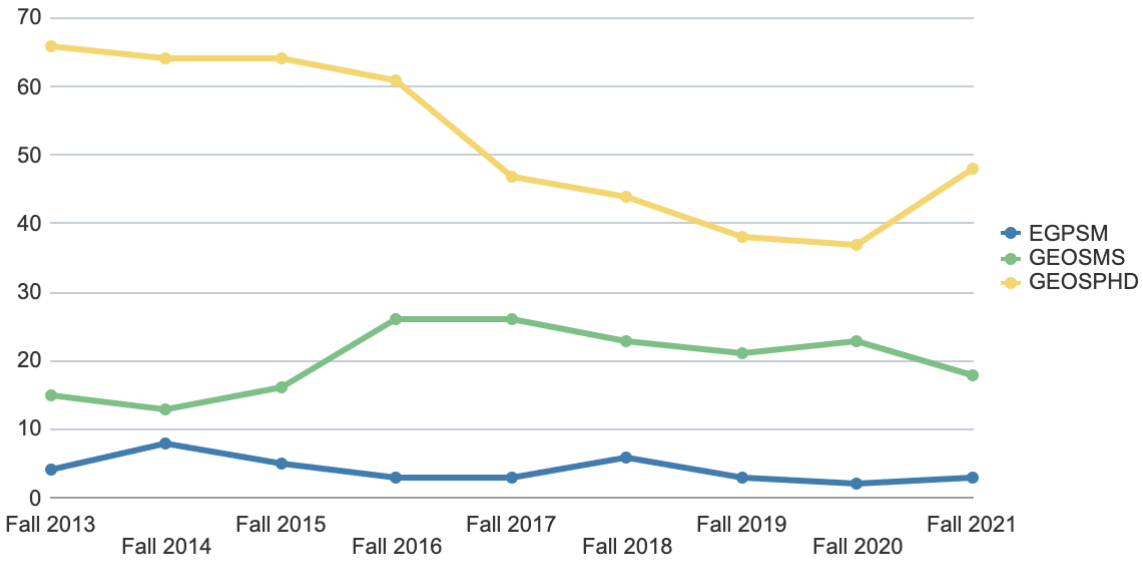


Figure I.1.2. Number of graduate students in each program (MS, PhD, EGPSM) from Fall 2012 to Fall 2021.

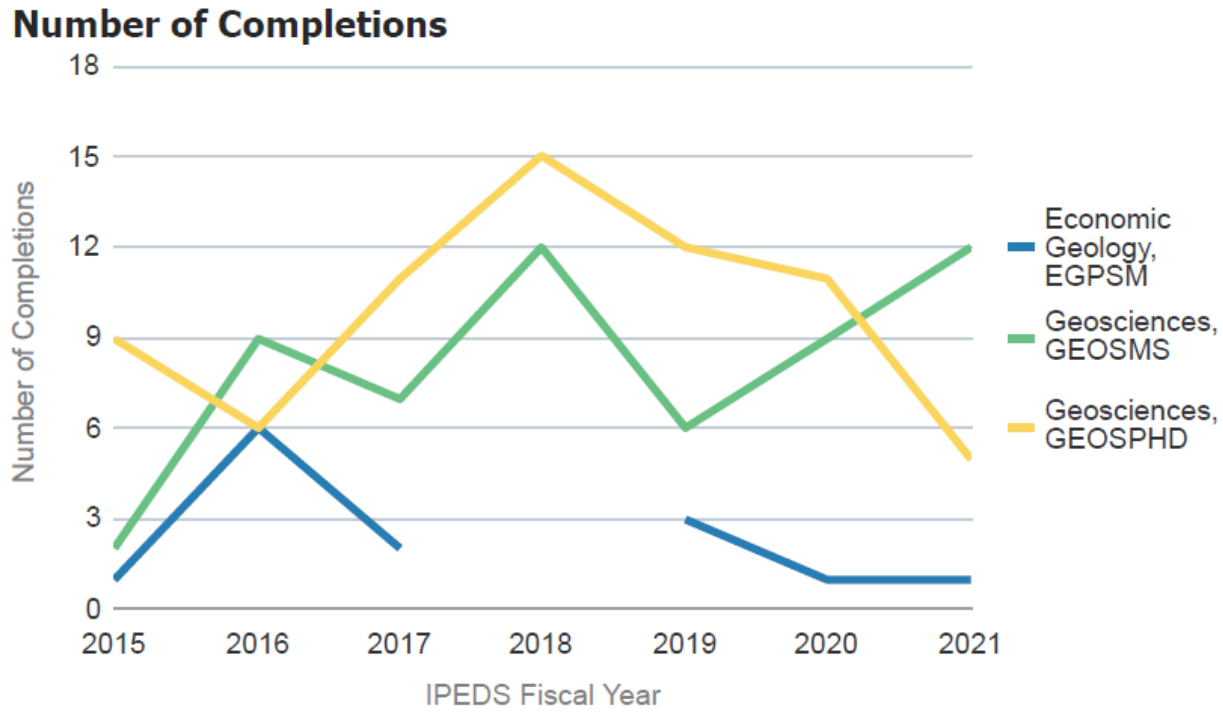


Figure I.1.3. Number of graduate degrees granted in the three programs in the Department of Geosciences from 2015 to 2021.

I.2. Graduate Program - Curriculum and Courses

I.2.a. Adequacy of Graduate Courses

All our 400/500 combined courses have additional work and learning expectations for graduate students, as established by the instructor and described in the syllabus.

I.2.b. Learning Outcomes

The learning outcomes listed on all face-to-face, hybrid, and online course syllabi for the same courses are the same.

I.2.c. Graduate Courses Description

We offer graduate classes across all disciplines in the department as most of our faculty teach a graduate class in their discipline at least once every 2 years (many faculty teach a graduate class every year). We encourage graduate students to take classes across the department and outside of the department as needed for their research. Many of our courses are co-convened 400/500 level (undergraduate is 400 level and 500 is graduate level). This allows us to teach a wider range of topics and still have the enrollment large enough to justify teaching the course and allows our top undergrads to take valuable classes. Our graduate students have a wide range of backgrounds so we can provide them with the background necessary for their research. Some of the graduate students like the 400/500 level classes. Other graduate students tell us that they prefer graduate-only courses especially if the 400/500 level courses are dominated by undergraduates. We have renewed our efforts to distinguish between the 400 and 500 level courses that are co-convened by adding different and additional assignments and separate discussion sessions to 500 level courses.

Below, we provide a list of graduate courses offered by the Department of Geosciences. Some classes are offered every year while others are offered every other year depending on faculty teaching schedules and enrollment. *Denotes classes cross listed between departments but taught by faculty in other departments.

GEOS 500 - Introduction to Geochemistry
GEOS 503 - Physics of the Solar System*
GEOS 504B - Lowell Program Topics in Ore Deposits Mapping
GEOS 504C - Lowell Program Topics in Mineral Deposit Types
GEOS 504D - Geological Inputs to Integrated Planning*
GEOS 504E - Mine Engineering Inputs to Integrated Planning*
GEOS 504F - Metallurgical Inputs to Integrated Planning*
GEOS 512A – Geoarchaeology; GEOS 516 - Field Studies in Geophysics*
GEOS 517 - Sedimentary Basin Analysis; GEOS 518 – Geometallurgy*
GEOS 519 - Physics of the Earth; GEOS 520 – Meteorites*
GEOS 521 - Petroleum Geology and Geophysics
GEOS 525 - Regional Tectonics
GEOS 527 - Orogenic Systems

GEOS 529 - Objective Analysis in the Atmospheric and Related Sciences*
GEOS 530 - The Chemical Evolution of Earth
GEOS 531 – Hydrogeology*
GEOS 532 - Introduction to Seismology
GEOS 534A - Introduction to Exploration Seismology
GEOS 535 - Advanced Subsurface Hydrology*
GEOS 536 - Earthquakes and Volcanic Systems: Processes and Hazards
GEOS 537 - Introduction to Earth-System Modeling
GEOS 539A - Introduction to Dendrochronology*
GEOS 540 – Geodynamics
GEOS 541 - Soils and Landscapes of Arizona*
GEOS 546 - Economic Mineral Deposits
GEOS 548 - Geophysical Exploration and Engineering*
GEOS 553 - Glacial and Quaternary Geology*
GEOS 554 - Evolution of Planetary Surfaces*
GEOS 556 - Thrust Belts
GEOS 560 - Characterization and Identification of Minerals
GEOS 562 - Petrology of Gems
GEOS 566 - Stable Isotope Geochemistry and Paleoclimate
GEOS 569- Seismic Data Processing
GEOS 570L - Volcanology: Laboratory and Field Methods
GEOS 570R - Volcanology: Physical Processes and Petrologic Applications
GEOS 577 - Active Tectonics
GEOS 578 - Global Change
GEOS 579 - Introduction to Climate Dynamics
GEOS 580 - Isotope Tracers in Hydrogeology
GEOS 583 - Modes of Climate Variability
GEOS 584 - The Coevolution of Earth and the Biosphere*
GEOS 585A - Applied Time Series Analysis*
GEOS 586 - Organic Geochemistry
GEOS 589 - Quaternary Geochronology
GEOS 590 - Remote Sensing for the Study of Planet Earth*
GEOS 596F - Interpretation of Seismic Reflection Data.

In addition to these classes a variety of graduate level seminars are offered every year on topics of general interest to our graduate students.

I.2.d. Active Learning Strategies

Many of our graduate courses have discussions, computer assignments, projects, group activities and/or field trips. We offer short courses and workshops on topics in economic geology and tectonics. Our

graduate students work in state-of-the-art geochemistry and computer labs as part of their research. Many of our graduate students are supported on research assistantships from faculty research grants and work closely with the faculty and in research groups.

We encourage graduate students to consider summer internships at agencies including the USGS, NOAA, EPA, National Laboratories and other industries for practical experience, but there is no requirement for an internship. In any one semester, approximately33% of our grad students are Teaching Assistants or Associates in our undergraduate classes gaining valuable experience teaching and working with faculty,and 39% of all our graduate students are on Research Assistantship with their advisor. The other 28% of graduate students have a scholarship, fellowship, are staff, or are employed outside of the department.

I.2.e. Instructional Technology

Our faculty use D2L (Desire to Learn, UA system), Zoom and Panopto in graduate classes, as well as social media to keep in touch with students. Some faculty use jupyter notebooks for their class. We have a new interactive/computer lab/classroom that opened just before the Covid-19 shut down that allows interactive discussion and computer activities during class time. We started using this room in Fall of 2021, and several graduate classes are taught in this new classroom.

I.2.f. Online Courses

We do not currently have many on-line courses for our graduate students. We are transitioning back to face-to-face courses, although some courses this semester are hybrid, and the learning outcomes are the same. The Professional Science Master program in Economic Geology offers some courses hybrid/online and is transitioning into more online courses. There are plans to offer a mineral resource certificate program as part of the Lowell Programs. Given the national to global opportunity, and the demand for training that need not lead to a formal degree, a logical direction is to offer a mix of online and in-person courses that can stand-alone, be part of a certificate, or contribute to a regular degree. To this end, with support from Lowell Institute Mineral Resources (LIMR) (Freeport-McMoRan, Lundin family funding), the Lowell Program is developing 3 new online, modular 5-7 unit, 400/500-level courses. These on-line courses will be available to PhD and MS students in the future as part of their course requirement.

I.2.g. Adequacy of the Resources for Graduate Students

All of our graduate students have an office in the Department of Geosciences space and access to laboratories appropriate for their research. Graduate students have access to the UA high performance computer at no cost (sometimes with lower priority compared to paying researchers, but it has not been a problem). Graduate students have access to state-of-the-art geochemistry labs and appropriate computers depending on their research. Graduate student advisors are responsible for supplies and travel funds to be paid from a funded grant. The department has some small scholarship funds (usually ~$1,500-$2,000 per student who applies) for summer research support or to use to attend a meeting. These funds are given out each spring. The Director of the Graduate Studies along with the graduate policy committee make decisions about funding based on the criteria of the scholarship fund.

I.2.h. Courses and Minors in Other Disciplines

The graduate college allows PhD students to major and minor in the same department which many of our graduate students do. We have between 2 and 5 PhD students completing a minor outside our department in any given year, which corresponds to between 13% and 50% of the PhD students since 2014 (TableI2). The PhD students who have a minor outside Geosciences often minor in Hydrology and Atmospheric Sciences, Applied Math, or Lunar and Planetary Science. We have a minor in Geosciences that is composed of graduate students from other departments, including Lunar and Planetary Sciences, Hydrology and Atmospheric Sciences, Anthropology, and a few other departments.

Table I.2.h.1. PhD Degrees\Granted in Geosciences Completing Minors in Other Disciplines

PhD completers in **Geosciences**

	2014	2015	2016	2017	2018	2019	2020	2021
Total PhD completers in prompted plan	11	8	7	14	15	11	6	6
PhD completers in prompted plan who minored in other disciplines	3	4	2	3	2	5	2	2
Proportion	27%	50%	29%	21%	13%	45%	33%	33%

PhD completers OUTSIDE of the discipline who minored in **Geosciences**

	2014	2015	2016	2017	2018	2019	2020	2021
PhD completers in other disciplines who minored in prompted plan	8	8	9	11	17	10	8	6
Total PhD completers in other disciplines	411	481	413	407	383	395	418	417
Proportion	1.95%	1.66%	2.18%	2.70%	4.44%	2.53%	1.91%	1.44%

I.2.i. Link to an Electronic Copy of Geosciences' Graduate Student Handbook

https://www.geo.arizona.edu/sites/default/files/data/phd_handbook_2021-2022_0.pdf
https://www.geo.arizona.edu/sites/default/files/data/ms-psm_handbook_2021.pdf

I.3. Graduate Students

I.3.a. Recruitment and Quality of Students

We recruit graduate students with our website, information tables/booths at national meetings (GSA and AGU) and by individual faculty engaging with prospective graduate students throughout the year. Our program is highly ranked so most faculty get emails from prospective graduate students starting in the summer before our admissions deadline of Jan. 1. We use a holistic approach to evaluate graduate student applications including grades, undergraduate curriculum (what courses have they taken), statement of interest, letters of recommendation, research experience, other activities outside of the classroom and zoom or skype interviews. Students admitted to the program have strong GRE and GPA (Table I.3.a.1). We note that GRE scores are no longer required (starting in 2020).

We receive strong applications across the department, and we often compete with top schools across the country. We have seen a drop in our graduate applications in the last 8 years. We received 211 applications for all our graduate programs in 2013 and 135 applicants in 2021. After reviewing applications, we invite 20-30 prospective graduate students (at the department's expense) to visit before making final decisions on admissions. We suspended this practice due to Covid-19 in 2021 (using individual zoom interviews instead), but we hope to restart in-person visits in the Spring of 2022, if possible. We admitted 28 graduate students in 2014 and 33 graduate students in 2020 with 24 and 16 accepting our offers,respectively, and coming to the University of Arizona. The acceptance rate for MS students is between 56% and 100% and for PhD students is between 43% to 80% depending on the year (Table I.3.a.2). Figure I.3.a.1. shows where graduate students go when they decline our offers.

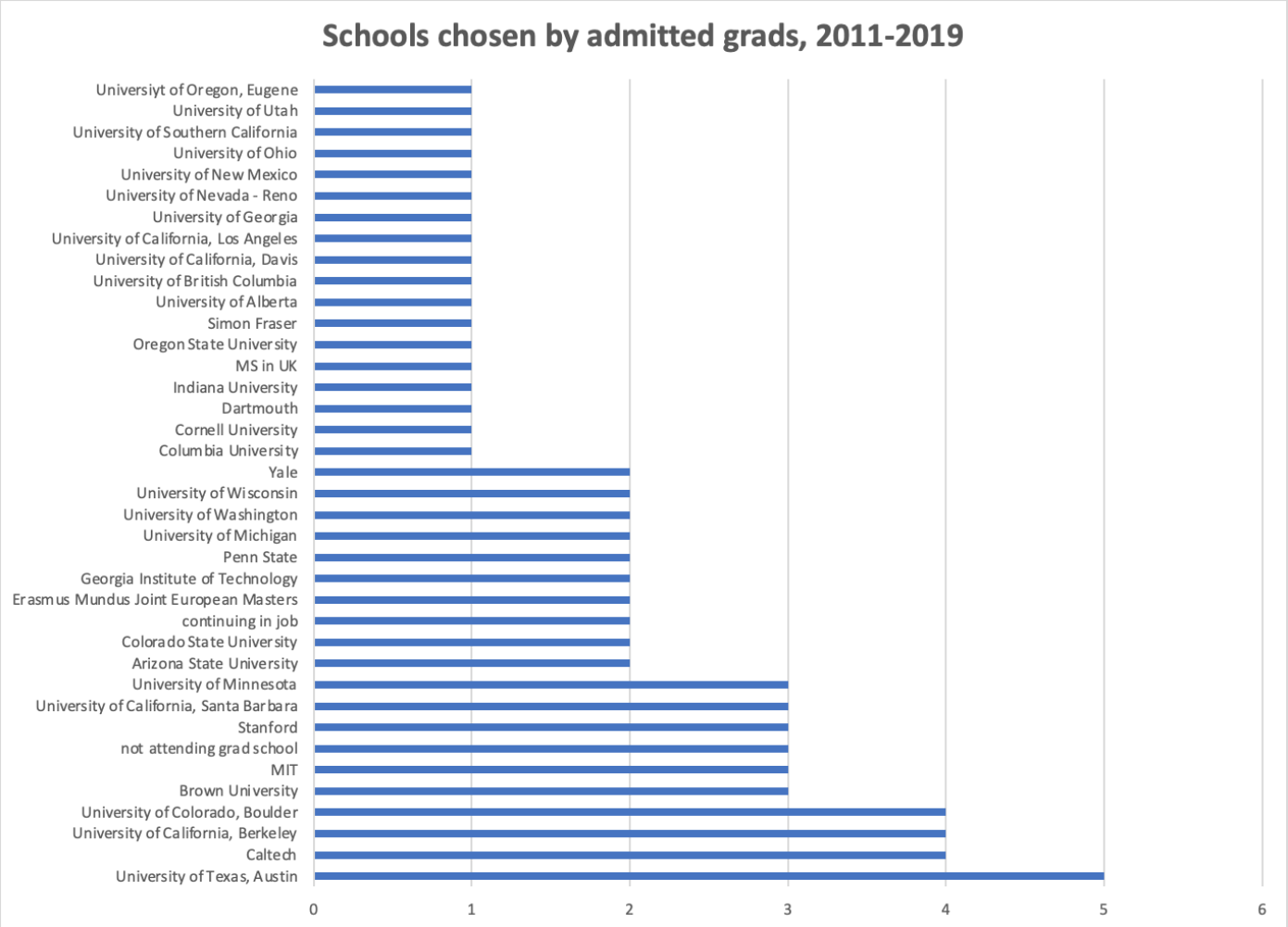


Figure I.3.a. Other schools for graduate students.

Table I.3.a.1.

Geosciences

GEOSMS

Admit Term Description	Headcount	Graduate Admit GPA	GPA Headcount	GRE Quantitative	GRE Quan Headcount	GRE Verbal Reasoning	GRE Verb Headcount	GRE Writing	GRE Writ Headcount
Fall 2017	7	3.60	7	155.43	7	159.00	7	4.29	7
Fall 2018	9	3.59	9	154.67	9	154.44	9	3.89	9
Fall 2019	9	3.74	9	158.13	8	159.75	8	4.31	8
Fall 2020	11	3.51	10	153.30	10	156.70	10	3.90	10

GEOSPHD

Admit Term Description	Headcount	Graduate Admit GPA	GPA Headcount	GRE Quantitative	GRE Quan Headcount	GRE Verbal Reasoning	GRE Verb Headcount	GRE Writing	GRE Writ Headcount
Fall 2017	6	3.69	6	158.83	6	156.67	6	4.17	6
Fall 2018	13	3.72	13	157.67	12	160.75	12	4.38	12
Fall 2019	9	4.00	9	161.00	7	160.43	7	4.29	7
Fall 2020	6	3.83	6	156.80	5	151.60	5	4.20	5

Table I.3.a.2. Admission Acceptance Rates Overall and by Degree and Gender from 2014-2020

In-Depth Admissions Acceptance
2014-2020

PSM							
Academic Year (fall)	2014	2015	2016	2017	2018	2019	2020
# Applicants	16	5	4	6	7	2	7
# Admitted	6	2	2	3	3	1	0
# Matriculated	5	1	2	2	3	1	0
% Matriculated	83%	50%	100%	67%	100%	100%	0%

MS							
Academic Year (fall)	2014	2015	2016	2017	2018	2019	2020
# Applicants	93	91	94	73	77	93	67
# Overall Admitted	11	5	16	8	15	13	10
# Overall Matriculated	8	5	13	6	9	8	10
% Overall Matriculated	73%	100%	81%	75%	60%	62%	100%
# Women Admitted	6	0	7	4	6	8	6
# Women Matriculated	4	0	6	3	4	5	6
% Women Matriculated	67%	0%	86%	75%	67%	63%	100%
# Men Admitted	5	5	9	4	9	5	4
# Men Matriculated	4	5	7	3	5	3	4
% Men Matriculated	80%	100%	78%	75%	56%	60%	100%

PhD							
Academic Year (fall)	2014	2015	2016	2017	2018	2019	2020
# Applicants	88	86	102	73	75	64	46
# Overall Admitted	21	15	12	12	18	14	7
# Overall Matriculated	11	8	7	5	11	7	6
% Overall Matriculated	39%	53%	58%	42%	61%	50%	86%
# Women Admitted	15	6	7	5	11	7	2
# Women Matriculated	8	3	3	2	6	3	2
% Women Matriculated	53%	50%	43%	40%	55%	43%	100%
# Men Admitted	6	9	5	7	7	7	5
# Men Matriculated	3	6	4	3	5	4	4
% Men Matriculated	50%	67%	80%	43%	71%	57%	80%

We make every effort to identify applicants from underrepresented groups and encourage faculty to consider their applications carefully. We do well with international students, but we have not been able to diversify our U.S. graduate student population as much as we would like. We are not always able to recruit all of the diverse students that apply to come to UA. There is strong competition for many of the highly qualified students from underrepresented groups in Geosciences. Part of the problem is that there is a small pool of students that apply, hence, we need to work harder to expand the pool of applicants that apply to UA. To this end, we are planning to apply to the AGU Bridge Program next year.

I.3.b. Gender and Race/Ethnicity Composition of the Current Graduate Students

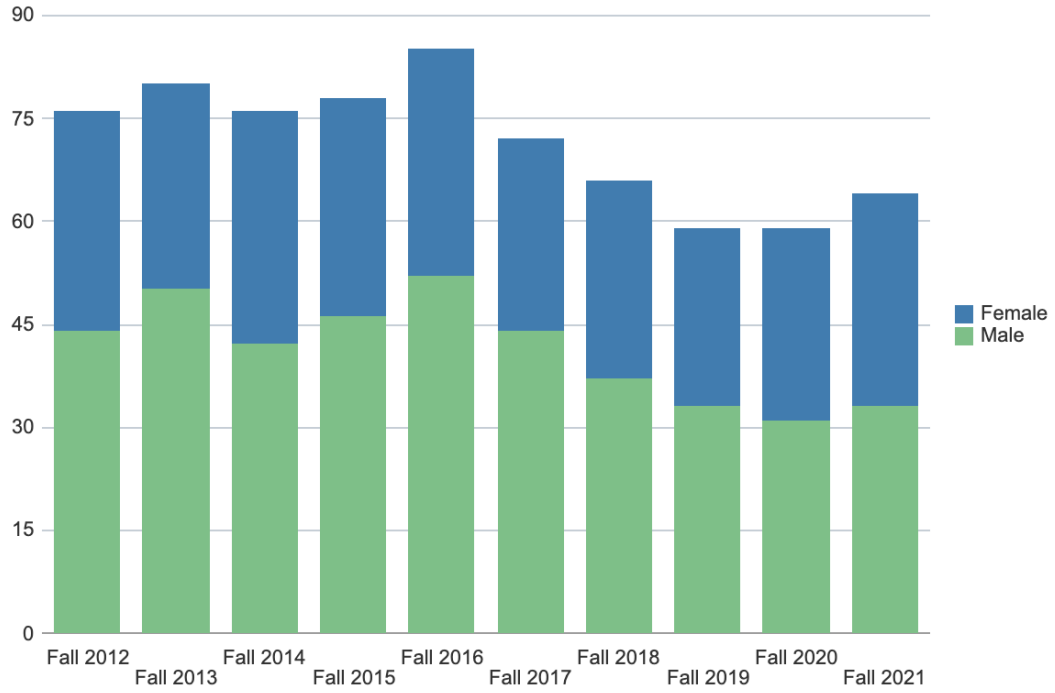


Figure I.3.b. Gender of Our Graduate Students from 2012 to 2021 (PhD and MS students only).

Table I.3.b.1. Gender and Race/Ethnicity Composition of the Current Graduate Students with Majors

Sex	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Female	32	30	34	32	33	28	29	26	28	31
Male	44	50	42	46	52	44	37	33	31	33
Grand Total	**76**	**80**	**76**	**78**	**85**	**72**	**66**	**59**	**59**	**64**

Table I.3.b.2. Graduate Completed Majors & Certificates by Academic Plan and IPEDS Race/Ethnicity

Graduate Completed Majors & Certificates by Academic Plan and IPEDS Race/Ethnicity

IPEDS Race/Ethnicity	2015	2016	2017	2018	2019	2020	2021
Asian			9.1%				
Hispanic or Latinx		16.7%			16.7%	9.1%	20.0%
International	11.1%			6.7%		9.1%	40.0%
Not reported	22.2%		18.2%	6.7%	16.7%		
White	66.7%	83.3%	72.7%	86.7%	66.7%	81.8%	40.0%

Masters Economic Geology EGPSM

IPEDS Race/Ethnicity	2015	2016	2017	2018	2019	2020	2021
Asian		16.7%					
International		33.3%			33.3%		
White	100.0%	50.0%	100.0%		66.7%	100.0%	100.0%

Masters Geosciences GEOSMS

IPEDS Race/Ethnicity	2015	2016	2017	2018	2019	2020	2021
Asian			14.3%	8.3%			
Black or African American				16.7%			
Hispanic or Latinx			14.3%		16.7%	22.2%	
International		22.2%	14.3%	16.7%	33.3%		25.0%
Not reported		11.1%	14.3%			11.1%	
Two or more races	50.0%	11.1%	14.3%				
White	50.0%	55.6%	28.6%	58.3%	50.0%	66.7%	75.0%

Export

Our efforts to increase representation of under-represented groups are summarized under the DEI activities we have in place. In 2020, we removed the GRE requirements for admission to our graduate program. Our counts of gender and race/ethnicity are self-identified by the students at the time of census snapshot. Our PhD program is 48% female and 52% male as of Fall 2021. The percentage of female PhD students was similar in 2014 at 44%. Our MS program has 52% female and 48% male students as of Fall 2020, with similar percentages since 2014. The professional MS program has small numbers and currently has 3 male students and no female students. The number of female Professional MS students was 50% in 2014 but has declined since then.

We are aware that our graduate program is not as ethnically diverse as we would like it to be. We use a holistic approach to graduate admissions (as discussed above) using a wide range of metrics including undergraduate record, statement of interest from the applicant, GPA, letters of reference and skype or zoom interviews. Until last year we also required GRE scores, but we have never used a minimum cut-off score and we recently dropped the GRE requirement from our admissions process. We are aware of many biases in our (and most) graduate admissions processes. Our admissions committee (4 faculty members from across the department) review each applicant from an under-representative group and make sure multiple faculty review each applicant. The admissions committee identifies any funding that an applicant might be qualified for to make sure we can make the most competitive offer that we can.

Our PhD program is currently 45% white, 29% international, 18% Hispanic or Latinx or 2 or more races, and 8% not reporting ethnicity. In the Fall of 2014, we had 70% white PhD students. In terms of absolute

numbers in 2014, we had four Hispanic students and one mixed race PhD student, compared to four Hispanic and three mixed race PhD students in 2020. In Fall 2020, our MS program was 52% white, 9% Hispanic or Latinx, 11% international and 9% mixed race with 9% not reporting ethnicity. Our numbers of MS students have increased since 2014, but most of that increase was due to an increase in white students.

I.3.c. Graduate Stipends and Assistantships

Approximately 33% of our graduate students are on teaching assistantships, and approximately 39% are on research assistantships. The rest of the graduate students are on scholarships, fellowships, are department staff or are employed outside the department.

