MESSAGE FROM THE CHAIR

Welcome to the 2014 EES newsletter that will provide you – alumni and friends – an opportunity to hear the latest from several of our department members. Let me take the opportunity here to mention a few highlights from the past academic year.

As you probably know, Ron Parsley has retired and is now an Emeritus Professor; the symposium in his honor last October was a great success. Another recent retiree is Nancy Walker, who has been a Senior Program Coordinator in EES since 2006. Nancy’s contributions to department life have been huge, for the outside world most notably through her efforts to maintain our website. We are very grateful for her commitment through the years, and we welcome Karen Muse who recently took over her position. Karen has worked in a variety of positions at Tulane since 2000 and therefore brings a lot of institutional experience to EES.

Brad Rosenheim left the department last winter to continue his career at the University of South Florida. He will be sorely missed, but we are pleased that he remains connected with EES as an Adjunct Professor. We are excited that the search to replace Brad was successful; Brent Goehring just joined the department as an isotope geochemist. Brent’s work focuses on cosmogenic isotopes. He studies a variety of problems, many of which in glacial terrains (soon to include Antarctica) where he has pioneered the use of in situ production of $^{14}$C to date ice retreat.

And to continue on important personnel news, we are very happy to share that both Nicole Gasparini and Kyle Straub have recently been awarded tenure and will soon be promoted to the rank of Associate Professor.

The past academic year has also been very successful in terms of fundraising. In particular, I would like to mention a major gift by Michael (B.S., Geology, ’63) and Mathilda Cochran which has enabled the establishment of a new endowed professorship. In the tight budget climate that seems to be a reality of our time, donations like these are critical to secure the long-term health of the department. I am excited to share that Karen Johannesson will be the first holder of the Cochran Family Professorship in Earth and Environmental Sciences; the investiture of this position will take place in the Spring of 2015.

With our vibrant graduate student body, the needs for travel support are rapidly increasing. Our students are engaged in exciting research and frequently present their findings at national and international conferences. Supporting the associated travel expenses is an important priority and we would therefore encourage donations to the Tulane Geology Fund (see the last page of this newsletter).

Our Alumni Party takes place on Friday, November 14, as part of the annual Homecoming festivities; further details can be found elsewhere in this newsletter. We hope that many of you will be able to attend.

Torbjörn Törnqvist
Vokes Geology Professor and Chair, Department of Earth and Environmental Sciences
To the average person, names like Faure, Kastner, Hitchon, Brantley and Wedepohl probably don’t mean much. To Karen Johannesson, a geochemistry professor at Tulane University, the names represent the best in her field, a virtual who’s who of geochemists from around the world.

So when Johannesson received a letter from the International Association of Geochemistry that she would be joining the world’s most famous geochemists as an IAGC Fellow, she was honored beyond words.

“This is in recognition of your pioneering studies in the geochemistry and of the rare earth elements, especially in the hydrosphere, and also your more recent work on arsenic, selenium and tungsten in groundwater,” a letter from the organization read.

The honorary title of IAGC Fellow is bestowed annually to two scientists who have made significant contributions to geochemistry. This year, Johannesson and Jérôme Gaillardet of the Institut de Physique du Globe de Paris in France are the honorees.

“It’s nice,” Johannesson says. “It really surprised me, because they only give out two worldwide. It’s a lot of relatively well known people, so I don’t know if I belong there.”

Johannesson is modest, to say the least. She is considered an international authority in the behavior of rare earth elements in the hydrosphere and their potential impact on human health. She was one of the first to estimate rare earth element speciation in terrestrial waters and illustrated the importance of complexation and pH as controls on their behavior.

Johannesson’s more recent work has included the investigation of the behavior of the chemical compound oxyanion forming trace metals such as arsenic, selenium and tungsten in groundwater systems.

Johannesson and her students are currently investigating the presence of arsenic in southern Louisiana’s shallow groundwater. She says she plans to stick with the research for a long time to come.

“Most of the environmental emphasis at Tulane tends to be on the sinking coastline, rather than water quality, which is equally important to those drinking the water.”

Karen Johannesson has been honored for her pioneering studies in geochemistry and rare earth elements, and her more recent work on arsenic, selenium and tungsten in groundwater.
GEOLOGY IN THE REAL WORLD

A large number of our alumni have found employment in the energy industry, and many with great success. A group of current EES graduate students recently got a taste of industry life, applying their knowledge to “real world” problems. Nancye Dawers, who served as the faculty advisor for this group, reports on this exciting experience.

Five graduate students participated in the American Association of Petroleum Geologist’s Imperial Barrel competition during the past academic year. Our department team included Alex Breaux, Michael Hopkins, Heng Hu, Dianne Palmore, and Xu Zhou. This was the Department’s first experience with AAPG’s popular student program, and it will certainly not be the last.

As the team’s faculty advisor, I was impressed with what this experience has to offer our graduate students and the potential that it holds for enhancing our graduate-level curriculum.