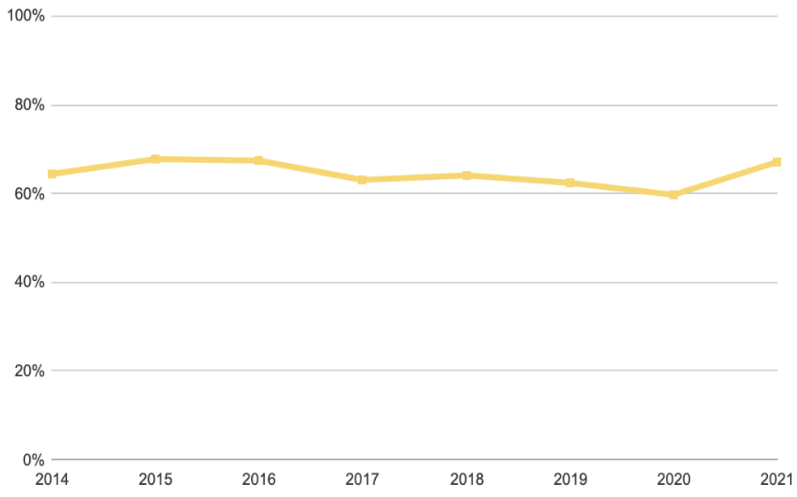
Table I.3.c.1. Number of Graduate Students with Research or Teaching Assistant or Associate Positions from 2014 to Fall 2021

ABOR Code	UA Title	2014	2015	2016	2017	2018	2019	2020	2021
Graduate Assistant/Associate	Graduate Assistant, Research	8	6	8	8	9	7	9	9
	Graduate Assistant, Teaching	2	6	5	7	7	10	6	9
	Graduate Associate, Research	27	24	25	25	14	18	12	15
	Graduate Associate, Teaching	19	21	18	15	18	12	13	12
Grand Total		**56**	**57**	**56**	**55**	**48**	**47**	**40**	**42**

Percent of Enrolled Graduate Students with an Assistantship in Program

Captured by dividing the number of graduate students enrolled in academic plans owned by the department by the number of assistantships that are filled by students who are enrolled in academic plans owned by the department. Please note that this number of assistantships may be less that the total number identified in above section.

Counts are captured at fall fall census snapshot date of each fiscal year displayed (i.e. the FY 2012 counts were captured on the fall 2011 census snapshot date).



Fiscal Year	Enrolled Grad Students	Assistantships	Enrolled Grad Students with Assistantship
2014	84	54	64%
2015	84	57	68%
2016	83	56	67%
2017	87	55	63%
2018	75	48	64%
2019	72	45	63%
2020	62	37	60%
2021	61	41	67%

Figure I.3.c.1. Number of graduate students with teaching or research assistantships in the department from 2014 to Fall 2021.

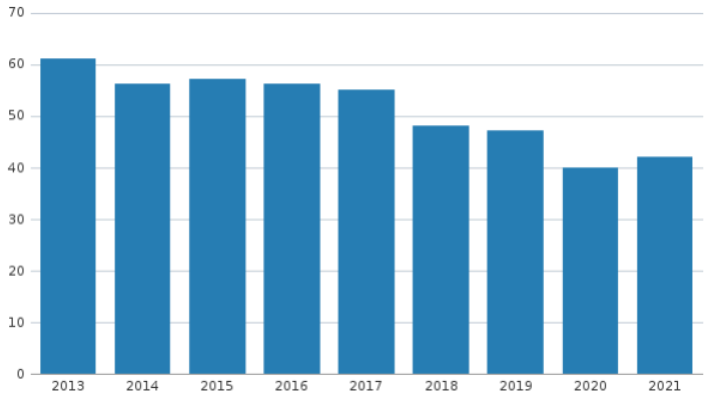


Figure I.3.c.2. Number of graduate assistantships (both TAs and RAs) from 2013 to 2021.

We currently pay graduate students ~$18-19K per academic year (9 months, depending on their level of assistant or associate and MS or PhD) for a ½ time TA or RA. We pay TAs and RAs at the same level, the same amount. As of Spring 2022 semester, we are increasing our graduate student stipend and all graduate students will be paid at least $20k for 9 months. Many of our internal scholarships from endowments for graduate student support are given as ¼ time support and matched with a ¼ time TA to lighten the teaching load for a graduate student and also spread out TAs to give more students teaching experience. External fellowships and scholarships including NSF graduate fellowships or NASA graduate fellowships pay significantly more. During the summer months, the advisor is responsible for paying their graduate students, usually as a research assistant from a grant. We have small amounts of department scholarship money from endowments to give out for summer support to students for research costs, travel to meetings, or self support with priority going to the students with the most need. Currently, ~67% of our graduate students have RA or TA assistantships with the others having a combination of department scholarships, external fellowships/scholarships, hired as staff or employed outside the department.

Rents have historically been low in Tucson, especially compared to many other cities on the east and west coasts. However, in the last 1.5 years (in part due to covid-19 and a significant influx of people to Tucson,) rent has gone up much faster than graduate student stipends. This is clearly an issue for the department going forward. Our temporary teaching budget (funds for teaching assistants from the COS) is not likely to go up and has been declining since 2013. We have raised our graduate stipends to just over $20K for 9 months starting in Spring 2022 to help with some of the increases in cost of living. This will likely lead to a smaller graduate population as our TA budget is not going up to cover the increased cost. Clearly, we need to increase our graduate research assistantships and scholarship funds if we want to keep a vibrant graduate program.

Table I.3.c.2. Salary for Graduate Students for Years, 2013 to 2021

At this time, the current salary levels for our Graduate Teaching/Research Assistants/Associates are as follows:

Academic Standing	Annualized Salary
MS Student	$40,000.00
PhD I	$40,608.00
PhD II	$41,612.00

A historical trend of our graduate student salary levels are shown in the table below.

	2013		2014		2015		2016		2017		2018		2019		2020		2021	
ABOR Code	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX	Base Salary MIN	Base Salary MAX
Graduate Assistant/ Associate	$33,000	$37,400	$33,363	$37,812	$33,363	$37,812	$33,363	$37,812	$36,000	$38,112	$36,000	$38,112	$36,800	$38,640	$36,800	$38,640	$36,800	$39,480

I.3.d. Student/Faculty Thesis and Dissertation Supervision

Our faculty typically supervise between one and 10 graduate students each year depending on the field and on the level of external grant funds to pay graduate student stipends. Our Economic Geology program usually has more students per faculty member due to a larger program and funding.

We conduct exit interviews and ask graduate students where they are going after graduation. Since 2019, our PhD students have gone to academic postdocs, national labs, state government, and oil companies and mining companies. Our exit survey indicates that MS students are going on to PhD programs (often in our program), state geologic surveys, NOAA, mining companies, and the forest service. We are not able to track many of our former graduate students after they move from their first job but many continue in academia.

I.3.e. Scholarly Activities of Our Graduate Students

Our graduate students are encouraged to publish their research in peer-reviewed journals and give presentations at professional meetings. Most graduate students give a professional talk or poster presentation at least once a year at a national or international meeting. In addition, they present their research at the Department of Geosciences GeoDaze, a graduate student-run professional symposium organized each spring. On average, we expect PhD students to write 3 papers suitable for a peer-

reviewed journal and MS students to write one paper. This may vary depending on the discipline and/or the length of papers. At the time of graduation, it is not uncommon for a PhD student to have 2 papers published and one ready for publication soon after graduating. Obviously, the number of papers varies with the discipline, type of research and journal. The PhD and MS committees have discretion on the number of papers. Many of our MS students publish one paper from their work. We accept either a traditional MS thesis or a pre-publication manuscript so unfortunately, some of our MS graduate students do not publish their research. We strive to have all MS students publish, but sometimes as they start jobs and move on it does not happen.

I.3.f. Enrollment Trends and Time to Degree

We encourage and expect PhD students to finish in five years and MS students to finish in 2-2 1/2 years. Obviously, not all students finish within this timeline as research does not always progress as planned. Figure 1.3.f.2 shows our time to completion for each degree program. We make every effort to monitor graduate student progress to help students finish in a timely manner. We currently have three out of 62 (or ~5%) of PhD students in their 6th year and no PhD students beyond six years (as of Spring 2021). We have some students leave to take full time jobs before finishing (five students since 2015). Despite the student and the faculty advisors' good intentions these five students took seven to eight years to finish, and they continued to pay for one credit of tuition each semester to be considered enrolled as a student. We discourage students from leaving before they graduate but often their five years of support has run out, they get offered the perfect job or they have family obligations (e.g., spouse employed out of state). We realize it would be better if these students took a leave of absence, but they often are optimistic that they will finish the following semester.

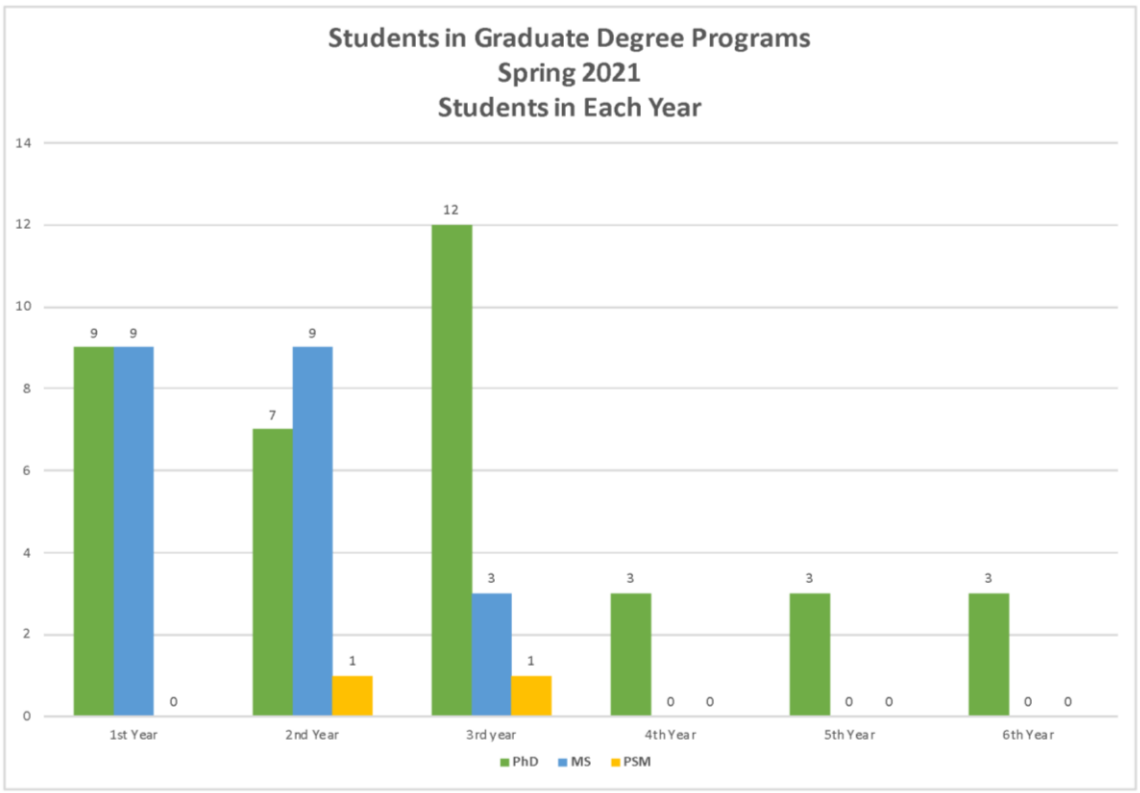


Figure I.3.f. Number of students in each year of the program as of Spring semester 2021. We expect PhD students to finish in five years, MS students in two or 2.5 years, and PSM students in one year.

Table I.3.f.1. Number of Admissions for GEOS MS, PhD, and EGPSM Programs

EGPSM	Economic Geology		
Admit Term Description	Applications	Admits	Enrolled
Fall 2013	16	3	3
Fall 2014	16	5	8
Fall 2015	3	2	1
Fall 2016	7	3	3
Fall 2017	6	2	2
Fall 2018	7	3	3
Fall 2019	2	1	1
Fall 2020	7	0	0

GEOSMS	Geosciences		
Admit Term Description	Applications	Admits	Enrolled
Fall 2013	106	6	6
Fall 2014	105	11	10
Fall 2015	94	5	5
Fall 2016	99	17	15
Fall 2017	80	9	8
Fall 2018	80	16	10
Fall 2019	74	12	10
Fall 2020	68	11	11

GEOSPHD	Geosciences		
Admit Term Description	Applications	Admits	Enrolled
Fall 2013	86	22	15
Fall 2014	89	21	12
Fall 2015	87	14	8
Fall 2016	98	10	6
Fall 2017	73	11	5
Fall 2018	78	18	12
Fall 2019	54	13	7
Fall 2020	46	9	6

Table I.3.f.2. Time to Major Completion

Doctorate Geosciences GEOSPHD

	2015	2016	2017	2018	2019	2020	2021
Major Count Awarded	9	6	11	15	12	11	5
Average Time to Major Completion	5.44	6.60	5.45	6.71	5.42	5.68	6.00
Median Time to Major Completion	5.00	5.00	5.00	5.50	5.25	5.50	6.00

Masters Economic Geology EGPSM

	2015	2016	2017	2018	2019	2020	2021
Major Count Awarded	1	6	2		3	1	1
Average Time to Major Completion	2.00	1.58	2.25		2.00	1.50	2.00
Median Time to Major Completion	2.00	1.50	2.25		2.00	1.50	2.00

Masters Geosciences GEOSMS

	2015	2016	2017	2018	2019	2020	2021
Major Count Awarded	2	9	7	12	6	9	12
Average Time to Major Completion	2.00	1.78	2.00	2.13	2.17	2.67	2.67
Median Time to Major Completion	2.00	2.00	2.00	2.00	2.00	2.50	2.00

I.4. Graduate-Student Learning Outcomes Assessment

Please find our graduate degree program below, and hyperlink to Taskstream URL. Address: https://www.taskstream.com/ts/msgeosciences/ProgramAssessment

Password: geosms2021

Please find our graduate degree program below, and hyperlink to Taskstream URL. Address: https://www.taskstream.com/ts/phdgeosciences/ProgramAssessment

Password: No password specified

We updated and significantly improved our MS and PhD graduate student assessment plans in September of 2021. Our new assessment does a better job of linking outcomes to activities. Below are the mission statements, program Learning outcomes, and Curriculum maps for our MS and PhD programs. Each assessment plan has a curriculum map that links each outcome to activities in the program. In addition to the assessment, we have a written exit interview for all graduating graduate students. We also describe our progress in creating similar assessment components for our Professional Master's Degree program.

I.4.a. GEOS MS Assessment Components

Mission Statement**.** The Department of Geosciences Master of Science graduate program is intended to train students for careers across a vast array of integrative and interdisciplinary opportunities in geoscience, including research and education in climate, earth surface history and processes, energy and mineral resource exploration, geochemistry, geophysics, tectonics, and many other areas. MS level education is intended to include both coursework and research. In all cases our goal is both to provide high level training in key subject areas and an understanding of how a professional scientist needs to approach all aspects of analyzing geoscience problems from both technical and ethical standpoints. Given this broad and rapidly evolving array of career opportunities our goal is to provide great flexibility in course work and research opportunities for our MS students, tailoring the specific requirements for each student to their own specific needs, rather than prescribing a set list of course work. We aim to provide students with a comprehensive vision of the breadth of Geosciences through integrative and interdisciplinary activities that unify the department, such as our weekly required colloquium and our annual, student-lead *Geodaze* research symposium.

MS Program Learning Outcomes

Outcome 1: Analysis	Students will learn the broad range of topics related to the Earth and its history, oceans and atmosphere including societally critical topics in climate, resources, hazards, environmental issues and basic research amenable to analysis using geoscience research approaches
Outcome 2: Career Preparation	Students will learn state-of-the-art field, laboratory, computational and analytical methodologies appropriate to their chosen subdiscipline within the geosciences.
Outcome 3: Career Preparation	Students will be conversant in the research literature within their chosen subdiscipline of the geosciences
Outcome 4: Career Preparation	Students learn to produce publishable research findings in their subdiscipline and present them in both written and oral formats
Outcome 5: Best practices and ethical standards for professional geoscientists	Students will understand professional, ethical norms of behavior in research, collaborative activities, presentation of results and publication expected of all practicing geoscientists.

MS Curriculum Map

		Outcomes			
	Outcome 1: Students learn breadth of geosciences	**Outcome 2: Students learn geoscience methodologies appropriate to their subdisciplines**	**Outcome 3: Students become conversant in research literature in their subdiscipline**	**Outcome 4: Students learn to produce publishable research in their subdiscipline**	**Outcome 5: Students understand professional and ethical norms**
Course and Learning Activities					
GEOS 595A (Department Colloquium)	**I**				**I,P,A**
500 and 600 level course in student's geoscience subdiscipline		**I,P,A**	**I,P,A**		
Geodaze presentation of thesis findings		**A**	**A**	**P,A**	
Thesis		**P,A**	**P,A**	**P,A**	**P,A**
Program Outcome Assessment Activities					
GEOS 595A	**A**				

500 and 600 level course in student's geoscience subdiscipline		**A**	**A**		
Annual Assessment Meeting with Thesis Committee (including Thesis Advisor)	**A**	**A**	**A**	**A**	
Geodaze presentation of thesis findings		**A**	**A**		
Citiprogram On-line class: Intro. To Responsible Conduct In Research					**A**
Legend: I Introduced; P Practiced; A Assessed					

MS Process of Assessment. Because M.S.-level instruction in Geosciences is highly individualized, the primary responsibility for ensuring that student learning occurs in the four outcome areas primarily rests with the individual student's advisor and the student's 3-person thesis committee. MS student advisors are responsible for ensuring that the student's thesis committee conducts an annual formal meeting with the student to assess their progress in Outcome areas 1-4. Geodaze presentations, a department-wide annual presentation of student research results, are formally judged for each student by a panel of faculty and subject area experts in Outcome areas 2-4, and students receive written feedback on these evaluations. Individual 500/600 level courses will each conduct their own learning assessments appropriate to the subject matter in Outcome areas 2 and 3.

I.4.b. GEOS Ph.D. Assessment Components

Mission Statement**.** The Department of Geosciences Ph.D. graduate program is intended to train research scientists and college/university level educators for careers across a vast array of integrative and interdisciplinary opportunities in geoscience, in climate, earth surface history and processes, energy

and mineral resource exploration, geochemistry, geophysics, tectonics, and many other areas. Ph.D. level education is intended to focus on research activities and training but also includes course work. In all cases our goal is both to provide high level training in key subject areas and an understanding of how a professional scientist needs to approach all aspects of analyzing geoscience problems from both technical and ethical standpoints. Given this broad and rapidly evolving array of career opportunities our goal is to provide great flexibility in research opportunities and coursework for our Ph.D. students, tailoring the specific requirements for each student to their own specific needs, rather than prescribing a set list of course work. We aim to provide students with a comprehensive vision of the breadth of Geosciences through integrative and interdisciplinary activities that unify the department, such as our weekly required colloquium and our annual, student-lead *Geodaze* research symposium.

PhD Program Learning Outcomes

Outcome 1: Analysis	Students will be able to discuss and critique research findings across a broad range of topics related to the interior and surface of the Earth and its history, oceans and atmosphere including societally critical topics in climate, resources, hazards, environmental issues and basic research amenable to analysis using geoscience research approaches
Outcome 2: Career Preparation	Students will be able to use state-of-the-art field, laboratory, computational and analytical methodologies appropriate to their chosen subdiscipline within the geosciences.
Outcome 3: Career Preparation	Students will be conversant in and able to critique the research literature within their chosen subdiscipline of the geosciences
Outcome 4: Career Preparation	Students will be able to produce publishable research findings in their subdiscipline and present them in both written and oral formats
Outcome 5: Best practices and ethical standards for professional geoscientists	Students will demonstrate a knowledge of professional and ethical norms of behavior in research, collaborative activities, presentation of results and publication expected of all practicing geoscientists.

PhD Curriculum Map

		Outcomes			
	Outcome 1: Students learn breadth of geosciences	**Outcome 2: Students learn geoscience methodologies appropriate to their subdisciplines**	**Outcome 3: Students become conversant in research literature in their subdiscipline**	**Outcome 4: Students learn to produce publishable research in their subdiscipline**	**Outcome 5: Students understand professional and ethical norms**
Course and Learning Activities					
GEOS595A (Department Colloquium)	**I**				**I,P,A**
500 and 600 level courses in student's geoscience subdiscipline		**I,P**	**I,P**		
Dissertation		**P,A**	**P,A**	**P,A**	**P,A**
Program Outcome Assessment Activities					
GEOS595A	**A**				

Annual Assessment Meeting with Thesis Committee (including Thesis Advisor)	**A**	**A**	**A**	**A**	
Final Meeting-Student Self Reflection Survey	**A**	**A**	**A**	**A**	**A**
Citiprogram On-line class: Intro. To Responsible Conduct in Research					**A**
Legend: I Introduced; P Practiced; A Assessed					

PhD Process of Assessment. Because Ph.D.-level instruction in Geosciences is highly individualized, the primary responsibility for ensuring that student learning occurs in the five outcome areas primarily rests with the individual student's advisor and the student's 4-person dissertation committee. Ph.D. student advisors are responsible for ensuring that the student's dissertation committee conducts an annual formal meeting with the student to assess their progress in Outcome areas 1-4 with a final evaluation taking place as a part of the student's dissertation defense. Aggregated results for each year's findings will be discussed by the entire faculty and consequent adjustments to the Ph.D. program based on these findings considered at the annual faculty retreat (August of each year).

I.4.c. Lowell Professional Master's Program in Economic Geology

We are currently updating the assessment process of our Lowell Professional Master's Program in Economic Geology. This program is being expanded and modified to include new certificates and more courses in a hybrid and/or on-line form with the goal of broadening the scope of the program and reaching more students. We will develop a new assessment plan as these changes are finalized and implemented over the next few years.

I.4.d. How Assessment of Student Learning Outcomes Has Changed/Improved Your Program

Our previous graduate student assessment (2014-2021) had similar outcomes, but we found it difficult to evaluate findings and make changes to our program based on those findings. The primary issue is that we do not have core classes that every graduate student takes due to the large breadth of our program and our student's diverse backgrounds. For MS students, we have found two issues, including

(1) two committee meetings during the course of a 2-year MS program does not provide sufficient information for a meaningful assessment, and (2) MS students commonly give their final presentation at a professional meeting which is not always attended by all committee members.

I.5. Postdoctoral Fellows

I.5.a. Post-Docs Working with Susan Beck

Colton Lynner: Contributed to the global seismology program, worked with students, published papers, gave guest lectures; 3 years, 2015-2018; Became Assistant Professor at the University of Delaware

I.5.b. Post-Docs Working with Barbara Carrapa

Julie Fosdick: Research in thermochronology applied to sedimentary basins; 2 years, 2012-2014; Became Associate Professor at the University of Connecticut

Gilby Jepson: Research in experimental and applied thermochronology and petrochronology; 3 years, 2019-present.

I.5.c. Post-Docs Working with Mihai Ducea

Jing-Liang Guo; Research on Zr isotope fractionation mechanisms; 1 year, 2018, Became an Assistant Professor at China University of Geosciences, Wuhan.

Antoine Triantafyllou: Research on Neo Proterozoic island arcs of North Africa; 1 year, 2019-2020; Became Research Associate Professor at University of Lyon.

I.5.d. Post-Docs Working with Karl Flessa

Martha Gomez-Sapiens: Research on effects of environmental flows on vegetation of Colorado River Delta; development of drone-based remote sensing to evaluate vegetation health; 2021-present.

I.5.e. Post-Docs Working with George Gehrels

Alyssa White: Assisted with research in the Arizona LaserChron Center; 1 year, 2019-2020; Became Research Scientist in Hydrology at the University of Montana.

Kurt Sundell: Developed cyberinfrastructure for Arizona LaserChron Center; 3 years, 2017-2021; Became Assistant Professor at Idaho State University.

Sarah George: Assisted with research in the Arizona LaserChron Center, 3 years, 2018-present.

Federico Moreno: Assisting with research in the Arizona LaserChron Center, 2 years, 2019-present.

Zach Michels: Manager of the SEM lab of the Arizona LaserChron Center; 1 year, 2021-present.

Wai Allen: Assisting with research in the Arizona LaserChron Center; 1 year, 2021-present.

Yanling Wang: Assisting with research in the Arizona LaserChron Center; 1 year, 2021-present.

I.5.f. Post-Docs Working with Christopher Harig

Anthony Osei Tutu: Research on geodynamics and mantle viscosity; 3 years, 2018-present.

Lavanya Ashokkumar; Research on glacier modeling and ice mass balance; 3 years, 2018-2021; present position unknown.

I.5.g. Post-Docs Working with Mauricio Ibanez-Mejia

Scott Maclennan: Set up lab facilities, support grad students with research, wrote manuscripts as author/co-author; 1 year, 2021-2022; Will become Tenure-track faculty at the University of the Witwatersrand, Johannesburg, South Africa.

I.5.g. Post-Docs Working with Timothy Jull

Ching-Chih Chang: Research on Iodine-129 chemistry in the ocean; 2 years, 2016-2018; currently at Colorado State University.

I.5.h. Post-Docs Working with Paul Kapp

Fulong Cai: Conducted and published research on the tectonic evolution of the Tibetan Plateau and the history of wind erosion in central Asia. Collaborated on field geology research in China; 1 year, 2015; Became Associate Professor, Institute of Tibetan Plateau Research, Chinese Academy of Sciences.

Houqi Wang: Conducted and published research on the tectonic evolution of the Tibetan Plateau. Collaborated on field geology research in China; 1 year, 2016; Became Associate Professor at the Institute of Tibetan Plateau Research, Chinese Academy of Sciences.

Liyun Zhang: Conducted and published research on the tectonic evolution of the Tibetan Plateau. Collaborated on field geology research in China; 1 year, 2015; Became Associate Professor at the Institute of Tibetan Plateau Research, Chinese Academy of Sciences.

I.5.i. Post-Docs Working with Marcus Lofverstrom

Malin Odalen: Research; 1 year, 2020; Became Postdoctoral scholar at University of Kiel, Germany.

I.5.j. Post-Docs Working with Luke McGuire

Hui Tang: Research, publishing papers, presenting at conferences, etc.; 2 years, 2017-2019; Became Senior Scientist, German Research Center for Geosciences (GFZ).

Tao Liu: Research, publishing papers, presenting at conferences, etc.; 2019-Current.

William Struble: Research, publishing papers, presenting at conferences, etc.; 2021-Present.

I.5.k. Post-Docs Working with Jon Pelletier

Tyler Doane: Performed sediment transport modeling research as part of joint UA-USDA project; 2 years; Became Postdoc at Indiana University.

Pailin Chatanantavet: Performed landscape evolution modeling as part of HSPDP project; 2 years; Became Environmental Consultant, Ocean and Human, Tokyo, Japan.

I.5.l. Post-Docs Working with Jay Quade

Zhennan Wang: Research, staff scientist; 3 years, 2018-2021; Became Senior Scientist, German Research Center for Geosciences (GFZ).

I.5.m. Post-Docs Working with Peter Reiners

Audrey Margirier: Carried out research on tectonics of the Ecuadorian Andes; 1 year, 2018-2019; Became a Postdoctoral Fellow at Universitat Potsdam, Potsdam, Germany.

Wentao Huang: Carried out research on paleomagnetic and thermochronologic records of hydrothermal remagnetization; 3 years, 2015-2018, Became Postdoctoral Fellow at University of Rochester, New York.

Peter Lippert: Carried out research on paleomagnetic and geochemical proxies of paleowildfire; 2 years; Became Assistant Professor at The University of Utah.

Alexis Ault: Carried out research on geo/thermochronology of secondary bedrock-hosted Fe-oxides; 2 years; Became Assistant Professor at Utah State University.

I.5.n. Post-Docs Working with Joellen Russell

Benjamin Bronselaer: Carried out and analyzed simulations of the Southern Ocean winds, sea ice and biochemistry; 3 years, 2016-2019; Became Global Weather Analyst, Engelhart Commodities Trading Partners.

Rebecca Beadling: Carried out and analyzed simulations of the Southern Ocean winds, sea ice and biochemistry; 1 year, 2020; Became NOAA Climate and Global Change Postdoctoral Fellow, NOAA Geophysical Fluid Dynamics Laboratory.

I.5.o. Post-Docs Working with Diane Thompson

Ty Roach: Led long-term monitoring of microbial community in the Biosphere 2 Ocean, contributing directly to PI Thompson's ongoing project on biogeochemistry of degraded and remediated coral reef ecosystems on diurnal to interannual timescales; 1 year, 2018-2019; Current position unknown.

Daniel Killam: Cultured giant clams in the Biosphere 2 Ocean to study the impacts of photosynthesis and changing environmental conditions on the health of the organism and the incorporation of trace elements into their shells (which are critical archives of past and present climate change); 2020-present.

I.5.p. Post-Docs Working with Jessica Tierney

Tripti Bhattacharya: Research, publishing papers, presenting at conferences, etc.; 2 years, 2016-2018; Became Assistant Professor, Department of Earth Sciences, Syracuse University.

Steve Brewster: Research, publishing papers, presenting at conferences, etc.; 2 years, 2017-2019; Became Analyst, Rhodium Group.

Lauren O'Connor: Research, publishing papers, presenting at conferences, etc.; 2 years, 2019-2021; Became Postdoctoral scholar, University of Manchester.

Matthew Osman: Research, publishing papers, presenting at conferences, etc.; 2019-present.

Andrew Walters: Research, publishing papers, presenting at conferences, etc.; 2020-present.

Jordan Abell: Research, publishing papers, presenting at conferences, etc.; 2021-present.

I.5.q. Post-Docs Working with Jianjun Yin

Chia-Wei Hsu: Research on NOAA project to understand sea level variability and change in the tropical Pacific, as well as global temperature variability and change; 2 years, 2019-2021; Became Research Scientist, Colorado State University.

ACADEMIC OUTREACH

SECTION J: ACADEMIC OUTREACH

J.1. Nature of Outreach Activities

For decades, the Department of Geosciences has been proactive in reaching out to students and educators in southern Arizona, and in the process, raising interest in Geosciences as a major. A departmental outreach committee meets twice per year to assess community needs and direct departmental outreach efforts. In some cases, outcomes assessments were conducted, allowing the department to evaluate the effectiveness of its efforts, however the assessment efforts have been largely disorganized. We attribute this to the lack of a dedicated outreach coordinator in geosciences, making it nearly impossible to organize, implement, compile, and track assessment outcomes for our outreach efforts. In addition, outreach takes many forms, some of them ad hoc, and is done by faculty, students, and staff in various ways. In order to properly implement and monitor assessment for outreach, we would need someone to provide an easy way for all those who do outreach to collect assessment data, and this is simply untenable without a coordinator. We have tried using staff and graduate students in this capacity, but because these people are either overtaxed with other duties for the department or only here temporarily, there has been little consistency.

The Department of Geosciences is deeply involved in outreach and service in many forms. All faculty serve on various departmental, university, professional, and national committees and groups. Many contribute through manuscript review and journal editing, as well as serving in various positions in professional societies such as the Geological Society of America and the American Geophysical Union. In addition to our scholarly and professional service, the department has a long tradition of outstanding community service through varied outreach activities. These range from individual faculty and/or students visiting local classrooms to large cohorts of our faculty and students running large outreach events reaching thousands of local youth. The department has outreach programs specifically aimed at increasing diversity in the geosciences (one NSF supported). Several of our laboratories participate in outreach events, making themselves available to tours for youth, students, and adults visiting UA campus for events (e.g., Tucson Festival of Books). Important departmental outreach revolves around annual community events, and these provide Geoscience students with the opportunity to take on leadership roles. We identify graduate students and undergraduate students to staff our outreach, under the guidance of faculty such as Paul and Jessica Kapp, who advise our SESS club. Additionally, we make funding available to provide for supplies and food for each event.

Outreach to local schools happens on an ad hoc basis. General inquiries coming to the department for classroom visits are directed to the faculty advisor (J. Kapp) of our undergraduate geology club, the Society of Earth Science Students (SESS). SESS has an outreach coordinator who recruits undergraduates, graduate students, and/or faculty to fill the need of the local school making the request. Visits are made to K-12 classrooms and local youth programs and have involved everything from highly specialized content presentations (per the request of a teacher) to broad presentations for multiple classes or organizations. One of our major struggles is that K-12 schools want visitors to come during normal school hours, which often conflicts with our faculty and student schedules. It is difficult to say yes to all requests because of

these timing conflicts. We would like to provide more outreach to K-12 schools but this issue makes it challenging.

Several faculty visited local schools and groups to widen awareness of the geosciences. Dr. Marc Sbar's efforts in this regard stand out. He has presented to various middle and high schools, using his experiences in the oil industry as a way to introduce the students to careers in geoscience. He has also piloted the use of kits in select classrooms - these kits are intensive, six week curricula that require teacher training and a dedicated volunteer to guide classroom implementation. While they are very useful to the teachers who participate, we simply do not have the manpower or organization capabilities to continue their use on a regular basis. The kits are also quite expensive, and we do not have an outreach budget. With the outlook of the College of Science budget being extremely grim, we do not anticipate having any discretionary outreach funds any time soon.

Some of our faculty, graduate students, and undergraduates, visit classrooms and local programs to deliver geosciences content through presentations and hands-on activities, as well as directing science fair experiments for class science fair projects at the K-12 level, and judging science fair presentations. SESS commonly provides outreach to local schools through hands-on activities. Several of our undergraduates also created and implemented outreach curricula for underserved libraries in the Tucson area, a project in conjunction with the College of Science entitled STEMCats.

Up until Covid-19, our department participated each spring in Science City at the Tucson Festival of Books. At this event, tens of thousands of community members had the chance to learn about geology from our graduate and undergraduate student volunteers. Our volunteers presented hands-on science activities to attendees throughout the event (e.g., rock and fossil samples, digging for dinosaurs, earthquake simulations), and provided twice daily "eruption" demonstrations of our liquid nitrogen volcano. The festival is slated to return to in-person in spring 2022, and geosciences plans to have a presence in Science City.

Every February brings the world-renowned Tucson Gem and Mineral Show to the Tucson Convention Center, and Geosciences has a major presence at every show, which is the largest gem and mineral show in the nation and perhaps the world. Jessica Kapp and the Society for Earth Science Students (SESS) coordinate and implement this effort every year. Thousands of local families visit the SESS Junior Education area at the gem show over a three-day period to experience hands-on science activities and add exciting (and free) rock and mineral samples to their collections. The Junior Education area consists of 6-7 activities kids can participate in, such as earthquake simulators, erupting volcanoes, rock and mineral identification and viewing through microscopes, make your own fossil imprints, make your own comets, generate tsunamis, create stream patterns with water and sand, dig for dinosaur bones, and do a treasure hunt (i.e., answer questions about displays throughout the show) to win a mineral or fossil of your choice! All kids who participate get a free mineral kit, free larger rock and mineral samples, and a coloring and activity book to take home. The geosciences Junior Education area at the Tucson Gem and Mineral Show has been going on for over two decades and continues to be our biggest outreach event.

The Department of Geosciences is strongly connected to the new UArizona Alfie Norville Gem and Mineral Museum, which recently opened in the historic Pima County Courthouse in downtown Tucson. The gem and mineral collection that was previously housed in Flandrau Science Center is now on display in the new downtown museum, along with new and dynamic displays created and curated by geoscience collaborators. In addition, the first required course on our Gem Science sub-plan is taught at the mineral museum, where students get hands-on experience with world class specimens. The museum also offers laboratory and office space for gem science students and faculty, as well as opportunities for the community to utilize equipment and samples for citizen science. The SESS club will begin offering monthly outreach events at the museum in 2022. The department will also offer outreach activities at the museum during the yearly Tucson Gem and Mineral Show, a time when the museum is sure to see a major uptick in traffic. The monthly outreach events will potentially serve hundreds of community members, while the activities during the Gem and Mineral show could reach thousands of people from all over the nation and world.

J.2. How Activities Reflect Program Goals

Our outreach activities contribute to program goals by serving our local community, by sharing our science with younger generations and by educating the general public on relevant issues related to our planet like climate change, the future of natural resources and fundamental science.

J.2.a. Professional Development

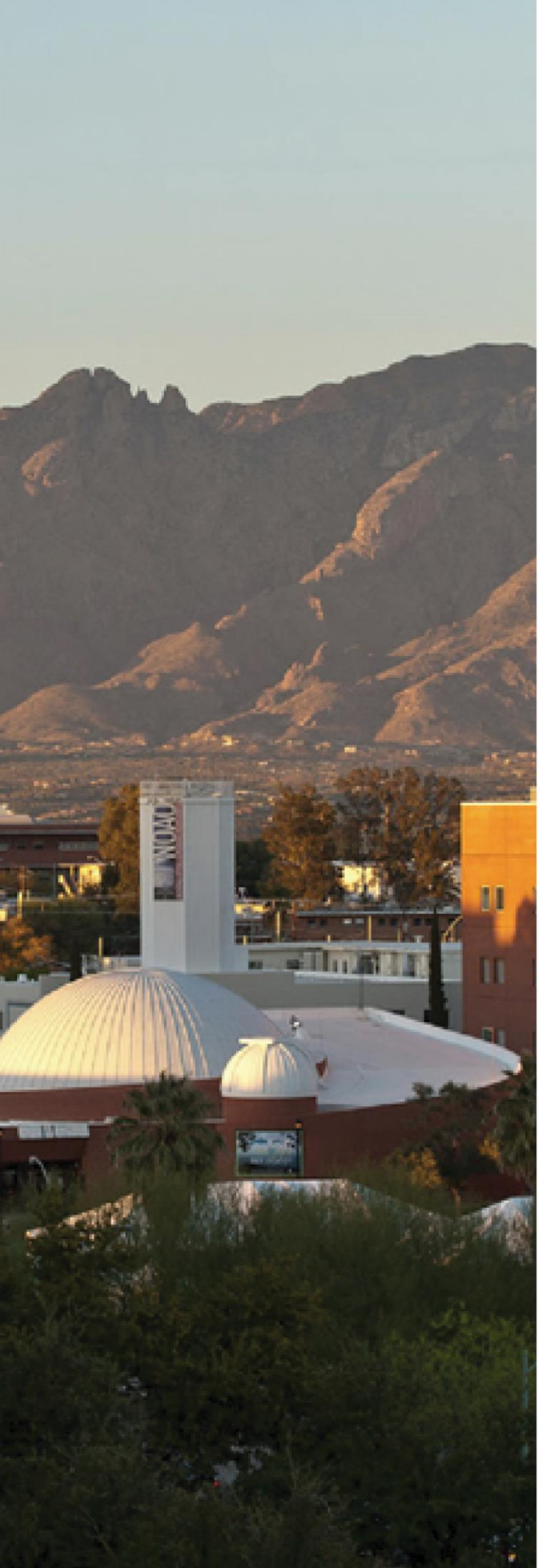
Faculty members in the Department of Geosciences participate in many different professional development activities, including (i) leading and serving on many different national and international committees, (ii) collaborating on research projects with faculty members and professional geologists from many other institutions and in many different countries, and (iii) sharing our laboratory facilities with a large number of external researchers and students.

J.2.b. Sharing Expertise with the Local Community

Many of our outreach activities are designed to share our expertise with members of the local community. These include (i) conducting activities in local schools, (ii) providing expertise to the local media when natural disasters (e.g., floods, earthquakes) occur, iii) creating content for regional museum displays (e.g., video project for Colorado River Indian Tribes Museum) and (iii) volunteering to assist with Science Fair projects and judging.

J.2.c. Recruiting Students into Geosciences

One of the benefits of our outreach activities is that some student participants end up choosing to attend the UofA to study Geosciences.



COLLABORATION WITH OTHER UNITS

SECTION K. COLLABORATION WITH OTHER UNITS

Members of the Department of Geosciences interact with other academic units on campus in many different ways and engage in extensive interaction with other academic units at the University of Arizona. These interactions include involvement in interdisciplinary programs, courtesy appointments, and service on mentoring committees.

Eleven faculty members have courtesy appointments in other departments, as follows:

- Anthropology: Jay Quade
- Ecology and Evolutionary Biology: Andrew Cohen
- Mining and Geological Engineering: Mark Barton
- Geography: Vance Holliday, Jessica Tierney
- Hydrology and Atmospheric Sciences: Richard Bennett, Joellen Russell
- Mathematics: Joellen Russell
- Physics: Tim Jull
- Planetary Sciences: Jack Holt, Jon Pelletier, Joellen Russell

Nine faculty members are members of a Graduate Interdisciplinary Programs, as follows:

- Applied Mathematics: Luke McGuire, Jon Pelletier, Joellen Russell
- Global Change: Rick Bennett, Andrew Cohen, Chris Harig, Tim Jull, Joellen Russell, Diane Thompson, Jessica Tierney
- Remote Sensing and Spatial Analysis: Rick Bennett, Chris Harig

Interdepartmental research collaborations have been established with many departments and units, including Accelerator Mass Spectrometry Laboratory, Anthropology, Arizona Geological Survey, Arizona Space Institute, Bio5 Institute, Earth Dynamics Observatory, Computer Science, Ecology and Evolutionary Biology, Environmental Science, Geoarchaeology, Geography and Development, Hydrology and Atmospheric Sciences, Laboratory of Tree Ring Research, Lowell Institute, Lunar and Planetary Laboratory, Mining and Geological Engineering, Natural Resources and the Environment, and Planetary Sciences.

Research Collaborations with Faculty from other units have included the Accelerator Mass Spectrometry Laboratory, Department of Anthropology, Arizona Geological Survey, Arizona Space Institute, Bio5 Institute, Earth Dynamics Observatory, Department of Computer Science, Department of Ecology and Evolutionary Biology, Department of Environmental Science, Geoarchaeology, Department of Geography and Development, Department of Hydrology and Atmospheric Sciences, Laboratory of Tree Ring Research, Lowell Institute, Lunar and Planetary Laboratory, Department of Mining and Geological Engineering, Native Peoples Technical Assistance Office, School of Natural Resources and the Environment, and Department of Planetary Sciences.

Guest lectures in other departments have been provided by many faculty members, including Mark Barton, Andrew Cohen, Paul Goodman, Jack Holt, Amanda Hughes, Mauricio Ibanez-Mejia, Tim Jull, Ananya Mallik, Luke McGuire, Jon Pelletier, Joellen Russell, Diane Thompson, and Jessica Tierney.

Faculty members in the Department of Geosciences have also served on many service committees in other units, including Faculty Search, Graduate Admissions, Graduate Policy, Promotion and Tenure, and

PeerEvaluation of Teaching committees for many departments, the College of Science Diversity, Equity, and Inclusion Committee, Promotion and Tenure Committee, Lecture Series Planning Committee, Earth Dynamics Observatory Executive Committee, and theBiosphere 2 Scientific Advisory Board and Biosphere 2 Board. Many Geoscience faculty members have mentored students from other units, including Mark Barton, Chris Harig, Vance Holliday, Jack Holt, Amanda Hughes, Tim Jull, Paul Kapp, Ananya Mallik, Jon Pelletier, Joellen Russell, Diane Thompson, and Jessica Tierney.

In terms of teaching, Geosciences courses that are cross listed with other departments include:

- Geos 388 (Biosphere2: from Wonder to Discovery)
- Geos 412 (Ocean Sciences)
- Geos 419/519 (Physics of the Earth)
- Geos 478/578 (Global Change)
- Geos 484/584 (Coevolution of Earth and Biosphere)
- Geos 512A (Geoarchaeology)
- Geos 514 (Quaternary Geology)
- Geos 549 (Radar Remote Sensing of Planetary Surfaces)
- Geos 561 (Paleoindian Origins)

FACULTY PLANNING

SECTION L: FACULTY PLANNING

L.1. Faculty View of Program Future

The faculty's collective view of the program's future, its desired directions, and its means for reaching these objectives is summarized in our strategic plan addressed in section B2.

L.2. Directing Program Change

Decisions regarding changes to our program have been made, and will continue to be made, with shared governance among the Department Head, Faculty, and Staff, with strong input from students. In most cases, priorities are set and decisions are made first by departmental committees which include representatives of all stakeholders. Information is then shared with the Department Chair, revised as needed, and then shared with faculty members during faculty meetings or retreats. Important documents are commonly available for faculty input, as well as staff or student input when appropriate, for some period of time, and then discussed and voted on by the full faculty.

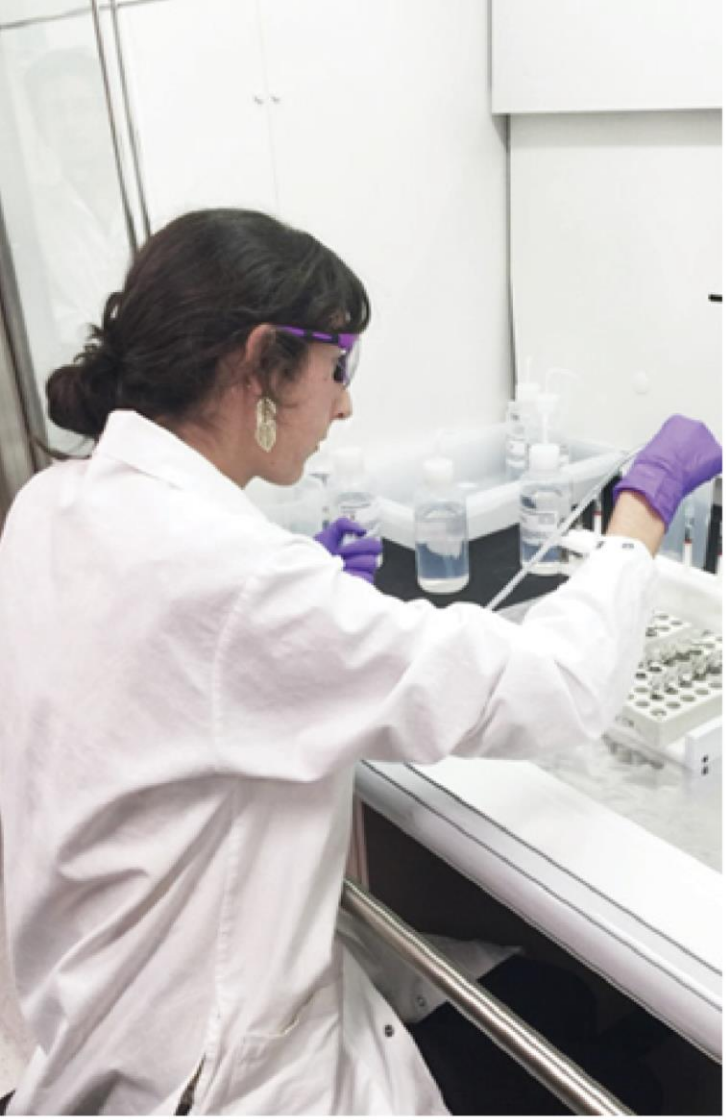
SPECIAL CONSIDERATIONS

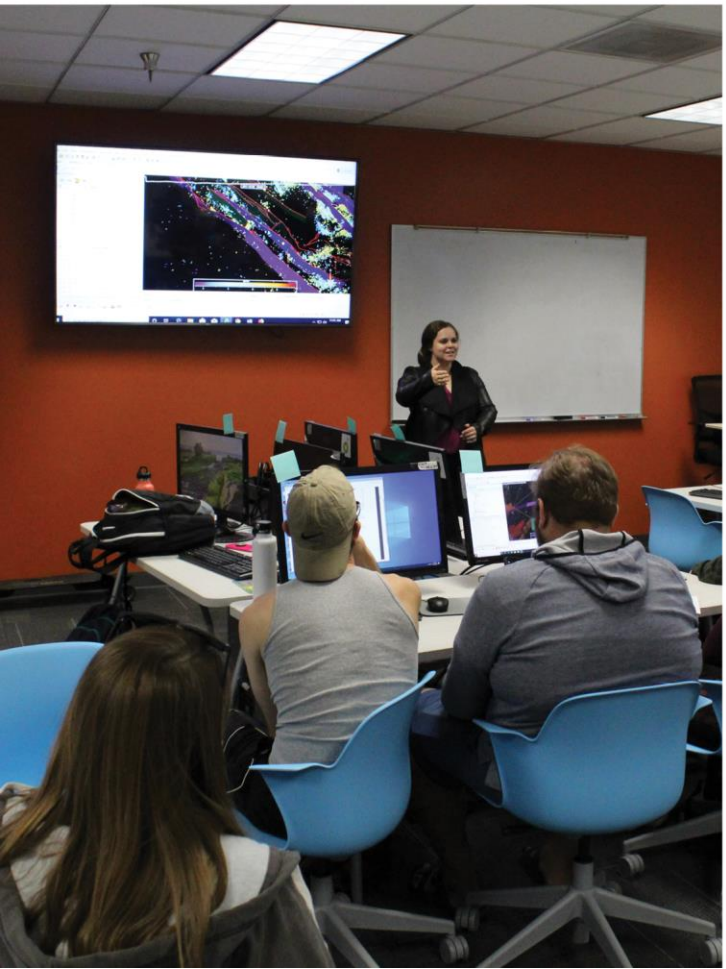
SECTION M: SPECIAL CONSIDERATIONS

The Department of Geosciences presently exceeds the ABOR minimum degree program requirements as evidenced in Table M1.

Table M.1. Number of Degrees Granted by Geosciences in Relation to ABOR Requirement

Degree Level	ABOR Requirement	GEOS - 3 year total
Baccalaureate	24 or more	89
Masters	9 or more	27
Doctorate	6 or more	28
Total Completions		**144**





APPENDICES

APPENDIX A: FACULTY BIOSKETCHES

Mark D. Barton, PhD
Director, Lowell Institute for Mineral Resources
Interim Director, School of Mining and Mineral Resources
Professor of Geology and Geochemistry, Department of Geosciences
Adjunct Professor of Mining and Geological Engineering
University of Arizona
Gould-Simpson Building, Room 339
Tucson, AZ 85721-0077

Email: mdbarton@arizona.edu
Phone: (520) 621-8529

Ph.D. (Geophysical Sciences), 1981, University of Chicago

Barton's **research** interests span aspects of energy and mass transfer in the Earth's lithosphere and their applications to mineral deposits. Topics range from mineralogy to physical modeling to field relations and have emphasized ore deposit studies with a focus on porphyry, IOCG, sediment-hosted Cu-Co-U-V, and various precious metal systems, and their broader geologic and environmental context. Ongoing collaborative studies involve many mining companies and the USGS and have recently been supported by these groups, the US National Science Foundation, Keck Foundation, National Institutes of Health, and Science Foundation Arizona.

Founder and director, Center for Mineral Resources 1994-2008; co-founder, Lowell Institute for Mineral Resources, Assoc. Director 2008-17, Director 2017-present; co-founder and interim director University of Arizona School of Mining and Mineral Resources 2021-present. **Served on** multiple NSF, NRC, and society committees and panels. **Awards include**: The Mineralogical Society of America Award, Lindgren Award (Society of Economic Geologists), International Exchange Lecturer (Society of Economic Geologists). He has advised over 70 MS, PSM, and PhD students and has published over 100 peer-reviewed articles, conference proceedings, and guidebook articles.

Susan L. Beck, PhD
Professor of Global Seismology
Director of the Graduate Program
Department of Geosciences
University of Arizona
Gould-Simpson Building, Room 510
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Ph.D. (Seismology), 1987, University of Michigan

Beck's **research involves** using broadband seismology to understand mountain belts, earthquakes, and faulting. She is interested in the evolution of the North and South American Cordilleras and Tethyan subduction with much of her current research on the Andes and the South American subduction zone. Beck works with seismic tomography and receiver function methods to image volcanic arcs, continental lithosphere and the mantle associated with subduction zones and mountain building. Served as Department Head, Geosciences, University of Arizona 2000-2007. **Served on** SZ4D Faulting and Earthquakes working group (2020-present), American Geophysical Union Fellows Committee (2017-2020), Geological Society of America George P. Woollard Award Committee (2018-2020), Chair of the IRIS Board of Directors 2002-2005 and numerous National Science Foundation review committees, National Academy of Science report committee, and IRIS committees. Beck is Director of the Graduate Program in the Department of Geosciences and serves on the Promotion and Tenure committee (2019-2021), Department Head Advisory committee (2018-present), Department Academic Program Review committee, Undergraduate scholarship committee (2021). **Awards include**: Geological Society of America Fellow (2015); Geological Society of America George P. Woollard Award in Geophysics (2017); American Geophysical Union Fellow (2014); American Geophysical Union Gutenberg Lecture (2014); American Geophysical Union Walter H. Bucher Medal (2020). Beck has published over 120 peer-reviewed articles and currently has 3 active NSF grants.

Richard Bennett, PhD
Professor Department of Geosciences
Professor, Department of Hydrology and Atmospheric Sciences
Professor, Global Change Graduate Interdisciplinary Program
Professor, Remote Sensing and Spatial Analysis Graduate Interdisciplinary Program
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Ph.D. (Geophysics), 1995, Massachusetts Institute of Technology

Bennett's **research** is motivated by global challenges in Earth Sciences. His main area of expertise is the field of high precision satellite geodesy for measurement of deformation and gravity, with application to studies of natural hazards. He has created and leads an international disability-accessible study abroad program based in Orvieto, Italy that introduces students to Earth observation data sets, concepts of space geodesy and remote sensing, as well as open source software for data acquisition, analysis, and visualization. **Other professional development:** Fellow, University of Arizona Academic Leadership Institute, 2018-2019. **Awards:** Richard Ruiz Outstanding Faculty Fellow in a Specialized Center, University of Arizona, 2015; Smithsonian Certificate for Outstanding Achievement, Smithsonian Astrophysical Observatory, 1999, 2000, 2001, 2003; Outstanding Student, College of Natural and Agricultural Sciences, UC Riverside, 1990**. Recent service:** NASA review panel**,** UNAVCO Education and Community Engagement Committee (chair), Earth Dynamics Observatory Executive Committee, NSF review panel**,** Accessible Earth Study Abroad (program lead), UNAVCO Inc. Board of Directors, WInSAR Member Representative for University of Arizona, USGS Geodetic Networks Panel, UNAVCO Inc. Member Representative for University of Arizona. **Scholarly activity:** Published ~60 peer reviewed articles in solid Earth, atmospheric, glaciological, and engineering journals and currently has NSF research grants.

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Ph.D. (Tectonics – Basin Analysis - Thermochronology), 2002, Vrije University, Amsterdam, The Netherlands

Carrapa's **research involves** the study of the interactions between tectonic processes and climate in shaping Earth's greatest topography. She specializes in thermochronology, sedimentary geology and tectonics. She has worked extensively in the Andes, Pamir, Alps, Tibet, Himalaya and Western North America Cordillera. Some of the fundamental questions she seeks to answer are: how does climate affect erosion, deposition and paleoecology-paleobiology over millions of years? How does tectonics affect climate in deep time through the creation of high topography, orography, volcanism, erosion and weathering? How are deep (lithospheric and mantle scale) Earth's processes affecting crustal evolution? Department Head, Geosciences, University of Arizona 2018-2021. **Served on** National Science Foundation Grant Review Committee 2017-2019; GSA International award committee (2018); associate editor of GSA Bulletin 2017-2019. **Awards include**: Alexander von Humboldt and Geological Society fellow. Published 94 peer reviewed articles and currently has NSF research grants.

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Ph.D. (Geology), 1982, University of California-Davis

Cohen's **research** involves using paleoecological and sedimentological methods to investigate lake history and past lake ecosystems from sediment cores, the field of paleolimnology. He applies these methods to study disparate questions, from the evolution of complex and ancient lake ecosystems, to human impacts from deforestation and climate change on freshwaters, to the study of records from long drill cores in African lake beds to reconstruct the environmental context of human evolution. He is the author of the leading text/reference book in his field, *Paleolimnology*: The History and Evolution of Lake Systems (Oxford U. Press). **Service:** Member of Board of Directors (2000-2013) and Chair of the BOD (2011-2013) of Drilling, Observation and Sampling of the Earth's Continental Crust (DOSECC Inc); Member of the Science Advisory Group of the International Continental Drilling Program (ICDP- 2008-2011); Director of the Hominin Sites and Paleolakes Drilling Project (2010-present). **Awards:** Fellow, Geological Society of America (1994) and the American Geophysical Union (2018); Geological Society of America Israel Russell Limnogeology Division Award (2015); International Limnogeology Association Wilmot H. Bradley Medal (2018); The University of Arizona Creative Teaching Award (2003); The University of Arizona Distinguished Professor Award (2014). Has published 169 peer-reviewed articles.

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Ph.D. (Economic Geology), 1971, University of Michigan

Davis' **research** focus lies at the interface of structural geology and regional tectonics, with attention to detailed structural analysis of fault, fold, fracture, and shear zone systems. Main topics are metamorphic core complexes and detachment faulting in the southern Basin and Range, the full array of structural systems of the Colorado Plateau, and geoarchaeology of the Sanctuary of Zeus, Mt. Lykaion, Peloponnesos, Greece. **Teaching** has focused on structural geology, including graduate research workshops and the mentoring undergraduate field-based research. Continuing to extend his reach as a teacher, Davis is engaged in preparing a 4th edition of his textbook, *Structural Geology of Rocks and Regions* (Wiley). **Administrative positions** held include President of the University of Vermont and Provost and Executive Vice President of the University of Arizona. **Professional service** nationally has been largely directed toward the Geological Society of America, where he is a Past-President; to the GSA Foundation, where his efforts led to the establishment of the J. David Lowell Endowed Field Camp Scholarship Program and the GSA Florence Bascom Prize Geological Mapping Award; and NSF, where he served as the Head of the GEO Directorate Advisory Board for 3 years (Atmospheric, Earth, and Ocean Sciences). Local Service beyond University of Arizona has engaged Saguaro National Park, Sonoran Desert Museum, Pima County Parks and Recreation, etc., in communicating geology to the public. **Awards include**: Society of Economic Geology Lindgren Award for Excellence in Research; Regents Professorship at University of Arizona; GSA Career Contribution Award in Structural Geology & Tectonics; Distinguished Alumni Award from The College of Wooster; Honorary Degree from Carleton College; and National Recipient of Inspire Integrity Award (National Society of Collegiate Scholars). Davis has advised more than 40 MS and PhD students, served on research committees of 120+ additional graduate students, and advised theses and independent study projects of ~25 undergraduate students. Having begun his career at University of Arizona in 1970, he has firsthand accrued a 50-year grasp of the history of the growth in stature of the Department of Geosciences, and certain pivotal circumstances that strategically made a difference in its rise.

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Ph.D. (Ecology and Behavioral Biology), 1981, University of Minnesota

Davis' **research focuses** on Palynology and plant fossil analysis of lakes, marshes, caves, coprolites, and packrat middens in western North America. **Service** includes: President of the Arizona-Nevada Academy of Sciences (2004), Managing Editor of Palynology (2001-2004), and serving on the Editorial Boards of Review of Paleobotany and Palynology, Conservation Ecology, Radiocarbon, and Palynology. He is also a Fellow of the Arizona-Nevada Academy of Sciences (2000).

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Ph.D. (Geology/Geochemistry), 1984, Indiana University

DeCelles' research focuses on the origins of Earth's major mountains, using an array of techniques including geological mapping, regional structural geology, basin analysis, detrital and bedrock geochronology and geochemistry, and sedimentary petrology. His main areas of research include the Himalayan, Tibetan, Alpine, Andean, and North American Cordilleran orogenic belts. He held an Assistant Professorship at the University of Rochester (1986-1992), joined the University of Arizona faculty in 1993, and has been Guest Professor at the University of Bologna (1990-91) and the Geological Institute of ETH-Zürich (2014-15). He was the Cox Professor at Stanford University (2007-08). He has served on National Science Foundation Grant Review Panels 2002-2005 and numerous departmental, college and university committees at the University of Arizona. He has been editor and associate editor of Basin Research, Journal of Geophysical Research, Geology, and Geological Society of America Bulletin. He is a Fellow of the American Geophysical Union (2017) and the recipient of the Pettijohn Medal (2018, Society for Sedimentary Geology) and the Lawrence L. Sloss Award (2008, Geological Society of America). He has published 180 peer-reviewed articles and two books, and his research is funded by the U.S. National Science Foundation, National Geographic, and various industry grants. DeCelles is a Fellow of the Explorers Club and a standing member of the American Alpine Club; he has sumitted numerous alpine peaks all over the world, including first ascents of four >20,000' (6000 m) peaks in Tibet and the Himalaya.

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Ph.D. (Mineralogy), 1992, Virginia Tech

Downs studies mineralogy, crystal chemistry, and mineral physics with a focus on Earth, deep Earth, and Mars. With colleagues he coined the phrase "mineral evolution" to examine the properties of minerals as a function of deep time. He is currently on the MSL Operations team and a PI of the CheMin instrument on the Mars Rover Curiosity, and is funded by NASA to develop instruments for future Moon and Europa missions. He is founder and director of the internet-based RRUFF project, with over 900 million hits that provides databases of chemical, crystallographic and spectral signatures of the minerals.

Served on the Executive Committee of the International Mineralogical Association, council for the Mineralogical Society of America, and crystallographic editor for American Mineralogist, The Canadian Mineralogists, and the European Journal of Mineralogy. He served on the National Science Foundation Grant Review Committee, and advisory committee for the Spallation Neutrons and Pressure project at Oak Ridge National Laboratory. **Awards include**: International Union of Crystallography Young Scientist Award, 1992; Leonard G Berry Medal from the Mineralogical Association of Canada, 2002, Elected Fellow of MSA 2002, and the American Association for the Advancement of Science 2009. Published 289 peer reviewed articles and currently has NASA research grants.

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Ph.D. (Geology), 1998, Caltech

Ducea's **research focuses on** a variety of tectonics problems from subduction related (magmatism, subduction erosion, delamination) to extension and collision of the continents. He investigates mineral evolution, cyclicity of orogens, sutures, transform faults, and metamorphism in collisional belts among others. He also runs a trace elemental geochemical and radiogenic isotopic (TIMS) facility. **Served/serves on** GSA's Publication committee, NSF panels; editor of GSA Today 2018-2021, associate editor of International Geology Review and Tectonics (2018-present). **Awards and honors**: GSA fellow, Fulbright fellow. Published 180 peer reviewed articles, has a h index of 59 on google scholar and 50 on Scopus. Currently has NSF research grants.

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Ph.D. (Geological Sciences) 1972, Brown University

Flessa's **research** focuses on conservation paleobiology – the use of organic remains, geochemical signatures and sedimentary archives to provide guidelines for the preservation and restoration of species and habitats. Most of his field-based research has been on the Colorado River's delta and estuary. He currently manages a team of scientists from government agencies, non-government organizations and universities from the U.S. and Mexico who are monitoring the environmental effects of restoration flows to the Colorado River delta**. Service includes**: Founding member, Colorado River Research Group, 2014; Head: Geosciences, University of Arizona, 2007-2012; Head, Ecology & Evolutionary Biology, University of Arizona, 1997-1999; Program Director, National Science Foundation, 1988-1990. **Awards and honors include**: Fellow, American Association for the Advancement of Science, Partner in Conservation Award, U.S. Department of the Interior, 2014, Outstanding Faculty Award, Geosciences Advisory Board, 2013, Centennial Fellow, The Paleontological Society, 2009, Faculty of Science Award for Creative Teaching, 1988. Published more than 150 peer reviewed articles and is currently supported by the International Boundary and Water Commission.

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Ph.D. (Geophysical Sciences), 1987, University of Chicago

Ganguly's **research** involves a wide range of areas in the Earth and Planetary Sciences relating to phase equilibria, thermodynamics, diffusion kinetics, heat transfer, thermo-barometry, thermochronology, subduction, tectono-metamorphic and Asteroidal processes, and computational quantum chemistry. His research received continuous external funding, mostly from NSF and NASA, over a period of ~ 40 years. He is an author/editor of several advanced level books dealing with thermodynamics and diffusion kinetics, especially as applied to geological and planetary systems, as well as a book on Meghnad Saha, a founding father of stellar astrophysics, and a recent Geochemical Perspective volume of the European Association of Geochemistry. Ganguly taught at University of Arizona, as well as taught many Short Courses in USA, Europe, India and China, at the invitation of professional societies or Government organizations. **Awards include**: Recipient of the Alexander von Humboldt research prize from Germany, a fellow of the Mineralogical Society of America and the American Geophysical Union, and a member of the editorial advisory board of Earth and Space Chemistry of the American Chemical Society.

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Ph.D. (Geology), 1986, California Institute of Technology

George Gehrels' **research involves** using U-Th-Pb geochronology to address a variety of problems in tectonics. Long-term projects involve studies of (1) Cordilleran batholiths, (2) the generation, transport, and accumulation of basinal sediments in many areas of the world, (3) evolution of the Himalaya-Tibet orogen, and (4) and the development of new geochronologic methods. Served on National Academy of Science Committee that prepared "A vision for NSF Earth Sciences 2020-2030: Earth in Time" report and served as Chair of the GSA Geochronology Division. **Awards include**: University Distinguished Professor Award (2006) and the Arthur Day Medal from the Geological Society of America (2010). Published 419 peer-reviewed articles, H-Index of 104, and currently has several NSF research grants.

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Ph.D. (Atmospheric Science), 2000, University of Washington

Goodman has been teaching and/or coteaching two of the largest Geosciences **undergraduate classes online** and in person for over 5 years. In 2020 this included 1158 students and 3474 student credit hours and he has taught or co-taught over 15,000 students in 6 different classes since 2009. Though primarily an instructor, he has maintained an active research profile assessing global climate and earth system models and mentoring students. **Served on** College of Science Undergraduate Education Committee, College of Science Undergraduate Policy Committee. Published 15 peer reviewed articles and currently has a NASA grant pending as co-I.

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Ph.D. (Geophysics), 2010, University of Colorado

Harig's **research involves** observations of time-variable gravity and geodynamic numerical models to study large ice sheets and glaciers, and how their changes impact the solid Earth. He is interested in how the Greenland and Antarctic ice sheets respond to climate change, as well as past ice such as the Laurentide ice sheet. He is also working to develop new techniques to analyze satellite gravimetry from upcoming NASA missions. **Founding member** of UArizona Earth Dynamics Observatory (EDO), and member of executive committee. Published 18 peer reviewed articles and currently has NASA research grants.

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Ph.D. (Geology), 1997, Caltech

Holt's **research involves** using geophysics to study ice and ice-related processes on Earth and other planetary bodies. He has led numerous airborne geophysical campaigns in Antarctica and field studies of mountain glaciers using airborne and surface-based methods, with a recent focus on Alaska. He is on the Science Team for Mars Reconnaissance Orbiter, leading studies of mid-latitude glaciers and polar caps using orbital radar. Holt also develops new techniques to map shallow ice as a resource for the future human exploration of Mars. **Served on** the National Academies of Science Planetary Decadal Survey Panel, 2020-21, NASA mission concept study teams 2019-20, NASA mission review panels, 2015-17, NASA research/analysis review panels 2014-2019. **Awards include**: NASA Technical Achievement Awards, NASA Group Achievement Awards, Antarctic Service Medal, UT Austin Jackson School of Geosciences Outstanding Research Award. Published 77 peer reviewed articles and currently has NSF and NASA research grants.

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Ph.D. (Geological Sciences), 1982, University of Colorado

Holliday's **research involves** an understanding of the timing, the character, and the environmental setting of the earliest peoples of the greater Southwest during the late Pleistocene, specifically in Texas, New Mexico, Arizona, Sonora and Chihuahua, Mexico, and Alaska. The research applies stratigraphy, sedimentology, geomorphology, soils, and geochronology to reconstruct the landscape of the First Americans, how it evolved as the early hunter-gatherers colonized the landscape, and the environmental drivers of landscape evolution. **Served on** Editorial boards of *Quaternary Research*, *Geoarchaeology*, and *PaleoAmerica*. **Awards include:** G.S.A. Gladys Cole Award and the Fryxell Award Archaeology for Interdisciplinary Research from the Society of American. Since 2002, has authored/co-authored 50+ peer-reviewed journal articles, one book, and co-organizer/co-editor/ chapter author for two edited volumes.

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Ph.D. (Earth and Planetary Sciences), 2012, Harvard University

Hughes's **research involves** integrating geophysical, geological, and rock mechanics data with numerical modeling techniques to better understand and characterize the physics governing the formation and growth of geologic structures in the Earth's crust. This process-based understanding of geologic structures is then applied to solve problems in seismic hazard assessment, subsurface resource characterization, and regional tectonics. Hughes also worked as a consulting structural geologist, exploration geologist, and research scientist in industry, 2012-2016. **Served** on the USGS National Earthquake Hazards Reduction Program Grant Review Committee 2018; as session chair for technical sessions at GSA, AGU, and GSA-SGT Forum, **Awards include**: Goldwater Scholar, Harvard BOK center award for teaching, 2009, 2011. Published 13 peer reviewed articles and has past, current, and pending funding from the Keck Foundation, SCEC (USGS/NSF), state geological survey (subcontract from DOE), and an industry-funded research grant.

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Ph.D. (Geosciences), 2014, University of Arizona

Ibañez-Mejia's **research** focuses on the application of geochemical techniques, particularly isotope geochemistry, to elucidate the timing and mechanisms of high-temperature processes in the Earth's crust and mantle. To achieve this, Ibañez-Mejia's group combines the use of radiogenic isotope systems to determine the time and rates of lithospheric and tectonometamorphic processes (e.g., U-Pb in zircon, baddeleyite, apatite, titanite; Lu-Hf and Sm-Nd in garnet), with geochemical tracers such as elemental abundances and isotopic compositions (both radiogenic and stable) of rocks and minerals, to understand petrologic processes in a robust temporal framework. Recent work by his group has also focused on the development of new methods of 'non-traditional stable isotopes' applied to the study of magma petrogenesis, crustal evolution, and sediment provenance. **Served as** National Science Foundation Grant Reviewer 2016-2021; National Science Foundation panel member in 2019; co-director of the Arizona LaserChron Center since June 2021. **Awards include:** Department of Geosciences Geodiscoveries award (2021); University of Arizona Hispanic Serving Institution (HIS) seed grants award (2021). Has published 44 peer reviewed articles, >60 conference abstracts, and currently has 6 active research grants: 3 NSF awards as lead PI, 1 Industry award as sole PI, and 2 NSF awards as co-PI.

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Ph.D. (Geophysics), 1984, University of Wyoming

Dr. Johnson's **research involves** the application of multichannel seismic reflection and refraction techniques to problems of crustal structure, tectonics, resource exploration, and groundwater and environmental investigations. Prior to his Ph.D. studies, he worked for the International Division of Union Oil Company (Unocal) and served as Director of Petroleum Technology at Colorado Northwestern Community College. He joined the University of Arizona in 1987. Dr. Johnson continues to be actively involved in the acquisition, processing, and interpretation of seismic data, particularly in Arizona, and operates field data recording systems and seismic data processing and interpretation facilities at the University of Arizona. His research efforts have provided hands-on training for undergraduate and graduate students in conventional and multi-component seismic exploration techniques applied to large-scale crustal structure, and in the application of high-resolution techniques for near-surface imaging. Dr. Johnson has worked on collaborative research projects funded by NSF, DOE, AZGS, and others. **Service:** Dr. Johnson served as the Chair of the Program for Array Seismic Studies (PASSCAL) Standing Committee of the Incorporated Research Institutions for Seismology (IRIS). **Awards include:** Shell Faculty Career Initiation Award; ConocoPhillips Faculty Sponsorship Award; British Institutions Reflection Profiling Syndicate (BIRPS) Visiting Fellowship, Cambridge University.

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Ph.D. (Chemistry), 1976, University of Bristol, UK

Jull's **research involves** using radiocarbon dating for a variety of studies in paleoclimate and understanding rapid changes in 14C due to solar and geomagnetic events, observed in tree rings. He also studies other radionuclides particularly Iodine-129 to study ocean circulation in the Pacific and cosmogenic nuclides (10Be, 14C, 26Al, etc.) to understand the exposure and terrestrial ages of meteorites. Current research includes annual 14C studies in tree-rings from various sites in Russia, Finland and the USA, I-129 studies along the Pacific coast and 14C studies in meteorites. He also works closely with other colleagues in Hungary, Japan and the Czech Republic. He was the AMS Laboratory director from 2000-2014. **Served on** various NASA review panels; editor of Radiocarbon, 1999-date and Meteoritics and Planetary Science, 2003-date; Encyclopedia of Quaternary Sciences, 2004-date. **Awards include** Kirk Bryan Award (GSA), 1997; Fellow of the Meteoritical Society 1998; Fellow, Geological Society of America 1998; Fellow of the Royal Society of Chemistry 2017; Fulbright Scholar 2012-2013. He has published over 410 peer reviewed articles and currently has a NASA research grant.

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Ph.D. (Geology), 2004, University of California, Los Angeles

Kapp's **work** focuses on teaching and learning, and curriculum development for both geosciences and general education at the University of Arizona. Her specialty is active learning in large lecture classes. She has been teaching general education geosciences for fifteen years to classes as large as 950 students. She also teaches Historical Geology for geoscience majors, and honors seminars that focus on women in science. In 2018, she received the College of Science Innovation in Teaching Award. For the past two years, she has played a major role in crafting the new general education curriculum (soft roll-out in spring 2022), and currently serves as the coordinator for the *Exploring Perspectives* curricular area of the new general education program. She also contributed to creating a new Quantitative Reasoning attribute requirement for general education and served as the coordinator for that attribute in fall 2020 and spring 2021. She currently serves as the Director of Undergraduate Studies, the Chair of the Undergraduate Policy Committee, and the Faculty Advisor of the undergraduate geology club (the Society of Earth Science Students) for the department of geosciences. She has participated in NSF funded research with colleagues in geosciences, primarily in broader impacts and educational applications.

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Ph.D. (Geology), 2001, University of California, Los Angeles

Kapp's **research involves** using geological mapping, structural-stratigraphic analysis, and geo-thermochronology to understand the tectonic evolution of orogenic systems and interplays among tectonics, climate, and landscape evolution. His current research is focused on the tectonic evolution of Asia and the North American Cordillera and late Cenozoic history of landscape evolution and climate change in central Asia and other arid regions globally. **Served on** Editorial Board of *Geology* (2019-2021) and *Fundamental Research* (2021-present); Associate Editor, *Tectonics* (2009-2015); Planetary Geosciences B.S. degree development committee (Chair). **Awards include**: University of Arizona College of Science Early-Career Teaching Award (2004) and Geological Society of America Outstanding Young Scientist Award (Donath Medal; 2008). Published >100 peer reviewed articles and currently has three NSF research grants.

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Ph.D., (Earth and Planetary Sciences), 2012, Harvard University

Eric's **research involves** using seismology to understand earthquakes, magmatic systems, and associated geohazards. He is particularly interested in the magmatic system of Mount St. Helens, the source properties of deep earthquakes, and coseismic landslides. **Served on** SZ4D Magmatic Drivers of Eruption working group 2019-present; Transportable Array Advisor Committee 2017-2020. Published 23 peer reviewed articles and currently has 1 NASA and 2 NSF research grants.

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Ph.D. (Meteorology), 2014, Stockholm University, Sweden

Lofverstrom's **research involves** using numerical models to study the coupled climate system, with a special focus on atmospheric circulation and interactions with ice sheets in past, present, and future climates. To this end, his research bridges the fields of Earth-system dynamics, (paleo-) climatology, and glaciology; utilizes a hierarchy of numerical models (from idealized to fully coupled state-of-the-art Earth-system models) and theoretical approaches; and encompasses many temporal and spatial scales. **Served on** numerous departmental and university level committees from 2018-present. **Awards include**: Department of Geosciences Outstanding Faculty Award 2021. Published 23 peer reviewed articles and currently has NSF research grants.

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Ph.D. (Earth Science), 2014, Rice University

Mallik's **research involves** using experimental petrology to the evolution and differentiation of the Earth and planetary bodies. She is interested in terrestrial deep volatile cycling, investigating feedbacks between the surface and interior reservoirs using volatile elements such as nitrogen and carbon as proxies. She is also investigating the evolution and differentiation of the Moon's interior. Specifically, she is constraining the current petrological and thermal state of the lunar interior as well as distribution of hydrogen in the Moon, in an effort to constrain how wet the Moon is. Mallik's **teaching involves** spearheading the only one of its kind undergraduate emphasis on Gem Science under Geosciences major. The emphasis is being rolled out from Fall 2022. **Served on** NASA review panels in 2019; associate editor of Journal of Geophysical Research-Planets 2020-present, ad hoc reviewer for NSF, NASA, NERC (UK), Flanders (Belgium), chaired sessions at AGU, Goldschmidt and Gordon Research Conference. **Invited presentations/colloquia** at AGU, Goldschmidt, and several institutions in the US and Europe. **Awards include**: Humboldt Postdoctoral Fellowship 2015-2018. Published 12 peer reviewed articles and currently has pending NSF and NASA research grants.

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Ph.D. (Applied Mathematics), 2013, University of Arizona

McGuire's **research involves** using a combination of numerical modeling and field-based methods to understand landscape evolution and landslide hazards. His recent work has focused on the role of land cover and disturbance events, specifically wildfire, on soil erosion and debris-flow hazards. He is also working to develop landscape evolution models that incorporate erosion associated with infrequent, extreme events, such as debris flows. He has **served as** a panelist on several webinars related to wildfire impacts targeted at general audiences and land managers and regularly organizes technical sessions at academic conferences. **Awards include:** the Bisgrove Scholar Award from Science Foundation Arizona in 2017 and the 2020 Outstanding Reviewer Award from *Geosciences*. He has published over 30 peer reviewed articles and has had recent research grants funded by NSF, NOAA, and the USGS.

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Ph.D. (Geological Sciences), 1997, Cornell University

Pelletier's **research involves** all aspects of landform evolution from time scales of individual storm events to mountain building and topographic decay. He is particularly focused on quantifying the feedbacks among topography, fluid flow, and the resulting sediment transport and deposition. His work integrates numerical modeling, remote sensing, field measurements, and geochronology. **Served on** National Science Foundation Geomorphology and Land-Use Dynamics grant review committee (2015-2017), associate editor for Geomorphology (2005-2019), GSA Bulletin (2012-2018), and JGR Earth Surface (2014-present). **Awards include**: Galileo Circle Fellowship (2011) and GSA Fellow (2015). Published 150+ peer reviewed articles and currently has a 10-year industry-funded grant to develop predictive models for rill erosion on hillslopes.

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Ph.D. (Geophysics), 1978, Massachusetts Institute of Technology

Richardson's **research involves** Science Education: science for non-science majors, curricular reform at the university level and service at the national level. Served as P.I. or co-P.I. on four NSF-funded science education grants, including Co-P.I. of the UA NSF ADVANCE Award and P.I. on the NSF's Recognition Award for the Integration of Research and Education (RAIRE) to UA totaling over $5M. Dynamics of plate tectonic processes: including the driving mechanism for plate tectonics; intraplate deformation; the origin and support of mountains using intraplate stress and the geoid. **Service included:** co-chair of UA's NCA 2000 and 2010 Accreditations, interim department head, associate dean of the College of Science, co-chair of the Strategic Budget and Advisory committee (SPBAC), and vice president for Undergraduate Education, President of the National Association of Geoscience Teachers 2015-2016. For the American Geophysical Union served on the Outreach Committee (Chair 2010-2012), Public Information Committee (Member 2006-2008 and Chair 2008-2010), Budget and Finance Committee (Member 2004-2006), and Committee on Education and Human Resources (Chair 1998-2000). For the American Institute of Physics served on the News and Media Services Committee (Member 2010-2012), Government Relations (Member 2012-2014, Chair 2014-15).

Joaquin Ruiz, PhD
Vice President, Global Environmental Futures
Director, Biosphere 2
Executive Director, Alfie Norville Gem & Mineral Museum
Thomas R. Brown Chair
Professor, Department of Geosciences
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Ph.D. (Geology), 1983, University of Michigan at Ann Arbor

Ruiz's **research involves** first-order problems in the Earth Sciences, such as the development of new isotope systems for studying ore deposits and the tectonic processes involved in the growth and evolution of Mexico. His research team addresses problems ranging from the origins of life to present-day climate change. **Service includes**: Head of the Department of Geosciences (1995-2000), Dean of theCollege of Science (2000-2019), Executive Dean of the Colleges of Letters, Arts and Science (2009-2018), and Vice President for Innovation (2013-2019), Vice President of Global Environmental Futures (2019), and Thomas R. Brown Chair and Director of Biosphere 2 (2013-current). Additionally, he has served as President of the Geological Society of America (2010-2011). He has served as Secretary of the Volcanology Section of the American Geophysical Union, Councillor of the Geological Society of America, and as a National Science Foundation Panel Member for the Instrumentation and Facilities Program and the Centers for Excellence in Science and Technology Program. He has served as Associate Editor of the *American Journal of Science*, *Geology*, *Revista*, and *Geofísica International* of the Institute of Geology, UNAM. **Awards include**: Fellow of the Society of Economic Geologists and member of the American Geophysical Union, the American Chemical Society, the Geochemical Society, and the National Research Council of the National Academies of Science. He is also a member of the Mexican Academy of Sciences and was named a National Researcher by the Mexican government in 2010, when he was recognized for his outstanding scientific contributions and efforts to enhance Mexico's scientific and technological capacity through collaborations with the UA and research institutions in Mexico.

Jay Quade, PhD
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Ph.D. (Geochemistry), 1990, University of Utah

Quade's **research involves** low-temperature geochemistry and paleoenvironmental reconstruction. He has worked all over the world documenting the evolution of climate and landscapes over the past 60 million years, including the context of early hominids in Africa. Published ~160 peer reviewed articles and currently has NSF research grants. **Served on** National Science Foundation Grant Review Committee 2020. **Awards include**: Outstanding Department of Geosciences Faculty Award 2008; Farouk El Baz Award, GSA (2001); GSA Fellow (2015), AGU Fellow (2015), Ben Tor Award (2014), Geochemical Society Fellow (2017); Lady Davis Fellowship (Hebrew University) (2016); Japan Society for the Promotion of Science Fellowship (U of Tokyo) (2017); Arthur L. Day Medal (GSA) (2018)

Peter Reiners, PhD
Associate Dean of Research, College of Science
Professor, Department of Geosciences
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Ph.D. (Geological Sciences), 1991, University of Washington

Reiners' **research involves** using geochemistry and geo/thermochronology to understand processes in Earth, environmental, and planetary science. **Served on** Editorial Board of *Chemical Geology* since 2008, and as Associate Editor of *American Journal of Science* since 2005. **Awards include**: Fellow of American Geophysical Union, 2019.

Joellen Russell, PhD
University Distinguished Professor
Thomas R. Brown Distinguished Chair of Integrative Science
Professor of Biogeochemical Dynamics, Department of Geosciences
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University of Arizona
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Ph.D. (Oceanography), 1999, Scripps Institution of Oceanography, University of California San Diego

Russell was just named as a **University Distinguished Professor** for her demonstrated scholarship and "extraordinary commitment to undergraduate teaching, advising, and mentoring." Russell's **research uses** robot floats, satellites, and supercomputers to observe and predict the ocean's role in the climate and carbon cycle of the past, the present and the future, with the overarching goal of understanding the Southern Ocean and the role of the Southern Hemisphere westerly winds in the global carbon cycle, the global climate, and their response to anthropogenic forcing. She is the **lead of the modeling team** for the NSF-, NOAA- and NASA-funded Southern Ocean Carbon and Climate Observations and Modeling project. Russell is PI on the recently-submitted Southern Ocean Storms–Zephyr, a $193M NASA mission proposal to quantify the global carbon budget and she would be **the first female PI of a NASA earth science mission**. **Served on:** As **Chair of** the National Oceanic and Atmospheric Administration's Science Advisory Board's **Climate Working Group**, Russell has been focused on earth system prediction, carbon accounting, and carbon dioxide removal. In 2021, she chaired the **Carbon Budget Verification session for the G7**: Future of the Seas and Oceans Initiative in support of the UN Decade of Ocean Science for Sustainable Development and served on three **National Academies of Science, Engineering and Medicine** panels. Russell was one of the **authors of the climate science amicus brief** cited in the 2007 Massachusetts vs the EPA Supreme Court decision that ruled that carbon dioxide is a pollutant and must be regulated by the EPA; **Awards include**: University Distinguished Professor (2021); Thomas R. Brown Distinguished Chair of Integrative Science (2017-present);1885 Society Distinguished Scholar Award (2014); Provost's General Education Teaching Award (2010).

Eric Seedorff, PhD (retired)
Associate Professor Emeritus, Economic Geology
Chair and Director, Lowell Program in Economic Geology
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Ph.D. (Ore Deposits and Exploration Prog), 1987, Stanford University

Seedorff's **research involves** the genesis of porphyry Cu, Mo, and Au deposits, and Carlin-type and epithermal Au deposits and tectonics of western North America, including normal faults and Cordilleran metamorphic core complexes. Prior to the University of Arizona, Seedorff was VP Mineral Resources for BHP Copper and Chief Geologist of Magma Copper. **Served on** editorial board of Economic Geology; Councilor of Society of Economic Geologists, and President of the Geological Society of Nevada (1991-1992); President of the Arizona Geological Society (2005); Co-Chair of AGS Ores and Orogenesis Symposium (2007). **Awards include**: Society of Economic Geologists Brian J. Skinner Award (2004).

Kaustubh Thirumalai, PhD
Assistant Professor, Department of Geosciences
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Ph.D. (Geological Sciences), 2016, University of Texas at Austin

Thirumalai's **research** focuses on reconstructing past climatic and oceanic fluctuations to help constrain future climate change scenarios. In combination with models and observations, Thirumalai utilizes stable isotopic and trace elemental geochemistry across a variety of carbonate archives (foraminifera, speleothems, corals, mollusks) to address regional and global changes. He is currently working on past changes in Indian oceanography with an emphasis on summer monsoon variability and its interaction with equatorial processes. Thirumalai is also working on past and future changes in the El Niño/Southern Oscillation phenomenon as well as focusing on changes in the Gulf Stream. Thirumalai **serves as** an Associate Editor for Paleoceanography and Paleoclimatology (AGU journal) and also serves as a faculty mentor for the Southern Arizona Research, Science, and Engineering Foundation (SARSEF), having mentored three high school students over three years. Thirumalai also served as a primary organizer for a NASEM committee to provide input on paleoclimate funding at the NSF. Recently, Thirumalai was an invited panelist for the *Vaibhav Summit*, organized by the Prime Minister's Office of India and also for the Micropaleontological Society's Annual Meeting. Thirumalai has 46 published peer-reviewed publications and currently has three active NSF grants and one USGS grant. Thirumalai **teaches** the following: Paleontology (GEOS308; undergraduate), Paleoceanography & Paleoclimatology (GEOS582; graduate), Stable Isotope Geochemistry (GEOS566; graduate+undergraduate), Trace Elements in Biogenic Calcite (GEOS596; graduate+undergraduate), Rock-Climate Interactions in Early Earth and Planets (GEOS596a; graduate).

Diane Thompson, PhD
Assistant Professor of Paleoceanography, Department of Geosciences
Director of Marine Research, Biosphere 2
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Ph.D. (Geosciences), 2013, University of Arizona

Thompson's **research** bridges the fields of ecology, paleoecology, and paleoclimatology to investigate climates and reef systems of the past, and in turn, improve our ability to preserve reef resilience under current and future climate change. Her work spans a range of scales from local (e.g., reef-scale circulation) to global (e.g., climate variability and change) and capitalizes on a blend of field and laboratory, observational and modeling, and experimental and theoretical approaches. **Served on** College of Science (2020), Department of Geoscience (2019-pesent) and AMerican QUaternary Association (2020-present) Diversity, Equity and Inclusion Committees. Serves as Marine Geoprocesses Councilor for the AMerican QUaternary Association. **Awards include**: 2020 Outstanding Faculty Award and NSF CAREER Award. Published 23 peer reviewed articles and currently has three active NSF research grants.

Dr. Jessica Tierney, PhD
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Ph.D. (Geology), 2010, Brown University

Tierney's **research** focuses on the study of past climates (paleoclimatology) using organic geochemical biomarkers for ocean temperatures and the hydrological cycle, statistical methods including Bayesian modeling and data assimilation, and climate modeling output. She has published 77 peer reviewed articles including works in top scientific journals such as *Nature* and *Science*, and since arriving at the University of Arizona in 2015 has brought in ca. 3.5 million dollars in research funding from NSF, PRF, and private foundations. She recently **served** as a Lead Author of the IPCC AR6 Working Group Report, released in August 2021. She is also a member of the Scientific Steering Committee for NCAR CESM; an Advisory Board Member for the Global Warming Mitigation Project (https://www.globalwarmingmitigationproject.org/), an Associate Editor for the journal *Geochimica et Cosmochimica Acta*; the Chair of the AGU Fellows Selection Committee for the Paleoceanography & Paleoclimatology Division; and lead PI on paleoCAMP, a new summer school for graduate students in paleoclimatology (https://paleoclimate.camp/). **Awards include** the David and Lucile Packard Foundation Fellowship in Science and Engineering (2015); the AGU James B. Macelwane Medal (2014); AGU Fellowship (2014); the Pieter Schenck Award for early-career organic geochemists (2015); the University of Arizona Department of Geosciences Outstanding Faculty Award (2019); and the University of Arizona College of Science Galileo Circle Curie Award (2019).

Jianjun Yin, PhD
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Ph.D. (Climate Dynamics), 2004, University of Illinois at Urbana-Champaign

Yin's **research involves** using global coupled climate models to understand climate change and sea level rise. He is interested in the role of the Atlantic Ocean circulation in sea level rise along the East Coast of the U.S. and extreme weather and climate events. He also conducted studies on the relationship between changes in global temperature and the Pacific sea level. He published more than 30 peer reviewed articles and currently has NOAA research grants. **Served on** NASA and NOAA proposal review panels.

George Zandt, PhD (retired)
Professor Emeritus, Department of Geosciences
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Ph.D. (Geophysics), 1978, Massachusetts Institute of Technology

Zandt's **research interests involve** understanding the geodynamic processes and geologic evolution of major continental mountain systems in North and South America. The main tool he employs is passive-source seismology, i.e., utilizing naturally occurring earthquakes to image large-scale lithospheric structures. **Service** includes: NSF Continental Dynamics Program Panel (1997-2002), Associate Editor, Journal of Geophysical Research – Solid Earth (1995-1998), and other national service to the seismological community.

APPENDIX B: FACULTY LEADERSHIP ROLES

(Examples of selected Faculty Participation, Leadership, and Influence in the Academic Profession through such avenues as professional associations, review panels, and advisory groups.)

Mark Barton

Professional Activity	**Participation Role**	**Years**
Lowell Institute of Mineral Resources	Director	2014-
Geological Society of America	Fellow	1985-
Society of Economic Geologists	Fellow	1980-
Mineralogical Society of America	Fellow	1973-
Society for Mining and Exploration	Member	
Society for Geology Applied to Mineral Deposits	Member	
Arizona Geological Society	Member	
Academic Program Review Committee for University of Nevada-Reno, Department of Geology	Review Member	

Susan Beck

Professional Activity	**Participation Role**	**Years**
SZ4D Faulting & Earthquakes Working Group	Member	2020-
AGU Union Honors Fellows Committee	Member	2017-2020
GSA George Woollard Award Committee	Member (2 years), Chair (1 yr)	2018-2020
Seismological Society of America Nominations Committee	Member	2019-2020
Seismological Society of America Reid Medal Nominations Committee	Chair	2017-2018
AGU Tectonophysics Nominations Committee	Chair	2015-2016
AGU Seismology Section Aki Early Career Award Committee	Chair	2015-2016
IRIS Advisory Committee for the NSF-MRI Chile Project	Member	2011-2015
External APR Committee, Dept. of Earth and Atmospheric Sciences, Purdue University	Chair	2014
External APR Committee, Dept. of Earth and Planetary Science, UC Santa Cruz	Member	2017

Richard Bennett

Professional Activity	**Participation Role**	**Years**
NASA	Review Panel	2020
UNAVCO	Member Representative	2007-
UNAVCO	Chair, Community Engagement Committee	2018-2019
WinSAR	Member Representative	2007-
American Geophysical Union	Member	1990-

National Science Foundation	Review Panel	2017

Barbara Carrapa

Professional Activity	Participation Role	Years
GSA Bulletin	2017– 2019	2017– 2019
Department Head of Geosciences	2018-	
National Science Foundation	Review Panel	2017, 2019
GSA International award committee	member	2018
APR reviewer for University of Idaho	External reviewer	2015
International Thermochronology Standing Committee	Member Representative	2014-
American Geophysical Union meeting organizer	meeting organizer	2013
American Geophysical Union	Member	2010-

Andrew Cohen

Professional Activity	Participation Role	Years
Hominin Sites and Paleolakes Drilling Project	Director	2010-
Species in Ancient Lakes 9-Conference (Kigoma, Tanzania)	Chair of Organizing Committee	2018-
Nominations Committee AGU Dansgaard Award	Member	2018-2019
Nominations Committee GSA-Continental Scientific Drilling Division	Chair	2019-2020
External Graduate Program Review Committee – Baylor University Geology Department	Member	2018
Continental Scientific Drilling Coordination Organization Policy Committee	Member	2015-
NSF Drilling Workshop-Bouse Formation, Parker, AZ	Convener	2018
ICDP Drilling Workshop-Lake Tanganyika, Dar es Salaam, Tanzania	Co-convener	2019
INQUA Special Session on African Paleoclimate, Dublin, Ireland	Co-convener	2019
University of California at Davis, Earth Science Department Advisory Board	Member	2019-
GSA Continental Scientific Drilling Division Distinguished Lecturer	Lecturer	2021-2022

George Davis

Professional Activity	Participation Role	Years
Board of Advisors - Jackson School of Geosciences, University of Texas at Austin	Member	2018-2021

Geological Society of America Foundation Campaign Committee	Member	2018

Peter DeCelles

Professional Activity	**Participation Role**	**Years**
Advisory Board, Indiana University, Bloomington, Dept. of Earth & Atmospheric Sciences	Member	2018-
Geological Society of America Penrose and Thompson Field Forum Committee	Member	2014-2016
Geological Society of America International Committee	Member	2015-2016
Geological Society of America Structural Geology & Tectonics Career Contribution Award Committee	Member and Chair	2011-2013
Geological Society of America Sloss Award Committee	Member and Chair	2010-2012
National Science Foundation Tectonics Program Grand Challenges Whitepaper	Member & Coauthor	2018

Mihai Ducea

Professional Activity	**Participation Role**	**Years**
GSA Publication Committee	Member	2019-2021
GSA Petrology Division – Award Committee	Member	2019-2021
Romanian Ministry of Education – Earth Science Accreditation Committee	Member	2019-

Karl Flessa

Professional Activity	**Participation Role**	**Years**
Conservation Paleobiology Research Coordination Network	Advisory Board & Online Learning Panel	2018-
Colorado River Research Group	Founding Member	2015-
Environmental Work Group, Minute 323, US-Mexico water treaty	Science Team Representative	2014-
NSF Review Panel, EAR	Panelist	2014
NSF Review Panel, OISE	Panelist	2017

George Gehrels

Professional Activity	**Participation Role**	**Years**
NSF Review Panel, EAR	Panel Member	2020, 2021

National Academy of Science, Engineering and Medicine - Committee on Catalyzing Opportunities for Research in the Earth Sciences (CORES): A Decadal survey for NSF's Division of Earth Sciences;	Member; Co-author of "A Vision for NSF Earth Sciences 2020-2030: Earth in Time (2020)"	2019-2020
NSF EAR	Co-author of community White Paper - "It's About Time: Opportunities and Challenges for U.S. Geochronology	2015
Society of Economic Paleontologists and Mineralogists	Co-author of "Statement on Evolution and Age of the Earth"	2020-2021
Geological Society of America Geochronology Division	Chair	2020

Vance Holliday

Professional Activity	**Participation Role**	**Years**
Journal, *Quaternary Research*	Associate Editor	2015-2018
Journal, *Geoarchaeology*	Associate Editor	2017-2021

Roy Johnson

Professional Activity	**Participation Role**	**Years**
Journal Reviewer	Reviewer	2014-2021
Math Challenge Award Recipients on UA Campus	Facilitator	2014-2018

A.J. Timothy Jull

Professional Activity	**Participation Role**	**Years**
NASA	Panelist	2020
American Geophysical Union, Devendra Lal Medal Committee	Member	2017-2023
Decadal Review Committee, Physical Research Laboratory	Member	2019
International Scientific Advisory Committee, A E Lalonde Accelerator Mass Spectrometry Laboratory, Ottawa, Canada	Member	2018
Advisory Board, Rez Accelerator Mass Spectrometry & Environmental Sciences (RAMSES), Prague, Czech Republic	Member	2019-2023
Meteoritics and Planetary Science	Editor	2003-
Radiocarbon	Editor	1999-

Jessica Kapp

Professional Activity	Participation Role	Years
General Education Refresh Advisory Committee	Faculty Participant	2018-2019
General Education Coordinator	Coordinator of Exploring Perspectives	2020-

Paul Kapp

Professional Activity	Participation Role	Years
Geological Society of America	Fellow	2008-
American Geophysical Union: Paleoceanography and Paleoclimatology	Member	1994-
Arizona Geological Society	Member	2002-
National Association of Geoscience Teachers	Member	2012-

Eric Kiser

Professional Activity	Participation Role	Years
SZ4D Magmatic Drivers of Eruption (MDE Working Group)	Member	2019-
Transportable Array Advisory Committee	Member	2017-2020

Marcus Lofverstrom

Professional Activity	Participation Role	Years
National Center for Atmospheric Research (NCAR) Land Ice Working Group (LIWG)	Core Member	2015-
Women in STEM mentoring program	Faculty Mentor	2020-2021

Ananya Mallik

Professional Activity	Participation Role	Years
NASA SSERVI CAN-3 Review Panel	Panelist	2019
NASA Emerging Worlds Review Panel	Panelist	2019
Journal of Geophysical Research – Planets	Associate Editor	2021-
Gem and Mineral Museum – Tucson	Advisory Committee	2020-

Luke McGuire

Professional Activity	Participation Role	Years
American Geophysical Union	Member	2014-

Jay Quade

Professional Activity	Participation Role	Years

Geochimica et Cosmochimica Acta	Associate Editor	2018-2019
Quaternary Research	Advisory Board	2016-2020
Quaternary Research	Associate Editor	2008-2015
National Science Foundation	P2C2 Panelist	2020

Joellen Russell

Professional Activity	**Participation Role**	**Years**
International Association for the Physical Sciences of the Oceans (IAPSO), International Union of Geodesy and Geophysics (IUGG), International Science Council (ISC).	Executive Committee Member	2021-present
National Aeronautics and Space Administration (NASA) Innovative Advanced Concepts (NIAC) Phase I Proposal Review Panel	Member	2021
National Academies of Science, Engineering and Medicine (NASEM), Workshop on A Research Strategy for Ocean Carbon Dioxide Removal and Sequestration (recording)	Panelist	2021
NASEM, Emerging Areas of Science, Engineering, and Medicine for the Courts: A Workshop (recording)	Panelist	2021
NASEM, Workshop on Earth System Predictability Research and Development Panel (recording) (proceedings)	Panelist	2020
National Oceanic and Atmospheric Administration (NOAA) Science Advisory Board, Climate Working Group	Chair	2019-present
External 5-Yr Review Stakeholder Panel, NOAA Geophysical Fluid Dynamics Laboratory	Member	2019
NOAA's Climate Connections: Connecting and Applying Climate Science Across NOAA	Panelist	2019
NOAA Climate and Global Change Postdoctoral Fellowship Program Review Panel	Chair	2018
American Geophysical Union (AGU) Science for Solutions Award Committee	Chair	2018-present
National Center for Atmospheric Research Community Earth System Model Advisory Board	Member	2017-present
US-Biogeochemical Argo Subcommittee, sponsored by Ocean Carbon and Biogeochemistry (OCB), part of the U.S. Carbon Cycle Science Program (link)	Member	2017-present
NOAA Climate and Global Change Postdoctoral Fellowship Steering Committee	Chair	2017-2019
NOAA Science Advisory Board, Climate Working Group	Member	2016-2019
AGU journal, *Paleoceanography and Paleoclimatology*	Associate Editor	2016-2019
NOAA Climate and Global Change Postdoctoral Fellowship Steering Committee	Member	2015-2017

U.S. Carbon Cycle Science Program's Carbon Cycle Scientific Steering Group (link)	Member	2014-present
Southern Ocean Region Panel, cosponsored by the World Climate Research Program's the Climate and Ocean: Variability, Predictability and Change (CLIVAR) and the Climate and Cryosphere (CliC) projects, and the Scientific Committee on Antarctic Research (SCAR) program (link)	Member	2014-2018
Antarctic Climate Change in the 21st Century (AntClim21), sponsored by International Council for Science (ICSU), SCAR Planning Group:	Co-Lead	2012-present
Gary Comer Foundation "Changelings"	Member	2012-present
Southern Ocean Working Group, co-sponsored by US CLIVAR & OCB (link)	Co-Chair	2012-2015
U.S. CLIVAR Office, Process Studies and Model Improvements Panel (link)	Member	2010-2014
Processes Affecting Air-Sea Exchange and the Biogeochemistry of the Upper Ocean, Session at the 2020 Ocean Sciences Meeting	Co-Convener	2020
Integrated Understanding of Global Carbon and Other Biogeochemical Cycles and Their Feedbacks in Coupled Model Intercomparison Project 6 (CMIP6), Session at the 2019 AGU Fall Meeting	Co-Convener	2019
New Frontiers in the Southern Ocean's Role in Climate: Recent Developments in Physical and Biogeochemical Observations and Modeling, Session at the 2018 AGU Fall Meeting	Co-Convener	2018
Modeling the Climate System at High Resolution, Session at the 2018 Ocean Sciences Meeting	Co-Convener	2018
#GreatAntarcticClimateHack (Workshop), sponsored by SCAR, National Science Foundation and Southern Ocean Carbon and Climate Observations and Modeling	Chair	2017
Physical and Biogeochemical Processes in the Southern Ocean: Observations, State Estimation and Modeling, Session at the 2016 Ocean Sciences Meeting	Co-Convener	2016
Ocean's Carbon and Heat Uptake: Uncertainties and Metrics (Workshop), sponsored by U.S. CLIVAR and OCB	Chair	2014
The Southern Ocean and Its Role in the Climate System: Observations and Modeling of Physical and Biogeochemical Processes, Session at the 2014 Ocean Sciences Meeting	Co-Convener	2014

Kaustubh Thirumalai

Professional Activity	Participation Role	Years
American Geophysical Union: Paleoceanography & Paleoclimatology	Associate Editor	2018-2020

Diane Thompson

Professional Activity	Participation Role	Years
AMerican QUaternary Association, Diversity, Equity, and Inclusion Committee	Member	2020-
American QUaternary Association, Marine Geoprocesses	Councilor	2018-2022
American Geophysical Union Fall Conference	Session Co-Chair	2018
NSF P2C2 Review Panel	Panel Member	2016
PAGES Ocean2k and Iso2k, Coral Archive Iso2k synthesis team	Leader	2015-

Jessica Tierney

Professional Activity	Participation Role	Years
Geochimica et Cosmochimica Acta	Associate Editor	2018-
American Geophysical Union Fellows Selection Committee, Paleoceanography & Paleoclimatology	Member	2019-2020
American Geophysical Union Fellows Selection Committee, Paleoceanography & Paleoclimatology	Committee Chair	2021
Community Earth System Model Scientific Steering Committee, National Center for Atmospheric Research	Member	2020-
Intergovernmental Panel on Climate Change Sixth Assessment Report, Working Group I	Lead Author	2018-2021
The Keeling Curve Prize	Advisory Board Member	2021-
paleoCAMP summer school	Lead Organizer and Instructor	2020-
Goldschmidt conference	Theme Leader & Session Chair	2019
Advanced Climate Dynamics Course	Instructor	2018-2019
Urbino Summer School in Paleoclimatology	Instructor	2016-2017
PAGES Ocean 2K	Group Leader	2012-2015
National Science Foundation	Panel Reviewer	2012-2016
American Quaternary Association	Geochronology, Geophysics, and Geochemistry Councilor	2012-2016
International Meeting of Organic Geochemistry	Scientific committee member	2015
Fall American Geophysical Union Meeting	Session Convener	2015, 2017, 2021

House of Representatives Select Committee on Climate Crisis	Expert testimony in a briefing on the IPCC AR6 report	2021

Jianjun Yin

Professional Activity	**Participation Role**	**Years**
UK Natural Environment Research Council	Reviewer	2017
NASA Proposals	Review Panel	2019
NOAA COP Proposals	Panelist	2021
NOAA OAR Outstanding Scientific Paper Awards	Reviewer	2021

APPENDIX C: TEACHING LOAD AND STUDENT CREDIT HOURS

Tenure-Track Faculty, Career-Track Faculty and Lecturers Who Teach Geosciences Courses

Tenure-Track and Career-Track Faculty	FTE	General Area of Expertise	Geosciences Course Number & Name
Barton, Mark Professor	1.00	Economic Geology, Geochemistry & Petrology	404B/504B Topics in Ore Deposits Mapping 404C/504C Topics in Mineral Deposit Types 446/546 Economic Mineral Deposits 596B&H Economic Geology Seminars 646A&B Advanced Ore Deposits Geology
Beck, Susan Professor	1.00	Seismology & Tectonics	218 Geological Disasters & Society 427/527 Orogenic Systems 432/532 Intro to Seismology 596F Geophysics Seminars
Bennett, Richard Professor	1.00	Geodesy & Tectonics	322 Introduction to Geophysics 424A/524A Space Geodesy 414 Geology Field Camp 477/577 Active Tectonics 528 Crustal Deformation 567 Inverse Problems in Geophysics 596F Geophysics Seminars
Carrapa, Barbara Professor	1.00	Sedimentary Geology & Low-T Thermochronology	255 Historical Geology 302 Principles of Stratigraphy & Sedimentation 414 Geology Field Camp 596A,D,F,&H Sedimentary Geo/Thermochron Seminars
Cohen, Andrew Distinguished Professor	1.00	Paleolimnology & Paleoecology	302 Principles of Stratigraphy & Sedimentation 308 Paleontology 412AB Ocean Sciences 596C&D Paleoclimate Seminars

Cole, Julia**** Professor	1.00	Paleoclimate & Global and Environmental Change	412AB Ocean Sciences 478/578 Global Change 596C Paleoclimate Seminars 582 Paleoclimatology 695G Global Change Toolkit
Davis, George** Regents' Professor Emeritus	0.49	Structural Geology	255 Historical Geology 304 Structural Geology 496E Field Mapping 596B&E Structural Geology Seminars
Davis, Owen** Professor Emeritus	1.00	Quaternary Paleoecology	170c Life on Earth
DeCelles, Peter Professor	1.00	Sedimentology & Tectonics	302 Stratigraphy & Sedimentation 414 Geology Field Camp 417/517 Sedimentary Basin Analysis 427/527 Orogenic Systems 456/556 Thrust Belts & Synorogenic Sediments 496E Field Mapping 544 Advanced Physical Sedimentology 596E Sedimentology Seminars
Downs, Robert** Professor Emeritus	1.00	Mineralogy & Crystallography	306 Mineralogy 460/560 Characterization & Identification of Minerals 596A&H Mineralogy Seminars
Ducea, Mihai Professor	1.00	Tectonics	251 Physical Geology 356 Petrology 408/508 Tectonic Petrology 425/525 Regional Tectonics 474A/574A Geochronology & Thermochronology 596A,B,E,F,&H Tectonics Seminars
Fay, Noah**** Lecturer	1.00	Geosciences	170A1 Earth: From Birth to Death
Flessa, Karl** Professor Emeritus	1.00	Invertebrate Paleontology & Paleobiology	308 Paleontology 596D Paleontology Seminars

Ganguly, Jibamitra** Professor Emeritus	1.00	Petrology & Geochemistry	356 Petrology 509 Advanced Petrology
Gehrels, George Distinguished Professor	1.00	Tectonics & Geochronology	212 Introduction to Oceanography 251 Physical Geology 302 Principles of Stratigraphy & Sedimentation 596A Tectonics/Geochronology Seminars
Goodman, Paul Senior Lecturer	1.00	Biogeochemistry, Oceanography & Climate Dynamics and Modeling	170A1 Earth: From Birth to Death 212 Introduction to Oceanography 218 Geological Disasters and Society 251 Physical Geology 412AB Ocean Sciences 478/578 Global Change
Harig, Christopher Assistant Professor	1.00	Geophysics	280 Programming and Data Analysis 419/519 Physics of the Earth 440/540 Introduction to Geodynamics 596F&H Cryosphere & Graduate Student Skills Seminars
Holliday, Vance *** Professor (25%)	1.00	Geoarcheology, Quaternary Landscapes & Soil Geomorphology	514 Quaternary Geology 596C Geoarcheology Seminars
Holt, Jack*** Professor (40%)	1.00	Earth Remote Sensing	
Hughes, Amanda Assistant Professor of Practice	1.00	Geophysics	304 Structural Geology 421/521 Petro Geology & Geophysics 477/577 Active Tectonics 496E/596E Topics in Struct. & Tecton.
Ibanez-Mejia, Mauricio Assistant Professor	1.00	Tectonics & Petrochronology	306 Mineralogy (Fall 2021)
Johnson, Roy** Professor Emeritus	1.00	Reflection Seismology & Crustal and	434A/534A Intro to Exploration Seismology 469/569 Seismic Data Processing 596F Geophysics Seminars

		Lithospheric Structure	
Jull, A.J. Timothy Professor	1.00	Geochronology, Radiocarbon Dating & Cosmogenic Nuclides	489/589 Quaternary Geochronology 474A/574A Geochronology & Thermochronology
Kapp, Jessica Associate Professor of Practice	1.00	Geosciences	170A1 Earth: From Birth to Death 255 Historical Geology 397A Teaching Geosciences
Kapp, Paul Professor	1.00	Structure and Tectonics	251 Physical Geology 304 Structural Geology 423/523 Regional Structural Geology 425/525 Regional Tectonics 596E&H Structure & Tectonics Seminars
Kiser, Eric Assistant Professor	1.00	Geophysics	322 Introduction to Geophysics 436/536 Earthquakes & Volcanic Systems 568 Advanced Seismology 596F Seismology/Tectonics Seminars
Lofverstrom, Marcus Assistant Professor	1.00	Dynamic Meteorology, Climatology, Paleoclimatology and Numerical Modeling	170A1 Earth: From Birth to Death 280 Programming and Data Analysis 285 Python in Geosciences 437/537 Earth-System Modelling 596E&H Earth Systems Seminars
Mallik, Ananya Assistant Professor and Endowed Chair	1.00	Gem Science	356 Petrology 462/562 Petrology of Gems 596A Petrology Seminars
McGuire, Luke Assistant Professor	1.00	Geomorphology	280 Programming and Data Analysis 300 Earth Surface Processes 450/550 Geomorphology 596C&H Geomorphology Seminars 650 Field Studies in Geomorphology

Overpeck, Jonathan**** Professor	1.00	Climate System Science	582 Paleoclimatology 596C Climate Seminars
Pelletier, Jon Professor	1.00	Geomorphology	218 Geological Disasters and Society 222 The Beauty of Landscapes 300 Earth Surface Processes 450/550 Geomorphology 502 Analytical & Numerical Models 650 Field Studies in Geomorphology
Quade, Jay Professor	1.00	Soil Geochemistry	400/500 Introduction to Geochemistry 414 Geology Field Camp 466/566 Stable Isotope Geochem & Paleoclimate 484/584 Coevolution of the Earth & Biosphere 489/589 Quaternary Geochronology 596D Geochemistry Seminars
Reiners, Peter Professor and Assistant Dean of Research	1.00	Geochemistry, Thermochronology & Applications in Earth and Planetary Science	251 Physical Geology 400/500 Introduction to Geochemistry 474A/574A Geochronology & Thermochronology 596H Thermochronology Seminars
Richardson, Randall** Professor Emeritus	1.00	Geophysics & Science Education	170A Earth: From Birth to Death 212 Introduction to Oceanography 218 Geological Disasters and Society 419/519 Physics of the Earth 567 Inverse Problems in Geophysics 596H Geophysics Seminars
Ruiz, Joaquin Professor	1.00	Geochemistry	400/500 Introduction to Geochemistry
Russell, Joellen Professor	1.00	Biogeochemistry, Oceanography & Climate Dynamics and Modeling	212 Introduction to Oceanography 478/578 Global Change 596H Oceanography Seminars

Seedorff, Eric** Associate Professor Emeritus	1.00	Economic Geology	251 Physical Geology 470R/570R Volcanology: Physical Processes 404B/504B Topics in Ore Deposits Mapping 404C/504C Topics in Mineral Deposit Types 543C Geologic Best Practices & Project Stages 596B Economic Geology Seminars
Shin, Ji-Yeon**** Senior Lecturer	1.00	Paleontology	170C1 Life on Earth 216 Dinosaurs 308 Paleontology
Steele-MacInnis, Matthew**** Assistant Professor	1.00	Economic Geology	251 Physical Geology 400/500 Introduction to Geochemistry 596A Geochemistry Seminars
Thirumalai, Kaustubh Assistant Professor	1.00	Paleoclimatology, Paleoceanography, & Paleobiology	308 Paleontology 342 Earth Climate History 466/566 Stable Isotope Geochem & Paleoclimate 582 Paleoclimatology 596A&C Climate seminars
Thompson, Diane Assistant Professor	1.00	Marine Geosciences	388 Biosphere 2: From Wonder to Discovery 412A&B Ocean Sciences 483/583 Modes of Climate Variability 596C&H Climate Seminars
Tierney, Jessica Associate Professor	1.00	Organic Geochemistry	342 The History of Earth's Climate 412A&B Ocean Sciences 486/586 Organic Geochemistry 596D,E,&H Geochemistry Seminars
Yin, Jianjun Associate Professor	1.00	Climate Dynamics and Modeling & Ocean Circulation and Sea Level Change	218 Geological Disasters and Society 412A&B Ocean Sciences 479/579 Introduction to Climate Dynamics 487/587 Physical & Dynamical Oceanography 573 Earth Systems Modelling

			596H Climate Seminars
Zandt, George** Professor Emeritus	1.00	Geophysics & Tectonics	427/527 Orogenic Systems 432/532 Introduction to Seismology 596A Geophysics Seminars
Titley, Spencer* Professor Emeritus	1.00	Mineral Deposits & Regional Geology	346 Mineral & Energy Resources 446/546 Economic Mineral Deposits

* Deceased

** Retired

*** Split Appointment

****Left the University of Arizona

Adjunct and Researchers Who Teach Geosciences Courses

Name	Geosciences Course Number & Name
Dettman, David Research Scientist	466/566 Stable Isotope Geochemistry & Paleoclimate
Hoffman, Derek Research Specialist	216 Dinosaurs
Lecumberri Sanchez, Pilar**** Research Scientist	596B Geochemistry Seminars
Mazdab, Frank Senior Research Specialist	306 Mineralogy 356 Petrology 596B Mineralogy/Petrology Seminars

Moitra, Pranabendu Research Scientist	170A1 Earth: From Birth to Death 270 Planetary Geosciences
Ojha, Tank Adjunct Lecturer	596H Sedimentary Seminar
Pepper, Martin Research Lab Coordinator	170A1 Earth: From Birth to Death 170C1 Life on Earth 218 Geological Disasters and Society 251 Physical Geology 255 Historical Geology 596H Geosciences Seminars
Sbar, Marc Adjunct Faculty	596F Interpretation of Seismic Reflection Data
Schmidt, Nan**** Adjunct Instructor	308 Paleontology

Joint Faculty Who Teach Geosciences Courses

Name	Geosciences Course Number & Name
Anchukaitis, Kevin Associate Professor	695G Global Change Toolkit
Baker, Victor Regents' Professor	415 Geological Hazards 453/553 Glacial & Quaternary Geology
Black, Bryan Associate Professor	497C/597C Dendrochronology
Falk, Donald Professor	497K/597K Dendroecology
Frank, David Professor	439A/539A Intro to Dendrochronology
Hamilton, Christopher Assistant Professor	470/570R Volcanology: Physical Processes
Hirschboeck, Katherine Associate Professor Emeritus	596H Climate Seminars
Huckleberry, Gary Adjunct Lecturer	195D: A Sense of Place
Hughes, Malcolm Professor Emeritus	439A/539A Intro to Dendrochronology 596K Respon Conduct of Environ Research
Meko, David Research Professor	497I/597I Practical Dendroclimatology 585a Applied Time Series Analysis
Saleska, Scott Professor	478/578 Global Change

Sheppard, Paul Associate Professor	195D: A Sense of Place 220 Environmental History of the Southwest 497C/597C Dendrochronology 497K/597K Dendroecology 596K Responsible Conduct of Environmental Research
Swetnam, Thomas Regents' Professor Emeritus	497K/597K Dendroecology
Touchan, Ramzi Research Professor	497I/597I Practical Dendroclimatology
Towner, Ronald Associate Professor	220 Environ History of the Southwest 497J/597J Dendroarcheology
Trouet, Valerie Professor	439A/539A Intro to Dendrochronology

Teaching load and student credit hours

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
Geosciences	Undergraduate	ANTH	199	Holliday,Vance T							0.2	0.02			0.2	0.02		
			332	Holliday,Vance T			11.1	0.92					11.1	0.92				
			439A	Chase,Anne L			0.0	0.00										
			492	Holliday,Vance T							0.7	0.06						
			498H	Holliday,Vance T	1.5	0.12												
			499	Holliday,Vance T	0.7	0.06					0.2	0.02	0.7	0.06				
		ATMO	412A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00						
				Cohen,Andrew S	6.0	0.50					18.0	1.50						
				Cole,Julia E	6.0	0.50	0.0	0.00										
				Tierney,Jessica E			21.0	1.75	24.0	2.00			3.0	0.25				
		BIOC	498H	Tierney,Jessica E									6.0	0.50				
		ECOL	412A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00		
				Cohen,Andrew S	15.0	1.25					42.0	3.50			21.0	1.75		
				Cole,Julia E	15.0	1.25	0.0	0.00										
				Thompson,Diane M											21.0	1.75		
				Tierney,Jessica E			30.0	2.50	33.0	2.75			30.0	2.50				
			412B	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00						
				Cohen,Andrew S	3.5	0.29					5.0	0.42			2.0	0.17		
				Cole,Julia E	3.5	0.29	3.0	0.25										
				Thompson,Diane M											2.0	0.17		
				Tierney,Jessica E			3.0	0.25	5.0	0.42			4.0	0.33				
			498H	Cole,Julia E			6.0	0.50										
				Tierney,Jessica E							3.0	0.25						
			499	Cole,Julia E					3.0	0.25								
		ENVS	412A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00						
				Cohen,Andrew S	6.0	0.50					6.0	0.50						
				Cole,Julia E	6.0	0.50	0.0	0.00										
				Tierney,Jessica E			15.0	1.25	3.0	0.25			15.0	1.25				
		GEOG	439A	Chase,Anne L			0.0	0.00	0.0	0.00								
		GEOS	170A1	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Goodman,Paul J	1,119.0	74.60	1,116.0	74.40										
				Kapp,Jessica L	1,560.0	104.00	897.0	59.80	1,398.0	93.20	75.0	5.00	1,371.0	91.40	1,326.0	88.40	1,011.0	67.40
				Loefverstroem,Marcus C											498.0	33.20		
				Pepper,Martin B							1,368.0	91.20			21.0	1.40		
				Richardson,Randall					1,071.0	71.40								
			170C1	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00				
				Davis,Owen K	1,635.0	109.00												
				Pepper,Martin B									285.0	19.00				
				Shin,Ji Yeon					558.0	37.20	600.0	40.00	0.0	0.00	282.0	18.80		
				Waldrip,William R			1,227.0	81.80										
			212	-			32.0	2.13										
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00	0.0	0.00
				Gehrels,George E			2,161.8	144.12			1,050.0	70.00	798.0	53.20	970.0	64.67		
				Goodman,Paul J	591.0	39.40	743.3	49.55	2,972.3	198.15	2,334.0	155.60	1,927.6	128.51	1,106.9	73.79	708.9	47.26
				Richardson,Randall	1,902.0	126.80												
				Russell,Joellen L	1,128.0	75.20	1,731.0	115.40	1,746.8	116.45	1,317.0	87.80	1,030.4	68.69	1,079.1	71.94	608.1	40.54
			216	Shin,Ji Yeon					897.0	59.80	2,052.0	136.80	1,944.0	129.60	1,053.0	70.20		
			218	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00					0.0	0.00	0.0	0.00
				Goodman,Paul J	432.0	28.80	441.0	29.40	447.0	29.80	699.0	46.60	579.0	38.60	666.0	44.40	432.0	28.80
				Pepper,Martin B													63.0	4.20
				Richardson,Randall			444.0	29.60										
				Yin,Jianjun	405.0	27.00			150.0	10.00								
			220	Chase,Anne L			0.0	0.00	0.0	0.00	0.0	0.00	30.0	2.00				
			222	Pelletier,Jon D					114.0	7.60			42.0	2.80				
			240	Carrapa,Barbara							42.0	2.80						
			251	-	215.0	14.33	246.0	16.40	188.0	12.53	190.0	12.67	139.0	9.27				
				Caylor,Emilia									19.0	1.27				
				Chase,Anne L	201.0	13.40	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Ducea,Mihai N					336.0	22.40								
				Gehrels,George E	201.0	13.40	738.0	49.20			360.0	24.00	208.5	13.90	540.0	36.00	334.0	22.27
				George,Sarah													334.0	22.27
				Gourley,Kenneth Christopher									17.0	1.13				
				Hayes,Robert George									33.0	2.20				
				Kapp,Paul A											336.0	22.40		
				Reiners,Peter W									207.0	13.80				
				Seedorff,Charles E							210.0	14.00						
				Spinler,Joshua C	243.0	16.20												
				Steele-MacInnis, Matthew					228.0	15.20								
				Sundell II,Kurt Eric									208.5	13.90				
			255	-			36.0	2.40	37.0	2.47	36.0	2.40	34.0	2.27				
				Carrapa,Barbara			108.0	7.20										

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
Geosciences	Undergraduate	GEOS	255	Chase,Anne L											0.0	0.00		
				Kapp,Jessica L	144.0	9.60			111.0	7.40	108.0	7.20			136.0	9.07		
				Pepper,Martin B									102.0	6.80				
			280	Chase,Anne L							0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Harig,Christopher T							33.0	2.20			48.0	3.20		
				Mcguire,Luke A							33.0	2.20	84.0	5.60	48.0	3.20	120.0	8.00
			299	Barton,Mark D	2.0	0.13									2.0	0.13		
				Gehrels,George E							1.0	0.07						
			299H	Russell,Joellen L											2.0	0.13		
			300	Chase,Anne L											0.0	0.00		
				Mcguire,Luke A									72.0	6.00				
				Pelletier,Jon D									72.0	6.00	153.0	12.75		
			302	-	83.0	6.92	65.0	5.42	24.0	2.00	31.0	2.58	51.0	4.25				
				Carrapa,Barbara			195.0	16.25			93.0	7.75						
				Chapman V,James Benjamin	51.0	4.25												
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	76.5	6.38	54.0	4.50	0.0	0.00
				Cohen,Andrew S	147.0	12.25			72.0	6.00	196.0	16.33	76.5	6.38	90.0	7.50	216.0	18.00
				Gehrels,George E	51.0	4.25												
			304	-	23.0	1.92	89.0	7.42	76.0	6.33	102.0	8.50	37.0	3.08				
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	55.5	4.63	0.0	0.00	0.0	0.00
				Clinkscales,Christopher Andrew									35.0	2.92	16.0	1.33		
				Davis,George H	257.0	21.42	168.0	14.00	159.0	13.25	165.0	13.75	105.0	8.75	96.0	8.00		
				Hughes,Amanda Nicole													148.0	12.33
				Kapp,Paul A	192.0	16.00			69.0	5.75	141.0	11.75	55.5	4.63	99.0	8.25		
				Pullen,Alexander T			99.0	8.25										
				Wang,Jordan Walter											17.0	1.42		
			306	-	49.0	4.08					71.0	5.92						
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Downs,Robert T	98.0	8.17	112.0	9.33			142.0	11.83	112.0	9.33	106.0	8.83		
				Fendrich,Kim Victoria			56.0	4.67										
				Hanagan,Catherine Elise											26.5	2.21		
				Jimenez Rodriguez,Jhon Sebastian									28.0	2.33				
				Mazdab,Frank K													147.0	12.25
				Rosenblatt,Melli Jane									28.0	2.33	26.5	2.21		
			308	-			20.0	1.67	33.0	2.75								
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00		
				Flessa,Karl W	104.0	8.67	113.5	9.46	66.0	5.50	99.0	8.25						
				Schmidt,Nancy J	52.0	4.33	73.5	6.13	156.0	13.00	144.0	12.00	132.0	11.00				
				Shin,Ji Yeon									102.0	8.50	258.0	21.50		
			322	-	38.0	3.17	54.0	4.50			56.0	4.67	45.0	3.75				
				Bennett,Richard A	76.0	6.33	108.0	9.00										
				Chase,Anne L											0.0	0.00		
				Guns,Katherine					44.0	3.67								
				Jose,Lisa					17.0	1.42								
				Kiser,Eric Daniel					122.0	10.17	112.0	9.33	90.0	7.50	111.0	9.25		
			342	Chase,Anne L											0.0	0.00	0.0	0.00
				Tierney,Jessica E							102.0	8.50	96.0	8.00	105.0	8.75	123.0	10.25
			346	Chase,Anne L	0.0	0.00												
				Seedorff,Charles E											39.0	3.25		
				Titley,Spencer R	45.0	3.75												
			356	-			51.0	4.25	55.0	4.58	40.0	3.33						
				Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00					0.0	0.00		
				Ducea,Mihai N	144.0	12.00	153.0	12.75	165.0	13.75			210.0	17.50	96.0	8.00		
				Hoffman,Derek R									70.0	5.83				
				Mazdab,Frank K							120.0	10.00						
				Profeta,Lucia Rodica	48.0	4.00												
			392	Bennett,Richard A			3.0	0.25										
				Carrapa,Barbara					9.0	0.75	3.0	0.25						
				Gehrels,George E			3.0	0.25										
				Harig,Christopher T									3.0	0.25				
				Kapp,Paul A	3.0	0.25												
				Kiser,Eric Daniel					3.0	0.25			3.0	0.25				
				Quade,Jay											4.0	0.33		
				Russell,Joellen L	3.0	0.25												
				Shin,Ji Yeon					3.0	0.25	5.0	0.42			3.0	0.25		
				Thirumalai,Kaustubh											3.0	0.25		
				Thompson,Diane M											2.0	0.17		
				Yang,Hexiong					3.0	0.25								
			393	Schmidt,Nancy J	4.0	0.33	8.0	0.67	9.0	0.75	9.0	0.75	3.0	0.25				
				Shin,Ji Yeon									4.0	0.33	8.0	0.67		
			397A	Bennett,Richard A	2.0	0.17	3.0	0.25										
				Carrapa,Barbara			11.0	0.92			9.0	0.75						
				Chase,Anne L	0.0	0.00	0.0	0.00					4.5	0.38	0.0	0.00	0.0	0.00
				Cohen,Andrew S	13.0	1.08			12.0	1.00	3.0	0.25	9.0	0.75	15.0	1.25	6.0	0.50
				Cole,Julia E	1.0	0.08			1.5	0.13								
				Davis,George H	12.0	1.00	18.0	1.50	8.0	0.67	20.0	1.67	21.0	1.75	9.0	0.75		
				Downs,Robert T	3.0	0.25	11.0	0.92			15.0	1.25	21.0	1.75	24.0	2.00		
				Ducea,Mihai N			9.0	0.75	21.0	1.75					3.0	0.25		
				Flessa,Karl W	12.0	1.00	9.5	0.79	7.0	0.58	9.0	0.75						
				Gehrels,George E	23.0	1.92	62.0	5.17			42.0	3.50	45.0	3.75	27.0	2.25	49.0	4.08
				Goodman,Paul J	28.0	2.33	75.0	6.25	90.0	7.50	46.0	3.83	8.5	0.71	38.0	3.17	26.0	2.17
				Kapp,Jessica L	45.0	3.75	39.0	3.25	44.0	3.67	8.0	0.67	9.0	0.75	17.0	1.42		
				Kapp,Paul A	9.0	0.75			3.0	0.25	6.0	0.50	9.0	0.75	15.0	1.25		
				Kiser,Eric Daniel							3.0	0.25	3.0	0.25	3.0	0.25		
				Pepper,Martin B							77.0	6.42	17.0	1.42				
				Profeta,Lucia Rodica			0.0	0.00										
				Pullen,Alexander T			3.0	0.25										
				Reiners,Peter W									30.0	2.50				
				Richardson,Randall	53.0	4.42	9.0	0.75	24.0	2.00								
				Russell,Joellen L	43.0	3.58	52.0	4.33	26.0	2.17	24.0	2.00	25.5	2.13	26.0	2.17	26.0	2.17

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
Geosciences	Undergraduate	GEOS	397A	Schmidt,Nancy J			1.5	0.13	9.0	0.75	9.0	0.75	4.5	0.38				
				Seedorff,Charles E							7.0	0.58						
				Shin,Ji Yeon					3.0	0.25	33.0	2.75	69.0	5.75	48.0	4.00		
				Spinler,Joshua C	12.0	1.00												
				Steele-MacInnis, Matthew					11.0	0.92								
				Thompson,Diane M											3.0	0.25		
				Tierney,Jessica E					2.0	0.17			3.0	0.25				
				Yin,Jianjun	3.0	0.25												
			399	Barton,Mark D											2.0	0.17		
				Bennett,Richard A					2.0	0.17								
				Cohen,Andrew S							5.0	0.42					3.0	0.25
				Flessa,Karl W			3.0	0.25	3.0	0.25	11.0	0.92						
				Kapp,Paul A	2.0	0.17	4.0	0.33	3.0	0.25					1.0	0.08		
				Mcguire,Luke A									6.0	0.50				
				Quade,Jay									3.0	0.25				
				Seedorff,Charles E									2.0	0.17				
				Thirumalai,Kaustubh											3.0	0.25		
			399H	Cole,Julia E							3.0	0.25						
				Goodman,Paul J			2.0	0.17										
				Kapp,Jessica L	20.0	1.67												
				Thirumalai,Kaustubh													3.0	0.25
				Thompson,Diane M									3.0	0.25	4.0	0.33	4.0	0.33
			400	Chase,Anne L			0.0	0.00									0.0	0.00
				Quade,Jay	39.0	3.25	18.0	1.50			57.0	4.75	30.0	2.50	12.0	1.00	54.0	4.50
				Reiners,Peter W									30.0	2.50	12.0	1.00		
				Steele-MacInnis, Matthew			18.0	1.50	45.0	3.75								
			408	Ducea,Mihai N	15.0	1.25							24.0	2.00				
			412A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00		
				Cohen,Andrew S	60.0	5.00					111.0	9.25			69.0	5.75		
				Cole,Julia E	60.0	5.00	0.0	0.00										
				Thompson,Diane M											69.0	5.75		
				Tierney,Jessica E			114.0	9.50	111.0	9.25			129.0	10.75				
			412B	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00						
				Cohen,Andrew S	9.0	0.75					19.0	1.58			8.5	0.71		
				Cole,Julia E	9.0	0.75	10.5	0.88										
				Thompson,Diane M											8.5	0.71		
				Tierney,Jessica E			10.5	0.88	18.0	1.50			15.0	1.25				
			414	Bennett,Richard A			6.0	0.50										
			415	Baker,Victor R					56.0	4.67	36.0	3.00	42.0	3.50	22.0	1.83	44.0	3.67
				Chase,Anne L					0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
			417	Decelles,Peter G					15.0	1.25			12.0	1.00				
			419	Chase,Anne L					0.0	0.00								
				Harig,Christopher T							81.0	6.75			63.0	5.25		
				Richardson,Randall	27.0	2.25			15.0	1.25								
			421	Hughes,Amanda Nicole							48.0	4.00	28.0	2.33	12.0	1.00		
			423	Kapp,Paul A	57.0	4.75			27.0	2.25			21.0	1.75				
			424A	Bennett,Richard A	15.0	1.25			12.0	1.00					15.0	1.25		
			425	Chase,Anne L			0.0	0.00										
				Ducea,Mihai N	27.0	2.25												
				Kapp,Paul A			36.0	3.00			39.0	3.25						
			427	Beck,Susan L			33.0	2.75	27.0	2.25	21.0	1.75	51.0	4.25				
				Decelles,Peter G											12.0	1.00		
			432	Beck,Susan L	30.0	2.50	21.0	1.75	27.0	2.25	24.0	2.00	72.0	6.00			48.0	4.00
				Chase,Anne L			0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00
			434A	Chase,Anne L			0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Johnson,Roy A	45.0	3.75	21.0	1.75	21.0	1.75	51.0	4.25	72.0	6.00	42.0	3.50	27.0	2.25
			436	Kiser,Eric Daniel									9.0	0.75	21.0	1.75		
			437	Loefverstroem,Marcus C											8.0	0.67		
			439A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00								
			440	Harig,Christopher T					15.0	1.25								
			446	Barton,Mark D	18.0	1.50	18.0	1.50			24.0	2.00			21.0	1.75		
				Chase,Anne L	0.0	0.00	0.0	0.00										
			450	Chase,Anne L					0.0	0.00								
				Mcguire,Luke A					88.0	7.33								
				Pelletier,Jon D	116.0	9.67	60.0	5.00									36.0	3.00
			453	Baker,Victor R					33.0	2.75			27.0	2.25				
			456	Chase,Anne L			0.0	0.00										
				Decelles,Peter G			18.0	1.50					18.0	1.50				
			466	Dettman,David L	1.5	0.13					4.5	0.38						
				Quade,Jay	1.5	0.13					4.5	0.38						
			469	Johnson,Roy A			3.0	0.25			24.0	2.00						
			470L	Seedorff,Charles E	9.0	0.75			5.0	0.42			7.0	0.58				
			470R	Seedorff,Charles E	30.0	2.50			15.0	1.25			21.0	1.75				
			474A	Ducea,Mihai N			4.5	0.38										
				Reiners,Peter W			4.5	0.38			6.0	0.50						
			477	Bennett,Richard A			9.0	0.75							21.0	1.75		
				Chase,Anne L			0.0	0.00										
				Hughes,Amanda Nicole											21.0	1.75		
			478	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Cole,Julia E	34.5	2.88	48.0	4.00	40.5	3.38								
				Goodman,Paul J							42.0	3.50			21.0	1.75		
				Russell,Joellen L									9.6	0.80	84.0	7.00	55.5	4.63
			479	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00								
				Yin,Jianjun	12.0	1.00	33.0	2.75	21.0	1.75	33.0	2.75	45.0	3.75	27.0	2.25		
			484	Quade,Jay			9.0	0.75					12.0	1.00				
			487	Chase,Anne L													0.0	0.00
				Yin,Jianjun											21.0	1.75	15.0	1.25
			489	Chase,Anne L			0.0	0.00										
				Jull,Anthony John T			1.5	0.13										
				Quade,Jay			1.5	0.13										
			492	Barton,Mark D									3.0	0.25				

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
Geosciences	Undergraduate	GEOS	492	Beck,Susan L							3.0	0.25	6.0	0.50				
				Bennett,Richard A	4.5	0.38	4.0	0.33	4.0	0.33	3.0	0.25	34.0	2.83				
				Carrapa,Barbara	10.0	0.83	7.0	0.58										
				Cohen,Andrew S			6.0	0.50	6.0	0.50	2.0	0.17	7.0	0.58	6.0	0.50		
				Cole,Julia E			4.0	0.33										
				Davis,George H			3.0	0.25			3.0	0.25			6.0	0.50		
				Downs,Robert T			4.0	0.33					3.0	0.25				
				Ducea,Mihai N	5.0	0.42	3.0	0.25	6.0	0.50								
				Gehrels,George E			10.0	0.83										
				Harig,Christopher T											3.0	0.25	2.0	0.17
				Johnson,Roy A	2.0	0.17					3.0	0.25	6.0	0.50				
				Kapp,Jessica L					1.0	0.08								
				Kapp,Paul A									11.0	0.92	12.0	1.00		
				Kiser,Eric Daniel							3.0	0.25			3.0	0.25	5.0	0.42
				Ojha,Tank Prasad			8.0	0.67										
				Pullen,Alexander T			3.0	0.25										
				Quade,Jay									4.0	0.33				
				Reiners,Peter W	4.0	0.33												
				Richardson,Randall	4.5	0.38	9.0	0.75										
				Sbar,Marc L									6.0	0.50				
				Seedorff,Charles E											3.0	0.25		
				Shin,Ji Yeon					3.0	0.25								
				Steele-MacInnis, Matthew					2.0	0.17								
				Thompson,Diane M													2.0	0.17
				Yang,Hexiong									6.0	0.50				
				Yin,Jianjun									3.0	0.25	3.0	0.25	6.0	0.50
			494	Davis,George H					3.0	0.25	9.0	0.75						
				Pepper,Martin B									27.0	2.25				
			496E	Chase,Anne L			0.0	0.00										
				Davis,George H	66.0	5.50							1.0	0.08				
				Decelles,Peter G			42.0	3.50	1.0	0.08								
				Hughes,Amanda Nicole									1.0	0.08				
			497C	Chase,Anne L	0.0	0.00												
			498	-	1.0	0.08												
				Carrapa,Barbara											3.0	0.25		
				Harig,Christopher T											3.0	0.25	3.0	0.25
				Thirumalai,Kaustubh													3.0	0.25
				Thompson,Diane M											6.0	0.50		
			498H	-	6.0	0.50	3.0	0.25			3.0	0.25						
				Barton,Mark D	3.0	0.25			6.0	0.50							3.0	0.25
				Bennett,Richard A	3.0	0.25	3.0	0.25	3.0	0.25								
				Carrapa,Barbara									6.0	0.50				
				Cohen,Andrew S					6.0	0.50								
				Cole,Julia E	3.0	0.25			6.0	0.50	6.0	0.50						
				Davis,George H			3.0	0.25	6.0	0.50								
				Decelles,Peter G							3.0	0.25						
				Ducea,Mihai N			6.0	0.50										
				Gehrels,George E					3.0	0.25			6.0	0.50			3.0	0.25
				Kapp,Paul A									6.0	0.50				
				Reiners,Peter W											6.0	0.50	3.0	0.25
				Russell,Joellen L	3.0	0.25												
				Tierney,Jessica E											6.0	0.50		
			499	Baker,Victor R					4.0	0.33								
				Barton,Mark D									2.0	0.17				
				Beck,Susan L									3.0	0.25				
				Chase,Anne L					4.0	0.33								
				Cohen,Andrew S	7.0	0.58			2.0	0.17			4.0	0.33				
				Davis,George H	9.0	0.75			1.0	0.08			16.0	1.33				
				Decelles,Peter G											3.0	0.25		
				Dettman,David L					3.0	0.25								
				Downs,Robert T									4.0	0.33				
				Ducea,Mihai N			3.0	0.25	3.0	0.25								
				Flessa,Karl W			6.0	0.50										
				Gehrels,George E									2.0	0.17				
				Harig,Christopher T									2.0	0.17				
				Holliday,Vance T					1.0	0.08			0.7	0.06				
				Hughes,Amanda Nicole									1.0	0.08				
				Johnson,Roy A									2.0	0.17				
				Kapp,Jessica L											9.0	0.75		
				Kapp,Paul A	3.0	0.25												
				Kiser,Eric Daniel											3.0	0.25		
				Mcguire,Luke A									3.0	0.25				
				Pelletier,Jon D	4.0	0.33												
				Reiners,Peter W									7.0	0.58				
				Russell,Joellen L			8.0	0.67	5.0	0.42								
				Schmidt,Nancy J									3.0	0.25				
				Seedorff,Charles E											1.0	0.08		
				Tierney,Jessica E					6.0	0.50	3.0	0.25			3.0	0.25		
			499H	Bennett,Richard A	3.0	0.25												
				Carrapa,Barbara			3.0	0.25										
		HNRS	195H	Richardson,Randall			18.0	1.20										
			195I	Carrapa,Barbara							17.0	1.13			18.0	1.20		
				Kapp,Jessica L							17.0	1.13	19.0	1.27				
				Overpeck,Jonathan T					18.0	1.20								
				Richardson,Randall	15.0	1.00			19.0	1.27								
				Russell,Joellen L							17.0	1.13	19.0	1.27	20.0	1.33		
		LASC	397B	Garcia,Victor Higareda			2.5	0.21										
			397C	Garcia,Victor Higareda			1.3	0.10										
		PHYS	492	Bennett,Richard A			3.0	0.25										
		SCI	195A	Matteson,Shawna K									6.7	0.44	10.6	0.71		
	Graduate	ANTH	512A	Holliday,Vance T	3.0	0.30			5.9	0.59			2.2	0.22				
			514	Holliday,Vance T			0.7	0.07							0.7	0.07		

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
	Graduate	ANTH	539A	Chase,Anne L	0.0	0.00	0.0	0.00										
			561	Holliday,Vance T	3.7	0.37			3.0	0.30					3.0	0.30		
			596D	Cohen,Andrew S	3.0	0.30			1.0	0.10								
				Quade,Jay	3.0	0.30	3.0	0.30										
			597B	Creasman,Pearce Paul											3.0	0.30		
			599	Holliday,Vance T			1.5	0.15										
			693	Holliday,Vance T	0.7	0.07												
			696A	Cohen,Andrew S									3.0	0.30				
				Holliday,Vance T			3.7	0.37			1.0	0.10	0.7	0.07				
			699	Holliday,Vance T	0.7	0.07							0.7	0.07				
			909	Holliday,Vance T	0.7	0.07							0.7	0.07				
			910	Holliday,Vance T	1.0	0.10					0.7	0.07						
			920	Holliday,Vance T	4.9	0.49	0.7	0.07	5.2	0.52	3.9	0.39	3.9	0.39	3.0	0.30	1.7	0.17
		ARL	920	Overpeck,Jonathan T									9.0	0.90	3.0	0.30		
		ATMO	573	Yin,Jianjun			6.0	0.60					3.0	0.30				
		ECOL	578	Chase,Anne L									0.0	0.00	0.0	0.00	0.0	0.00
				Goodman,Paul J											0.6	0.06		
				Russell,Joellen L									0.6	0.06	2.4	0.24	1.5	0.15
		GC	578	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00		
				Cole,Julia E	16.5	1.65	3.0	0.30	6.0	0.60								
				Goodman,Paul J							4.5	0.45			1.8	0.18		
				Russell,Joellen L									0.3	0.03	7.2	0.72		
			599	Cole,Julia E	1.0	0.10												
			695G	Cole,Julia E	10.0	1.00	7.0	0.70										
		GEOG	539A	Chase,Anne L					0.0	0.00								
			547	Russell,Joellen L			3.6	0.36										
			578	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00	0.0	0.00	0.0	0.00
				Cole,Julia E	3.0	0.30	9.0	0.90	3.0	0.30								
				Goodman,Paul J											0.6	0.06		
				Russell,Joellen L									0.3	0.03	2.4	0.24	1.5	0.15
		GEOS	500	Chase,Anne L			0.0	0.00									0.0	0.00
				Quade,Jay	30.0	3.00	15.0	1.50			18.0	1.80	10.5	1.05	7.5	0.75	18.0	1.80
				Reiners,Peter W									10.5	1.05	7.5	0.75		
				Steele-MacInnis, Matthew			15.0	1.50	36.0	3.60								
			502	Chase,Anne L			0.0	0.00										
				Pelletier,Jon D			27.0	2.70			39.0	3.90			21.0	2.10		
			504B	Barton,Mark D	7.5	0.75	7.5	0.75			6.0	0.60	4.0	0.40	3.5	0.35		
				Seedorff,Charles E	7.5	0.75	7.5	0.75			6.0	0.60	4.0	0.40	3.5	0.35		
			504C	Barton,Mark D	6.0	0.60	6.0	0.60	4.5	0.45	3.0	0.30	3.5	0.35	3.5	0.35		
				Seedorff,Charles E	6.0	0.60	6.0	0.60	4.5	0.45	3.0	0.30	3.5	0.35	3.5	0.35		
			508	Ducea,Mihai N	33.0	3.30							27.0	2.70				
			512A	Holliday,Vance T	0.7	0.07			1.5	0.15			1.5	0.15				
			514	Holliday,Vance T			2.2	0.22			2.2	0.22			2.2	0.22		
			517	Decelles,Peter G					15.0	1.50			12.0	1.20				
			519	Chase,Anne L					0.0	0.00								
				Harig,Christopher T							15.0	1.50			15.0	1.50		
				Richardson,Randall	18.0	1.80			21.0	2.10								
			521	Hughes,Amanda Nicole							24.0	2.40	20.0	2.00	16.0	1.60		
			523	Kapp,Paul A	30.0	3.00			15.0	1.50			30.0	3.00				
			524A	Bennett,Richard A	12.0	1.20			9.0	0.90					18.0	1.80		
			525	Chase,Anne L			0.0	0.00										
				Ducea,Mihai N	27.0	2.70												
				Kapp,Paul A			30.0	3.00			36.0	3.60						
			527	Beck,Susan L	27.0	2.70			15.0	1.50	21.0	2.10	18.0	1.80				
				Decelles,Peter G											21.0	2.10		
			528	Bennett,Richard A									24.0	2.40				
			532	Beck,Susan L	15.0	1.50	3.0	0.30	9.0	0.90	27.0	2.70	9.0	0.90			12.0	1.20
				Chase,Anne L			0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00			0.0	0.00
			534A	Chase,Anne L			0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
				Johnson,Roy A	9.0	0.90	6.0	0.60	12.0	1.20	9.0	0.90	15.0	1.50	9.0	0.90	6.0	0.60
			536	Kiser,Eric Daniel									9.0	0.90	6.0	0.60		
			537	Loefverstroem,Marcus C											16.0	1.60		
			539A	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00								
			540	Harig,Christopher T					15.0	1.50								
			543C	Chase,Anne L													0.0	0.00
				Seedorff,Charles E	21.0	2.10	18.0	1.80			15.0	1.50	18.0	1.80	18.0	1.80	15.0	1.50
			544	Decelles,Peter G							18.0	1.80					27.0	2.70
			546	Barton,Mark D	15.0	1.50	24.0	2.40			27.0	2.70			39.0	3.90		
				Chase,Anne L	0.0	0.00	0.0	0.00										
			547	Russell,Joellen L			4.8	0.48										
			550	Pelletier,Jon D	4.0	0.40	44.0	4.40									24.0	2.40
			553	Baker,Victor R					3.0	0.30			21.0	2.10				
			556	Chase,Anne L			0.0	0.00										
				Decelles,Peter G			33.0	3.30					39.0	3.90				
			561	Holliday,Vance T					0.7	0.07					0.7	0.07		
			566	Dettman,David L	28.5	2.85					19.5	1.95			5.0	0.50		
				Quade,Jay	28.5	2.85					19.5	1.95			5.0	0.50		
				Thirumalai,Kaustubh											5.0	0.50		
			567	Bennett,Richard A													18.0	1.80
				Chase,Anne L			0.0	0.00										
				Richardson,Randall			27.0	2.70			36.0	3.60						
			568	Kiser,Eric Daniel													15.0	1.50
			569	Johnson,Roy A			12.0	1.20			18.0	1.80						
			570L	Seedorff,Charles E	10.0	1.00			7.0	0.70			11.0	1.10				
			570R	Seedorff,Charles E	30.0	3.00			21.0	2.10			33.0	3.30				
			573	Yin,Jianjun			12.0	1.20					15.0	1.50				
			574A	Ducea,Mihai N			15.0	1.50										
				Reiners,Peter W			15.0	1.50			27.0	2.70			30.0	3.00		
			577	Bennett,Richard A			6.0	0.60							7.5	0.75		
				Chase,Anne L			0.0	0.00										
				Hughes,Amanda Nicole											7.5	0.75		
			578	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
	Graduate	GEOS	578	Cole,Julia E	18.0	1.80	6.0	0.60	3.0	0.30								
				Goodman,Paul J							3.0	0.30			0.6	0.06		
				Russell,Joellen L									0.9	0.09	2.4	0.24	1.5	0.15
			579	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00								
				Yin,Jianjun	18.0	1.80	6.0	0.60	12.0	1.20	6.0	0.60	6.0	0.60	3.0	0.30		
			582	Chase,Anne L			13.0	1.30									0.0	0.00
				Cole,Julia E			13.0	1.30										
				Overpeck,Jonathan T			13.0	1.30										
				Thirumalai,Kaustubh													57.0	5.70
			584	Quade,Jay			12.0	1.20					15.0	1.50				
			586	Tierney,Jessica E							12.0	1.20						
			587	Chase,Anne L													0.0	0.00
				Yin,Jianjun											6.0	0.60	6.0	0.60
			589	Chase,Anne L			0.0	0.00										
				Jull,Anthony John T			9.0	0.90										
				Quade,Jay			9.0	0.90										
			594	Davis,George H					15.0	1.50								
				Pepper,Martin B									9.0	0.90				
			595A	-							14.0	1.40						
				Bennett,Richard A	22.0	2.20												
				Chase,Anne L	0.0	0.00	0.0	0.00										
				Cohen,Andrew S									20.0	2.00				
				Decelles,Peter G											17.5	1.75	6.5	0.65
				Harig,Christopher T					10.0	1.00	12.0	1.20	20.0	2.00				
				Kiser,Eric Daniel					9.5	0.95								
				Mcguire,Luke A					19.5	1.95								
				Steele-MacInnis, Matthew			13.0	1.30										
				Thirumalai,Kaustubh													6.5	0.65
				Tierney,Jessica E			13.0	1.30							17.5	1.75		
				Yin,Jianjun	22.0	2.20												
			596A	Carrapa,Barbara									4.7	0.47				
				Downs,Robert T	15.0	1.50	17.0	1.70	9.0	0.90					1.0	0.10		
				Ducea,Mihai N			4.0	0.40					4.7	0.47				
				Gehrels,George E									4.7	0.47				
				Steele-MacInnis, Matthew					24.0	2.40								
			596B	Barton,Mark D	1.5	0.15			2.7	0.27	1.7	0.17					12.0	1.20
				Davis,George H	7.0	0.70												
				Ducea,Mihai N					2.7	0.27								
				Mazdab,Frank K							1.7	0.17						
				Seedorff,Charles E	19.5	1.95			2.7	0.27	8.0	0.80			14.0	1.40		
			596C	Cohen,Andrew S									3.0	0.30				
				Cole,Julia E	7.0	0.70												
				Holliday,Vance T							2.2	0.22	0.7	0.07				
				Overpeck,Jonathan T	7.0	0.70												
				Thirumalai,Kaustubh											4.0	0.40		
				Thompson,Diane M											4.0	0.40		
			596D	Carrapa,Barbara					10.0	1.00								
				Cohen,Andrew S	10.5	1.05			7.0	0.70			12.0	1.20	4.3	0.43		
				Flessa,Karl W	1.5	0.15												
				Quade,Jay	9.0	0.90	8.0	0.80							4.3	0.43		
				Tierney,Jessica E											4.3	0.43		
			596E	Carrapa,Barbara			3.0	0.30			7.5	0.75	6.0	0.60				
				Chase,Anne L									0.0	0.00			0.0	0.00
				Davis,George H									8.0	0.80	15.0	1.50		
				Decelles,Peter G			3.0	0.30										
				Ducea,Mihai N			3.0	0.30										
				Hughes,Amanda Nicole									6.0	0.60				
				Kapp,Paul A	5.0	0.50					1.5	0.15					6.0	0.60
				Loefverstroem,Marcus C													6.0	0.60
				Tierney,Jessica E									6.0	0.60				
			596F	Harig,Christopher T									16.0	1.60				
				Johnson,Roy A			6.5	0.65	6.0	0.60			5.0	0.50				
				Kiser,Eric Daniel							12.0	1.20						
				Sbar,Marc L			6.5	0.65	6.0	0.60			5.0	0.50				
			596H	Baker,Victor R											11.0	1.10		
				Barton,Mark D	7.0	0.70												
				Carrapa,Barbara					14.0	1.40								
				Chase,Anne L													0.0	0.00
				Downs,Robert T							1.0	0.10						
				Ducea,Mihai N	7.0	0.70												
				Harig,Christopher T											9.0	0.90		
				Kapp,Paul A													15.0	1.50
				Loefverstroem,Marcus C													18.0	1.80
				Loefverstroem,Marcus C.									8.0	0.80				
				McFarland,Phillip K			10.0	1.00										
				Mcguire,Luke A											7.0	0.70		
				Ojha,Tank Prasad			21.0	2.10										
				Pepper,Martin B											6.0	0.60		
				Reiners,Peter W			6.0	0.60										
				Richardson,Randall			10.0	1.00										
				Russell,Joellen L	27.0	2.70			8.0	0.80			10.0	1.00				
				Thompson,Diane M													3.0	0.30
				Tierney,Jessica E					16.0	1.60								
			599	Baker,Victor R									2.0	0.20	3.0	0.30		
				Barton,Mark D	9.0	0.90	5.0	0.50	4.0	0.40			2.0	0.20			1.0	0.10
				Beck,Susan L			7.0	0.70	3.0	0.30								
				Bennett,Richard A							3.0	0.30			2.0	0.20		
				Carrapa,Barbara											3.0	0.30		
				Chase,Anne L	0.0	0.00	0.0	0.00										
				Cohen,Andrew S	4.0	0.40							2.0	0.20			2.0	0.20

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
	Graduate	GEOS	599	Cole,Julia E					3.0	0.30								
				Davis,George H	3.0	0.30												
				Decelles,Peter G					3.0	0.30					14.0	1.40	7.0	0.70
				Downs,Robert T	3.0	0.30	4.0	0.40	6.0	0.60			7.0	0.70				
				Ducea,Mihai N					3.0	0.30					2.0	0.20		
				Ganguly,Jibamitra	3.0	0.30												
				Gehrels,George E			6.0	0.60	3.0	0.30								
				Harig,Christopher T									12.0	1.20				
				Holliday,Vance T	1.0	0.10			0.7	0.07								
				Hughes,Amanda Nicole											6.0	0.60		
				Johnson,Roy A	22.0	2.20	12.0	1.20	6.0	0.60	11.0	1.10	4.0	0.40	4.0	0.40		
				Kapp,Paul A	9.0	0.90			3.0	0.30			3.0	0.30				
				Kiser,Eric Daniel									4.0	0.40	4.0	0.40		
				Mallik,Ananya													4.0	0.40
				Pelletier,Jon D	3.0	0.30									3.0	0.30		
				Quade,Jay			3.0	0.30	4.0	0.40	3.0	0.30	2.0	0.20			4.0	0.40
				Reiners,Peter W	6.0	0.60	6.0	0.60							2.0	0.20		
				Ruiz,Joaquin			6.0	0.60	3.0	0.30								
				Russell,Joellen L	6.0	0.60	1.0	0.10	5.0	0.50	3.0	0.30						
				Seedorff,Charles E	6.0	0.60			6.0	0.60	3.0	0.30						
				Thompson,Diane M									3.0	0.30				
				Tierney,Jessica E											3.0	0.30		
				Titley,Spencer R	1.0	0.10												
				Yin,Jianjun			3.0	0.30										
			646A	Barton,Mark D	48.0	4.80	24.0	2.40										
			646B	Barton,Mark D									40.0	4.00				
			650	Mcguire,Luke A							15.0	1.50			24.0	2.40		
				Pelletier,Jon D					12.0	1.20								
			695G	Cole,Julia E			2.0	0.20										
			900	Baker,Victor R									1.0	0.10	2.0	0.20		
				Barton,Mark D	28.0	2.80	25.0	2.50	21.0	2.10	14.0	1.40						
				Beck,Susan L	16.0	1.60	35.0	3.50	15.0	1.50	8.0	0.80	16.0	1.60	19.0	1.90	3.0	0.30
				Bennett,Richard A	20.0	2.00	9.0	0.90	13.0	1.30	9.0	0.90	8.0	0.80	12.0	1.20	3.0	0.30
				Carrapa,Barbara	13.0	1.30	3.0	0.30	3.0	0.30	4.0	0.40	15.0	1.50	6.0	0.60	8.0	0.80
				Cohen,Andrew S	6.0	0.60	4.0	0.40	6.0	0.60	3.0	0.30			2.0	0.20	6.0	0.60
				Cole,Julia E	11.0	1.10	11.0	1.10	13.0	1.30	8.0	0.80						
				Decelles,Peter G	15.0	1.50							2.0	0.20	16.0	1.60	8.0	0.80
				Dettman,David L					3.0	0.30	3.0	0.30	6.0	0.60				
				Downs,Robert T	33.0	3.30	12.0	1.20	27.0	2.70	9.0	0.90	10.0	1.00	6.0	0.60		
				Ducea,Mihai N	9.0	0.90	1.0	0.10	26.0	2.60	2.0	0.20			5.0	0.50	12.0	1.20
				Flessa,Karl W	12.0	1.20	3.0	0.30										
				Gehrels,George E	15.0	1.50	12.0	1.20	12.0	1.20	26.0	2.60	6.0	0.60				
				Harig,Christopher T									1.0	0.10	3.0	0.30		
				Holliday,Vance T			1.5	0.15	3.0	0.30	2.2	0.22	3.0	0.30	2.2	0.22		
				Holt,John W													3.0	0.30
				Hughes,Amanda Nicole									2.0	0.20	16.0	1.60	15.0	1.50
				Jackson,Stephen T	6.0	0.60	18.0	1.80										
				Johnson,Roy A	29.0	2.90	30.0	3.00	11.0	1.10	4.0	0.40	3.0	0.30				
				Kapp,Paul A	23.0	2.30			11.0	1.10	11.0	1.10			11.0	1.10		
				Kiser,Eric Daniel									29.0	2.90	11.0	1.10	6.0	0.60
				Mallik,Ananya													4.0	0.40
				Mcguire,Luke A									3.0	0.30	7.0	0.70	6.0	0.60
				Overpeck,Jonathan T	26.0	2.60	17.0	1.70	18.0	1.80								
				Pelletier,Jon D	12.0	1.20	7.0	0.70	3.0	0.30								
				Quade,Jay	1.0	0.10	11.0	1.10	6.0	0.60	6.0	0.60	4.0	0.40	9.0	0.90		
				Reiners,Peter W	27.0	2.70	18.0	1.80	2.0	0.20	3.0	0.30	2.0	0.20	11.0	1.10	10.0	1.00
				Ruiz,Joaquin			14.0	1.40	14.0	1.40	1.0	0.10						
				Russell,Joellen L					12.0	1.20	12.0	1.20						
				Seedorff,Charles E	10.0	1.00	11.0	1.10	9.0	0.90	12.0	1.20	1.0	0.10				
				Steele-MacInnis, Matthew					7.0	0.70								
				Thompson,Diane M									12.0	1.20	14.0	1.40		
				Tierney,Jessica E					9.0	0.90	7.0	0.70	24.0	2.40	27.0	2.70	11.0	1.10
				Yin,Jianjun	24.0	2.40	15.0	1.50										
				Zandt,George	6.0	0.60	6.0	0.60										
			909	Baker,Victor R													3.0	0.30
				Barton,Mark D	21.0	2.10	8.0	0.80	20.0	2.00	21.0	2.10	13.0	1.30	2.0	0.20		
				Carrapa,Barbara			4.0	0.40	15.0	1.50			20.0	2.00				
				Cohen,Andrew S							6.0	0.60	2.0	0.20	1.0	0.10		
				Cole,Julia E			15.0	1.50	6.0	0.60	12.0	1.20						
				Dettman,David L							3.0	0.30						
				Downs,Robert T			3.0	0.30					3.0	0.30	3.0	0.30		
				Gehrels,George E			9.0	0.90	9.0	0.90	9.0	0.90	3.0	0.30				
				Johnson,Roy A			6.0	0.60										
				Kapp,Paul A							2.0	0.20					6.0	0.60
				Mcguire,Luke A									5.0	0.50				
				Overpeck,Jonathan T			9.0	0.90	8.0	0.80								
				Quade,Jay			2.0	0.20									5.0	0.50
				Reiners,Peter W			5.0	0.50			2.0	0.20						
				Seedorff,Charles E	19.0	1.90	19.0	1.90					12.0	1.20	5.0	0.50	3.0	0.30
				Steele-MacInnis, Matthew					2.0	0.20								
				Tierney,Jessica E							12.0	1.20						
			910	Barton,Mark D			12.0	1.20	9.0	0.90			6.0	0.60	6.0	0.60	6.0	0.60
				Beck,Susan L			6.0	0.60	1.0	0.10								
				Carrapa,Barbara					1.0	0.10								
				Cohen,Andrew S											11.0	1.10	1.0	0.10
				Decelles,Peter G	3.0	0.30					2.0	0.20			6.0	0.60		
				Downs,Robert T											3.0	0.30		
				Ducea,Mihai N	3.0	0.30			6.0	0.60	18.0	1.80	7.0	0.70				
				Gehrels,George E					6.0	0.60			12.0	1.20				
				Harig,Christopher T											6.0	0.60		
				Hughes,Amanda Nicole													6.0	0.60

					2015		2016		2017		2018		2019		2020		2021	
Department	Level	Subject Code	Catalog Number	Name	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE	Distributed SCH	Student FTE
			910	Johnson,Roy A	6.0	0.60	6.0	0.60			6.0	0.60	12.0	1.20				
				Mcguire,Luke A													6.0	0.60
				Quade,Jay											9.0	0.90	3.0	0.30
				Seedorff,Charles E									2.0	0.20	4.0	0.40	6.0	0.60
				Yin,Jianjun			6.0	0.60										
			920	Barton,Mark D	36.0	3.60	64.0	6.40	49.0	4.90	42.0	4.20	17.0	1.70	18.0	1.80	9.0	0.90
				Beck,Susan L	45.0	4.50	35.0	3.50	23.0	2.30	32.0	3.20	30.0	3.00	24.0	2.40	9.0	0.90
				Bennett,Richard A	3.0	0.30	25.0	2.50	16.0	1.60	30.0	3.00	24.0	2.40	27.0	2.70	9.0	0.90
				Carrapa,Barbara	27.0	2.70	24.0	2.40	18.0	1.80								
				Cohen,Andrew S	9.0	0.90	26.0	2.60	25.0	2.50	27.0	2.70	33.0	3.30	1.0	0.10		
				Cole,Julia E	1.0	0.10	10.0	1.00	15.0	1.50								
				Decelles,Peter G	9.0	0.90	17.0	1.70	10.0	1.00	23.0	2.30	18.0	1.80				
				Downs,Robert T	12.0	1.20	36.0	3.60	7.0	0.70	18.0	1.80						
				Ducea,Mihai N	6.0	0.60	12.0	1.20	3.0	0.30								
				Flessa,Karl W	12.0	1.20	14.0	1.40	15.0	1.50	2.0	0.20	1.0	0.10				
				Gehrels,George E	6.0	0.60			8.0	0.80	10.0	1.00	2.0	0.20				
				Holliday,Vance T	5.2	0.52	6.6	0.66	6.2	0.62	4.2	0.42	4.2	0.42	5.9	0.59	2.5	0.25
				Jackson,Stephen T					9.0	0.90			15.0	1.50				
				Johnson,Roy A	6.0	0.60	3.0	0.30	33.0	3.30	16.0	1.60						
				Jull,Anthony John T	2.0	0.20	15.0	1.50										
				Kapp,Paul A	18.0	1.80	72.0	7.20	33.0	3.30	4.0	0.40	9.0	0.90	18.0	1.80		
				Kiser,Eric Daniel											18.0	1.80	8.0	0.80
				Overpeck,Jonathan T			28.0	2.80	27.0	2.70	36.0	3.60	9.0	0.90				
				Pelletier,Jon D					9.0	0.90	15.0	1.50	7.0	0.70	18.0	1.80	9.0	0.90
				Quade,Jay	10.0	1.00					3.0	0.30	16.0	1.60	15.0	1.50	6.0	0.60
				Reiners,Peter W	6.0	0.60	6.0	0.60	18.0	1.80	18.0	1.80	6.0	0.60				
				Ruiz,Joaquin							18.0	1.80			15.0	1.50	4.0	0.40
				Russell,Joellen L			11.0	1.10	7.0	0.70	2.0	0.20	18.0	1.80	18.0	1.80		
				Seedorff,Charles E	9.0	0.90	22.0	2.20	35.0	3.50	16.0	1.60	28.0	2.80	18.0	1.80		
				Thompson,Diane M													8.0	0.80
				Tierney,Jessica E											9.0	0.90	9.0	0.90
				Woodhouse,Connie A			18.0	1.80										
				Yin,Jianjun	3.0	0.30	18.0	1.80	36.0	3.60	19.0	1.90						
				Zandt,George	13.0	1.30												
		HWRS	578	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00				
				Cole,Julia E	6.0	0.60	1.5	0.15	1.5	0.15								
				Goodman,Paul J							1.5	0.15						
				Russell,Joellen L									0.6	0.06				
		LAW	640G	Poulton,Mary M					0.3	0.03								
		MATH	900	Russell,Joellen L									7.0	0.70				
			920	Russell,Joellen L											18.0	1.80	6.0	0.60
		MNE	504B	Barton,Mark D			0.5	0.05			0.5	0.05	0.5	0.05	0.5	0.05		
				Seedorff,Charles E			0.5	0.05			0.5	0.05	0.5	0.05	0.5	0.05		
			504C	Barton,Mark D			0.5	0.05	1.0	0.10	1.0	0.10	0.5	0.05				
				Seedorff,Charles E			0.5	0.05	1.0	0.10	1.0	0.10	0.5	0.05				
			543C	Chase,Anne L													0.0	0.00
				Seedorff,Charles E									6.0	0.60			3.0	0.30
			599	Poulton,Mary M			0.3	0.03										
			699	Poulton,Mary M			0.1	0.01	0.3	0.03								
			920	Poulton,Mary M			1.2	0.12	0.5	0.05								
		PTYS	502	Chase,Anne L			0.0	0.00										
				Pelletier,Jon D			6.0	0.60							9.0	0.90		
			519	Richardson,Randall	6.0	0.60												
			567	Bennett,Richard A													9.0	0.90
				Chase,Anne L			0.0	0.00										
				Richardson,Randall			9.0	0.90			12.0	1.20						
		RNR	578	Chase,Anne L	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00						
				Cole,Julia E	1.5	0.15	1.5	0.15	3.0	0.30								
				Goodman,Paul J							3.0	0.30						
		WSM	539A	Chase,Anne L			0.0	0.00	0.0	0.00								
Geosciences Total					**13,752.3**	**1,005.98**	**13,869.8**	**1,015.43**	**13,581.7**	**980.16**	**14,373.0**	**1,040.30**	**13,001.2**	**950.25**	**11,396.6**	**829.80**	**5,198.2**	**381.78**

Rows 1 - 678 (All Rows)

APPENDIX D: TENURE-TRACK FACULTY EMPLOYMENT HISTORY

(See page below)

ACADEMIC FACULTY EMPLOYMENT HISTORY (FTE = 1.0 UNLESS INDICATED OTHERWISE)

Name	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Barton,Mark D	Professor, Tenured	Professor, Tenured	Professor, Tenured (.40 FTE)	Professor, Tenured (.40 FTE)	Professor, Tenured (.40 FTE)	Professor, Tenured (.40 FTE)	Professor, Tenured (.40 FTE)
Beck,Susan L	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Bennett,Richard A	Assistant Professor Tenure Eligible	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Cohen,Andrew S	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Colle, Julia	Professor, Tenured	Professor, Tenured	Professor, Tenured	Departed	Departed	Departed	Departed
Davis, George	Professor Emeritus, Tenured (.49 FTE)	Professor Emeritus, Tenured (.49 FTE)	Professor Emeritus, Tenured (.49 FTE)	Professor Emeritus, Tenured (.49 FTE)	Professor Emeritus, Tenured (.49 FTE)	Retired	Retired
Decelles,Peter G	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Downs,Robert T	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Prof Emeritus NTE (.49 FTE)	Prof Emeritus NTE (.49 FTE)
Ducea,Mihai N	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Hessa. Karl	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor Emeritus, Tenured (.16 FTE)	Professor Emeritus, Tenured (.16 FTE)	Professor Emeritus, Tenured (.16 FTE)
Ganguly, Jibamitra	Professor, Tenured	Retired	Professor Emeritus, Tenured (.30 FTE)	Retired	Retired	Retired	Retired
Gehrels,George E	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Harig,Christopher T		Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Ibanez Mejia,Mauricio							Assistant Professor Tenure Eligible
Johnson,Roy A	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Prof Emeritus NTE (.49 FTE)
Jull,Anthony John T	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured (.50 FTE)	Professor, Tenured (.50 FTE)
Kapp,Paul A	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Kiser,Eric Daniel		Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Loefverstroem,Marcus C				Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Mallik,Ananya						Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Maguire,Luke A		Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Pelletier,Jon D	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Quade,Jay	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Reiners,Peter W	Dept Head/Professor Tenured	Dept Head/Professor Tenured	Dept Head/Professor Tenured	Professor, Tenured (.50 FTE)	Professor, Tenured (.50 FTE)	Professor, Tenured (.50 FTE)	Professor, Tenured (.50 FTE)
Russell,Joellen L	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured	Professor, Tenured
Seedorf, Charles	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured	Retired
Thirumalai,Kaustubh					Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Thompson,Diane M				Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible	Assistant Professor Tenure Eligible
Tierney,Jessica E	Associate Professor, Tenure Eligible	Associate Professor, Tenure Eligible	Associate Professor, Tenure Eligible	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured	Associate Professor, Tenured
Yin,Jianjun	Associate Professor Tenured	Associate Professor Tenured	Associate Professor Tenured	Associate Professor Tenured	Associate Professor Tenured	Associate Professor Tenured	Associate Professor Tenured
Zandt, George	Professor, Tenured	Retired	Retired	Retired	Retired	Retired	Retired
TOTAL Faculty FTE	22.49	23.49	23.19	23.39	23.55	23.05	22.54

APPENDIX E: CAREER-TRACK FACULTY EMPLOYMENT HISTORY

CAREER TRACK FACULTY EMPLOYMENT HISTORY. FTE = 1.0 UNLESS INDICATED OTHERWISE

Name	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Goodman,Paul J	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Senior Lecturer, Career Track
Hughes,Amanda Nicole				Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track
Kapp,Jessica L	Senior Lecturer, Career Track	Senior Lecturer, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track	Assistant Professor of Practice, Career Track
Shin, Ji Yeon		Lecturer (Career-Track)	Lecturer (Career-Track)	Lecturer (Career-Track)	Senior Lecturer (Career-Track)	Departed	Departed
NT Teaching FTE	2	3	3	4	4	3	3

GEOSCIENCES ADMINISTRATIVE STAFF EMPLOYMENT HISTORY. FTE = 1.0 UNLESS INDICATED OTHERWISE							
Name	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**
Alvarez, Heather Business Office)	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.
Baker, Mark (Lab Support)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)	Bldg Mgr (.50 FTE)
Barth, Cindi (Business Office)	Accountant, Assoc.	Accountant, Assoc.	Accountant, Assoc.	Departed	Departed	Departed	Departed
Bouck Sharon (Business Office)	Acct. Principal	Acct. Principal	Acct. Principal	Acct. Principal	Acct. Principal	Retired	Retired
Buchanan, Tom (IT Support)				IT Specialist	IT Specialist	Departed	Departed
Carrillo, Denise (Business Office)	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Sr.	Acct. Principal
Chase, Anne (Student Support)	Program Coord. Sr.	Program Coord. Sr.	Academic Advisor, Sr	Academic Advisor, Sr	Academic Advisor, Sr	Academic Advisor, Sr	Departed
Duddleston, Christine (Business Office)						Manager, Business/Finance	Manager, Business/Finance
Garcia, Michelle (Front Office)	Program Coord.	Program Coord.	Program Coord. Sr.	Program Coord. Sr.	Program Coord. Sr.	Program Coord. Sr.	Program Coord. Sr.
Garcia, Rocina (Student Services/Development)							Student Srvcs. Administration Prof. III
Lange, Todd (Facilities Support)							Facilities Engineer II (.50 FTE)
Matteson, Shawna (Student Services)			Academic Advisor	Academic Advisor	Sr. Academic Advisor	Sr. Academic Advisor	Sr. Academic Advisor
McCormick, Hannah (Development/Communication)					Program Coord. Sr.	Program Coord. Sr.	Program Coord. Sr. (.025 FTE)
McElhaney, Benjamin (Facilities Support)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)	Electronic Technician (.50 FTE)
Quintero, Sylvia (Business Office)	Manager, Business/Finance	Manager, Business/Finance	Manager, Business/Finance	Manager, Business/Finance	Manager, Business/Finance	Retired	Retired
Saposnik, Alicia (Development/Communications)	Prog. Coord.	Program Coord. Sr.	Program Coord. Sr.	Program Coord. Sr.	Departed	Departed	Departed
Steinke, David (Facilities Support)	Facilities Engineer	Facilities Engineer	Facilities Engineer	Facilities Engineer	Facilities Engineer	Facilities Engineer	Facilities Engineer
Waters, Patricia (Business Office)							Acct Sr.
Way, Issac (IT Support)	IT Specialist	IT Specialist	IT Specialist	IT Specialist	Departed	Departed	Departed
Xiluri-Lauria, Kiriaki (IT Support)	IT Specialist	IT Specialist	IT Specialist	IT Specialist	IT Specialist	IT Specialist	IT Specialist
GEOS Staff FTE	**12**	**12**	**13**	**13**	**12**	**11**	**11.025**

APPENDIX G: STRATEGIC PLAN

STRATEGIC PLANNING
DEPARTMENT OF GEOSCIENCES
College of Science, U of Arizona

January 2022 (Preliminary)

RESEARCH PLANNING

In the Geosciences Department, our overarching goal is to lead the way in fundamental, cutting-edge research on Earth system processes and in innovative and effective training of pure, applied, and policy-making geoscientists. Our department is currently among the best in the nation, particularly among public institutions, and our sights are set on improving and expanding our capabilities to become even better. The strategy for future development and growth in the Department of Geosciences should be guided by four needs:

- Identify and pursue exciting and emerging opportunities in the rapidly expanding realms of geoscience research while maintaining strength in core sub-disciplines and programs.
- Excel in fundamental and societally relevant research and leverage technological advances to remain at the forefront of research.
- Increase diversity in the Geosciences and within the department.
- Broaden our curriculum.

We are among the top-ranked departments in the country (we consistently rank in the top #5 in Geology) and we plan to maintain or improve our rankings. Our ranking contributes to the reputation of the College of Science (CoS). Our reputation will remain strong if we continue to invest in areas of emerging opportunities and strength, including tectonics, geochemistry/Earth materials, and solid-Earth geophysics research and our rigorous, field-based educational programs and climate science. A particular challenge is the need to maintain our core courses and educational programs given that ~45% of the Geosciences faculty will be of average retirement age by 2024.

There is consensus among the Geoscience faculty that it is necessary to build strength in sub-disciplines that are societally relevant, will likely benefit from computational and other technological improvements, and provide an opportunity for our department to better integrate with other units across campus.

Our hiring priorities in the next few years include: 1) TECTONICS; 2) PALEOBIOLOGY/PALEOECOLOGY.

The rationale for these priorities is clear. Both will leverage faculty strengths, existing resources and coalesce strengths to enhance the College of Science's impact and reputation, and increase funding opportunities as described below. The tectonics position addresses the need to maintain our strengths in tectonics/geophysics research and our field-based undergraduate curriculum in the face of significant likely faculty attrition (e.g., retirements) over the next several years. The paleobiology/paleoecology position recognizes the importance of understanding the relationship of life to Earth's changing climatic conditions, the need to have a core faculty member who can incorporate their own and current scholarship in the teaching of paleontology, and the need to broaden our interaction with other units on campus (e.g., EEB and MCB). Filling these positions should be our top priority in the next 1-3 years.

TECTONICS

Justification: Tectonics is the pulse of the Earth, resulting in cycles of continental assembly and breakup, mountain building and collapse, sea-level rise and fall, and modulating climate by changing the distribution of elevated land and consuming and releasing atmospheric gases. Tectonics creates natural resources as well as hazards, with impact on every person on this planet. Fundamental advances in Geosciences, and our ability to predict and address "Future Earth" challenges, will stem from a better understanding of global Tectonics and the Earth as a holistic dynamic system. Understanding Earth from core to clouds is also important for our understanding of other planets, like Mars. New exciting avenues in Tectonics include the connections between deep Earth (lower mantle) and the surface through dynamic processes (geophysics), the role of tectonics on climate, and vice versa. This is also an opportune time to hire a person in Tectonics because of ongoing development of numerous new approaches and techniques for quantifying tectonic processes and funding opportunities (e.g., SZ4D discussed below).

The Department of Geosciences has been ranked nationally as one of the top 5 graduate programs in Geology for decades, and is particularly renowned for its research in Tectonics. This is in large part because Geosciences has maintained a critical mass of faculty in different solid-Earth sub-disciplines, but with shared interests, in collaboratively tackling big-picture problems in Tectonics from the "core to the clouds." We anticipate that 45% of ~30 Geosciences faculty will retire within the next 5-10 years; the vast majority of these are engaged in Tectonics research. Our most recent retirement in geophysics has opened an important gap (seismology) in the department, with serious implications for our ability to train undergraduate and graduate students for advanced level employment in the petroleum industry. Considering that our strengths in seismology are the basis for important connections with industry, a replacement in Geophysics may take priority over other Solid-Earth sub-fields. Overall, maintaining strength in Tectonics/Solid Earth is a top priority for Geosciences, and faculty voted in favor of requesting a hire in this field immediately given the current demographics and the need to maintain and grow rankings and reputation.

Discipline of targeted hire

Areas of specialization in Tectonics might include but are not limited to: Continental tectonics, Marine tectonics, Planetary tectonics, Geodynamics, Seismology and Tectonics-Surface-Climate interactions. This position could be shared and/or in collaboration with LPL. The ideal candidate would take advantage of existing facilities in the department including but not limited to the LaserChron Center and various other geochemical and geo-thermochronological facilities (e.g., Noble Gas Laboratory, Low-T Thermochronology Laboratory).

Rank: Assistant Professor
Salary Range: $82-87k
Start-up Range: estimated $400k
Renovation Costs: estimated $50k for lab renovation
Other Funding Commitments: None at present
Potential funding opportunities: NSF-FRES, NSF- initiative in Subduction Zone 4D (SZ4D), NASA. SZ4D is a new initiative in the U.S. research community to study subduction zones – the places where tectonic plates converge and collide – through both space and time, with a focus on the fundamental processes underlying geologic hazards such as great earthquakes, tsunamis, landslides, and volcanic eruptions

(https://www.sz4d.org/). With our tectonics, surface process, petrology and geophysics groups we are well positioned to take advantage of this new initiative.

PALEOBIOLOGY/PALEOECOLOGY

Justification: For decades, the Department of Geosciences at the University of Arizona has been internationally known for leadership in paleobiological and paleoecological research. The building that houses our department is named in part for George Gaylord Simpson, a former professor in the department and one of the architects of the 20th Century synthesis of understanding evolution through combining paleontology (his specialty) and other aspects of modern biology. Much of this foundational research has involved understanding the relationship of life to Earth's changing climatic conditions, of fundamental concern to society today. Paleobiology (the record of life, evolution and extinction under the range of environmental and climatic conditions of the past) provides some of the most essential data for understanding what our future holds for life on Earth under a future Greenhouse world.

Geosciences' distinguished efforts in paleobiology have earned numerous academic accolades, including millions of dollars of grant funding and high-profile publications. Training in paleobiology and paleoecology is critical for our Geology sub-plan undergraduates as an essential element for their understanding of the Earth's stratigraphic record and interpretation of depositional environments. This hire would fill critical teaching needs in undergraduate and graduate level education including the teaching of our 300-level Paleontology class – a core, required class for both our EOC and Geology sub-plans that at times has been offered every semester to meet student demand. In addition, the ideal candidate could further expand our course offering to draw in students from many other biologically-oriented departments, increasing the number of majors within the Geosciences department.

Discipline of targeted hire

The ideal candidate for this hire is working on the cutting edge of analytical techniques merging our understanding of the fossil record with paleoclimate research, genomics, proteomics, and conservation biology, and is capable of expressing the excitement and importance of this field through teaching core classes in paleobiology at the undergraduate and graduate level. Examples of particularly exciting areas that could be the focus of a hire here include: use of paleobiological approaches to understand the dynamics of past biological communities, food webs and species and how they have responded to climate change, particularly in ways relevant to the Anthropocene; use of ancient DNA, environmental DNA and ancient protein records, integrated with conventional body fossil and genomic approaches to understand the dynamics of speciation, extinction, and morphological and population change in the face of variable climates. use of other cutting edge geochemical techniques, for example new applications in chemostratigraphy and novel tracers of paleo-ecosystem states (e.g. productivity, respiration) for better tackling questions ranging from how species interactions, diet and life history have responded to past climate change to the conditions and biological processes surrounding the origins of life. The ideal candidate will have natural connections not only with Geosciences but also with EEB, MCB and LPL. EEB is interested in hiring a *paleontologist who studies past fluctuations in biodiversity to understand the current biodiversity crisis and other broad questions in ecology and evolution. This crucial area is currently unrepresented in both EEB and Geosciences and will create new connections between the two units, the Tree Ring Laboratory, and Tumamoc's Vertebrate Paleontology and Paleo Packrat Midden Collections.*

Although the ideal candidate could take advantage of existing facilities in the department, including but not limited to organic and inorganic geochemistry laboratories, new state of the art facilities with significant investment will be needed (e.g. CT scanning, aDNA/eDNA clean lab, etc).

Rank: Assistant Professor
Salary Range: $87-$82 k
Start-up Range: estimated $400k
Renovation Costs: estimated $50k for lab renovation
Other Funding Commitments: None at present
Potential funding opportunities: NSF, NASA

The department also recognizes strategic opportunities in multidisciplinary fields of interest of other units such as astrobiology. A position in astrobiology may be filling growing interest in deep time (e.g., >1 Gyr) processes and Earth history.

In addition, considering that Peter Reiners will be on leave from the University of Arizona during 2022, and the possibility that his departure may be permanent, the department has agreed (during our retreat in 2021) that we may need to hire a new faculty member in the broader field of THERMOCHRONOLOGY with particular emphasis on $^{30}Ar/^{39}Ar$. We believe that it is important to maintain state of the art facilities such as the new noble gas laboratory in the department. Such facilities not only move forward the research enterprise and contribute resources and prestige to the unit and the CoS but are also an opportunity to attract talented people with expertise in the field. Hence a faculty search in THERMOCHRONOLOGY may need to take priority in 2022-2023 (depending on circumstances).

ENROLLMENT/RETENTION PLANNING

The Department of Geosciences plans to grow its programs through the creation of **a new major in Planetary Geosciences and a new BA in Geosciences**. We are also planning to create **a new professional certificate program** in mineral resources in collaboration with the School of Mineral Resources. These initiatives will grow our undergraduate program, add prestige and quality to our graduate program, and provide professional education to non-traditional students.

PLANETARY GEOSCIENCE MAJOR

Scientific need

It is an exciting—and critical—time to investigate Earth, our Moon, Mars, and other planetary bodies and their rocky/icy moons in concert. Planetary exploration, including the search for life, habitable environments, additional natural resources, and new clues about Solar System evolution is accelerating. Space exploration and scientific discovery are predicated upon a knowledge of the Earth system from the core to the clouds. Despite this, most prominent Earth and/or Planetary science departments nationwide do not offer a B.S. degree that provides rigorous training in both Earth and Planetary sciences. A consequence at the graduate level is a cohort of young planetary scientists strong in STEM, but with limited geological experience and understanding of rocky planetary bodies.

Why the University of Arizona?

The UA is a global leader in space missions and identifies space and future Earth as a Grand Challenge in its strategic plan. The UA is uniquely poised to train the new generation of Planetary Geoscientists to

take on this grand challenge by combining courses and research opportunities in two top-ranked departments (Geosciences and LPL/Planetary Sciences). Currently, Planetary Sciences offers a B.S. minor but not a major. The Geosciences B.S. major provides traditional training for traditional geoscience careers. Hence, a new Planetary Geoscience degree would attract additional majors to the COS.

The proposed Planetary Geoscience degree would be the first of its kind. It would be academically rigorous, require a research thesis or capstone experience, and be aimed toward attracting elite students globally and preparing them for top graduate programs in the physical sciences. The degree would further increase the prestige of the UA by training future leaders in planetary geoscience and space missions and catalyze new collaborations (and collaborative proposals) among faculty, researchers, and labs in both units.

Market Analysis

Before the 21st century, a B.S. in Planetary Geoscience may not have been advantageous for entering the workforce. However, the American Geosciences Institute estimates that employment will increase ~6% for geoscientists and ~8% for atmospheric and space scientists by 2028. There is not yet a separate category for the rapidly emerging field of planetary geoscience.

We have conducted a survey of Arizona high school seniors and UA undergraduates to gauge interest in the proposed degree. Preliminary survey responses and feedback are overwhelmingly enthusiastic. Despite this interest, the numbers of students in departments nationwide pursuing somewhat similar degrees (B.S. in Geoscience with emphasis in Planetary or B.S. in Planetary Science) are relatively low. Given this, and the rigorous curriculum of the proposed degree, we do not anticipate (nor want) a large-enrollment program. Success of the proposed degree program (graduating ≥ 8 students each year) will likely require advertising until the program's reputation is established. The largest benefit to the UA and CoS will not be in the form of SCH, but in prestige and fostering new Geosciences – LPL collaborations, which in turn will lead to exciting new research endeavors.

B.A. in Geosciences

We propose to develop a new B.A. degree program through the Department of Geosciences. Our idea with this major is to reach an entirely new set of students with interests in the geosciences, but who are currently not well served by our department's B.S. offerings. The new B.A. program is explicitly designed for students who are not interested in the career paths of geology, geophysics or related fields, but who are interested in using a foundational understanding of the geoscience to further careers in other topics. For example, we envision the typical B.A. student to be someone interested in going into fields such as science outreach, journalism, policy, law, secondary education or business, in applications where a strong understanding of geoscience principles can be applied to their work. As specific examples, the type of student we hope to recruit to this program is someone interested in dealing with municipal planning and geological hazards, teaching middle or high school earth science, or going on for a law degree with an interest in climate change applications. There is a strong and increasing need for such individuals at the interface of science and society who are currently not well served by the science-only focus of our B.S. major offerings.

The B.A. program we have designed is intended to educate such individuals with a combination of a tailored science curriculum centered around geoscience topics of considerable societal and applied

interest, coupled with a solid foundation in one of several social science, policy or journalism options. The GEOS course requirements include courses such as Global Change, Ocean Science and Energy and Mineral Resources, all of which present critical content for someone hoping to apply geoscience principles to a public-facing career. Courses such as Intro to Programming and Data Introduction to Remote Sensing, and Introduction to Geographic Information Systems (GIS) will ensure the students have highly transportable skills for gathering and communicating geoscience information and concepts. Cognate science skills in mathematics, physics and chemistry are reduced in this program relative to our B.S. offerings to emphasize numeracy, especially in statistical reasoning, which is so critical in policy and social science careers. In addition to the science requirements, students in the Geoscience B.A. program will choose a series of courses from one of three emphasis areas: 1) Law, 2) Journalism/Writing/ Communication or 3) Politics/Public Policy. The offerings in each of these areas have been chosen to build core knowledge in an interface field that will allow our students to be competitive at either entry-level positions (for example in municipal government or science communication), or can prepare them for further education in law, business or (with certification) secondary science education.

Professional Certificates In Mineral Resources

A 15 unit (credit hour) certificate program has been designed to provide early career professionals and upper division undergraduates with a focused introduction to mineral resource geology principles and applications. This proposed certificate (approval pending) is intended to be offered as soon as Fall 2022.

To be offered through the Department of Geosciences, and run by the GEOS-based Lowell Program in Economic Geology (LPEG), this certificate will serve three groups at the UA and beyond: (1) UA undergraduates interested in graduate-level additional training and credentialing related to mineral resources, (2) early career professionals who choose to broaden their professional training as part of their career development, and (3) other non-UA students (undergraduate or postgraduate) wanting to acquire mineral resources training. Course content will be shared with other UA programs and potentially with others beyond.

The focus will be on modular and online delivery, with the option for intensive in-person courses. In addition to two existing survey courses, other courses will be a mix of existing regular and short courses and new modular course content. The goal is to maximize flexibility in delivery and availability. Interested students will have the option of taking these courses for university credit, or as professional development (non-credit) courses using the existing LPEG model. Students who complete one or more courses for credit may subsequently be able to apply those units toward a regular graduate degree should they be admitted to the graduate program.

Instructors will come from existing programs across campus and externally. In addition to regular and research faculty, non-university professionals will contribute to many of these courses as is already the case for our combined professional development / credit-bearing courses (e.g., the 504 series). Under the right circumstances there might be an option to offer this jointly with other universities who have complementary programs.

Funding will come through a combination of AIB-model tuition revenues for credit-receiving students and course fees for non-credit students. Revenue will cover instructor salaries and related expenses. Professional development reviews will also be used to provide partial support for a program coordinator

and the necessary teaching assistantships. To date, the LPEG courses have paid for program coordination, multiple TAs in sponsored classes (and our 500 level courses), plus UA student expenses in field courses.

Course list and requirements

All courses can be taken as stand-alone, as non-credit, as part of the certificate program, or as part of a regular degree program. Students seeking the certificate will choose from the following courses. [this is in progress, some are being revised, some are just now being proposed]

Required

1. GEOS/MNE 443D/543D (2 units): Sustainable Development and Mineral Resources (this is the interdisciplinary overview course a version of which was taught in the past, see attached syllabus – needs to be revised; will be offered asynchronously with discussion)
2. GEOS 446/546[ABC] (1-3 units): Economic Mineral Deposits (existing course the plan is to revise in spring 2021 to be 3 on-line modules – a survey, a focus on applications, and a focus on geological and geochemical principles; a lab component might ultimately be added as a 4th unit)

Optional

1. GEOS/MNE 504B (1 unit): Advanced Mapping (existing in-person 10-day field course, offered Fall semester)
3. GEOS/MNE 504C (1 unit): Mineral Deposit Types (existing in-person 10-day field course, offered fall semester)
4. GEOS/MNE 504D (1 unit): Structural Geology of Mineral Deposits (new 10-day field course; full offering beginning March 2022, one trial offering several years ago)
5. MNE/GEOS 404/504E-G (1 unit each): Inputs to Integrated Planning [Mining Engineering, Geological, Metallurgical] (now fully online)
6. GEOS 543C (3 units): Project Stages and Best Practices (existing course taught by Eric Seedorff to residential graduate students; writing intensive, may or may not be offered after Eric retires – see 483/583 below)
7. GEOS 481/581 (1-4 units): Petrological and Geochemical Principles for Resource Geology (this new course is modular, mainly online, and is applicable to minerals, fuels [oil, gas, etc.] and gems]) – see spreadsheet for details
8. GEOS 482/582 (1-4 units): Mineralogical Principles for Resource Geology (this new course is modular, mainly online, and is applicable to minerals, fuels [oil, gas, etc.] and gems]) – see spreadsheet for details
9. GEOS 483/583 (1-4 units): Principles of Mining and Exploration Geology (this new course is modular, mainly online; it will be taught by industry experts)
10. MNE/GEOS 418/518 (3 units): Geometallurgy (existing course, available synchronously online; requires advanced standing or permission)
11. MNE/ANTH/GEOS 401/501(?) (3 units): Non-renewable Resources and Human Civilizations (advanced course in development)
12. MNE 422/522 (3 units): Mineral Resource Sustainable Development (existing course, requires advanced standing or permission)
13. OTHERS: Mining Law Program etc.

APPENDIX H. EARLY CAREER FACULTY MENTORING PROGRAM

The goals of this mentoring program are to provide advice on Promotion and Tenure issues, provide support on issues regarding work-life balance, and support the overall development of early-career faculty within the Department of Geosciences. The long-term development of early career faculty is vital to the success and health of the department, as the benefits continue to accumulate throughout the faculty's career. Mentoring is a proven and rewarding strategy to facilitate faculty success. As the Columbia *Guide to Best Practices in Faculty Mentoring* notes, "Mentoring has been shown to enhance research productivity (Bland & Schmitz, 1986; Bland et al., 2002; Byrne & Keefe, 2002), to enhance teaching effectiveness (Williams, 1991), and to increase faculty retention, recruitment, productivity, and satisfaction, as well as to decrease faculty attrition. In addition, mentoring may promote a more positive organizational climate (Corcoran & Clark, 1984; Melicher, 2000)." This program is based primarily around the Columbia Guide, with additions from other resources listed in the appendix.

Desired outcomes of the Mentoring Program

This mentoring program is written to enable the following desired outcomes:

- Increase the scholarship and research productivity of early career faculty
- Support teaching performance
- Aid early career faculty in building their professional network
- Identify and enable professional goals for early career faculty
- Aid the early career faculty member's understanding of governance and finances within the university
- Identify avenues for sponsorship (e.g. nominations, recognitions, strategic opportunities)
- Help early career faculty identify determinants (both formal and informal) for their advancement in the department and in the university and leadership in the scientific community
- Give proactive recognition and mitigation to factors that disproportionately affect faculty from marginalized communities.
- Support a collegial departmental culture that supports the success of all its faculty.

The Program

The Department Head selects an appropriate mentor for each early career faculty in consultation with both parties and is responsible for overseeing the program and making sure that regular meetings between the mentors and mentees take place. Early career faculty are also encouraged to approach the Department Head if they wish to unpair themselves with originally selected mentors. The Department Head will also serve as an additional mentor to all early career faculty as necessary. The main program is as follows:

- **Senior-Early career Mentoring.** Soon after the early career faculty begins their position, the new faculty and the Department Head, should decide on a primary mentor. The early career faculty is welcome to seek out an additional external mentor outside the department (within the U of A) in consultation with the Department Head. The Department Head will help identify potential additional mentors. If an external mentor is selected, this mentor should be willing to meet the early career faculty once per semester perhaps over the phone or at a national meeting to discuss their impact in the scientific community in the context of promotion to tenure. This connection provides an opportunity to get advice on how an external letter writer might view the early career faculty's work, explore service opportunities outside the university

(i.e. on a society committee such as the AGU fall meeting program committee), and grow connections in the scientific field in general.

- **Mentorship Training.** The end of this guide lists resources related to faculty mentor training for both senior faculty and early career faculty. Upon entering a mentoring relationship, it is recommended that participants assess their own skills (mentor) and needs (mentee), and familiarize themselves with the appropriate best practices. This has been shown to make these relationships more successful (Pfund et al., 2006). This preparation is especially relevant for the formal senior-early career mentoring described above. Columbia's guide lists the key characteristics of successful mentoring (page 11), which are all intended to maintain the productivity of the relationship. The University of Arizona's Mentoring Toolkit includes best practices for participants in mentoring relationships. Mentors and mentees are recommended to discuss these items at the beginning of their relationship.
- **Group meetings.** The department will organize periodic (e.g. once per semester) informal meetings between all mentors and mentees on topics related to skills acquisition and tenure. Early career faculty are encouraged to suggest topics of interest to be discussed. Suggested topics can include:
    - How much effort should faculty be putting into their teaching and general guidance on matching that effort with expected performance.
    - General strategies for managing a lab and lab members to encourage productivity in a collegial and collaborative environment.
    - What is an appropriate level and type of service commitments for the pre-tenure career stage? Departmental vs external?
    - Best practices for managing financial accounts at the University. How much attention should we pay to transactions or quarterly summaries from the front office?
    - Strategies for successful proposal writing to federal agencies (NSF, NASA, DOE, etc)
- **Peer Mentoring.** The early career faculty should meet as a collective group once per semester to discuss issues that affect them. Demographic groups (i.e. women, non-whites, etc.) within the faculty are also encouraged to periodically collectively meet to discuss the unique issues that affect them. The department recognizes that these meetings often take on outsized mentoring responsibilities within and outside their cohorts, such as to graduate students and undergraduates. These extra service contributions by the mentees should be taken into account by the Department Head in the annual planning of upcoming departmental service (i.e. committee assignments). These service contributions should also be noted and rewarded in departmental annual performance reviews (see specific section on recognizing mentorship service).
- **Annual Informal Review.** Once per year the Department Head will arrange a meeting between the pre-tenure early career faculty, the most recent chair of the Tenure and Promotion Committee, the most recent chair of the Annual Performance and Evaluation Committee, and a full professor mentor of the early career faculty's choosing (typically someone in a similar or adjacent sub-discipline). The purpose of this meeting is to have an informal discussion on the early career faculty's academic progress toward tenure. Both the mentor and mentee are recommended to keep an informal record of the meetings as a measure of progress and for reference. Suggested topics of conversation can include:
    - Areas of success and excellence of the early career faculty member.
    - Areas that may need additional improvement.
    - The department's criteria for tenure and promotion. The College of Science's criteria for tenure and promotion.
- **Sponsorship.** The mentor and the Department Head are expected to act as the mentee's sponsors and promote the mentees for awards, when appropriate, through the department

nomination committee. In contrast to mentoring, which provides ongoing guidance and feedback, sponsorship provides specific strategic opportunities to an individual at a particular time (Ibarra et al., 2010). Award nominations are one form of sponsorship. Other forms include for example:
    - Helping someone get on an AGU (section) program committee.
    - Helping someone become a journal associate editor.
    - A strategic introduction to a key person in a discipline.
- **Proposals.** The department should compile a dossier of recently funded (and/or recently rejected) external proposals by faculty members (with their permission) and make these available to early career faculty so that they can read them as examples in advance of writing their own proposals.
- **Peer annual performance evaluation.** The DH will preferentially assign services at the department level such as serving on the departmental annual review evaluation committee so as to provide an opportunity for the faculty to review successful colleagues within the department.
- **Promotion and tenure package**. faculty are welcome to ask a faculty, through the DH if they wish, who recently went through the tenure process for her/his tenure review package, so that they can read them as examples in advance of submitting their own 3rd-year review and tenure packets.
- **Essential Documents.** The department has compiled a dossier of "Essential Documents for Early career Faculty," below, which is available to all early career faculty. This dossier includes:
    - Guide to the proposal submission process in the department (how to put together a budget and steps to submission).
    - Guide to resources available at sponsored projects for help with federal agencies such as NSF Fastlane etc.
    - Dept. guidelines and templates for tenure and promotion (including a checklist)
    - College of Science guidelines for tenure and promotion
    - University of Arizona guidelines for tenure and promotion
    - A document outlining the procedure and requirements for creating a new course.
- **Departmental recognition of mentoring service.** The department should recognize and celebrate the importance, value, and successes of mentorship. ○ Mentorship should be incentivized in ways such as making mentorship an integral part of service and the annual evaluation process.
    - Attention should be paid to the equitable distribution of the work of mentorship among the senior faculty.

Early Career Faculty Mentoring Resources

Course Development

- **New Course Development**

Promotion and Tenure

- **Promotion and Tenure Criteria**

Proposals

- **New Faculty Grant Guide**
- **Recently Funded GEOS Proposals**
- **Proposal Submission Process**
- **Proposal Routing Flowchart**

External Resources

- **provost.columbia.edu/sites/default/files/content/MentoringBestPractices.pdf**
- **diversity.arizona.edu/mentoring-resources**
- **brown.edu/research/projects/advance/sites/brown.edu.research.projects.advance/files/uploads/mentoring_guide.pdf**
- **inclusion.uoregon.edu/facultyexternal-mentor-program**
- **ems.psu.edu/resources-faculty-and-staff/faculty-mentoring-best-practices**