As many of you may know, the Imperial Barrel Award (IBA) originated within Imperial College, London, as part of their highly successful petroleum geology M.S. program. The word “barrel” by the way refers not to oil, but beer, which is of course a fitting award in most geology programs. Since about 2008, AAPG’s IBA program has grown into a worldwide university program. Each student team is given a data package for basin analysis, prospect definition, and evaluation; the final drilling proposals are presented to a panel of industry geologists who judge the competition. Typical datasets include 3D and/or 2D seismic data, suites of well logs, and a variety of other data from existing wells. The work is done entirely by the students. However, each team can have up to two industry mentors who in our case were Chevron geologists who had both participated in IBA as graduate students. Because no faculty input is allowed, my role was mainly as a facilitator (and part-time data loader and trouble-shooter/computer tech).

I’m hesitant to say too much about the specific basin and dataset, as these are reassigned to other teams in later years. In keeping with the IBA practice of not assigning data from the students’ own region, our basin was in no way related to the Gulf of Mexico. After delving into the published literature as a group, they divided up more specific tasks. Michael, one of my Ph.D. students, put together the tectono-stratigraphic interpretation from their 3D seismic interpretation. Alex, a M.S. student working on coastal processes with Alex Kolker, was responsible for the well tie using geophysical logs. Xu, a M.S. student who I also advise, did the petroleum systems analysis using what was known about the thermal history of the region. Dianne, a student of Karen Johannesson’s who recently graduated, did the petrophysics. Another M.S. student, Heng, who studies volcanology with Steve Nelson, was responsible for the volumetrics. The integration, risking, and ultimately their drilling proposal was a team effort, as was the final presentation.

The Gulf Coast regional competition was held in March in Houston and was hosted by BP. This is arguably one of the most competitive sections of the IBA. The 2014 Gulf Coast section had 13 teams representing universities from Texas to Alabama. While we did not win the regional competition – that honor went to ULL who went on to be the international winner as well – our students did an excellent job based on the feedback we received from the judges.

All of the students found the IBA to be an incredibly valuable experience. Alex felt that the IBA program was a great introduction to exploration geology and the oil and gas industry overall. He further commented to me that “it allowed our team to gain perspective on the industry without taking as much time out of our research and class schedules as traditional industry internships entail”.

The Tulane team in the 2014 IBA competition. From left to right: Xu Zhou, Michael Hopkins, Alex Breaux, Dianne Palmore, and Heng Hu.
A great preview to the industry world was Heng’s description of it. Michael said: “it gave us the experience of implementing our knowledge of geological principles to real world situations in which we had to make decisions with incomplete information; it’s a side of our science that we seldom get to practice to this extent as students”.

In addition to the technical aspects, the IBA also offered opportunities for the students to meet industry geologists at ice-breaker receptions, and with recently hired geologists one-on-one at a career workshop. Our students also really enjoyed touring BP’s high-performance computing facilities. (And I would add that the students, nor I, will ever forget our epic drive back from Houston after attending Shell’s IBA workshop in January – the normally 6 hour trip took 12 hours because of the worst ice storm in recent memory in south Louisiana.)

Based on the students’ experience with IBA, as well as conversations I had with faculty from other universities, judges, and AAPG’s IBA committee, I am aiming to get a Tulane team organized every other year at least. This year’s team largely self-organized while taking my subsurface geology class, which I generally teach every other Fall semester. The spring timing of the IBA tends to work well with this, and we are considering a format in which the students can also obtain graduate course credit for their IBA efforts, like many geoscience departments now do. From the graduate curriculum perspective, a major perk of the IBA program is that departments get to keep their datasets for teaching.

So expect more updates from us as these plans evolve.

Nicole Gasparini was going upstream against a major trend in geologic research. Many geologists ascribe to the popular hypothesis about the formation of very steep mountain ranges: that a wet climate and heavy rainfall on one side of a mountain range are needed to drive erosion and uplift the mountain to high elevations.

Gasparini, assistant professor of earth and environmental sciences at Tulane University, wanted to test the popular hypothesis.

So Gasparini used a computer model that she helped develop 20 years ago to create different scenarios, varying rainfall amounts in a small area on the eastern side of the Andes Mountains in northern Bolivia. She and a colleague used the computer simulations of an area of about 2,000 square miles, approximately the size of Delaware, to examine every situation they could imagine.

“We worked on this for six years. It was a labor of love. We just did not see climate in it,” Gasparini says.

Ironically, the scientist who works at near sea-level on the Tulane uptown campus has never been to the mountainous area in South America. Using the computer model and measurements from other scientists, Gasparini and her colleague showed the grinding together of the Earth’s tectonic plates in the area and the resulting upward movement of rocks were key to shaping the eastern side of the mountain — more than the heavy rainfall.

Their work was lauded in a recent issue of Nature in an article, “Earth science: Rain on the parade.”

“We have tiny snapshots of what’s going on today,” she adds. “We don’t know exactly what went on over the last 30 million years. So you’re never going to have a complete story.”

Now, with funding from the National Science Foundation, Gasparini and her collaborators are building a new, more user-friendly computer model to evaluate other mountain ranges around the globe.

SHAKING THINGS UP
Using computer modeling, Nicole Gasparini’s research disputes a popular hypothesis about the formation of the Andes Mountains in an area of northern Bolivia.

Photo by Paula Burch-Celentano
I began studying geology as an undergraduate at Washington and Lee University, where I received a B.S. in geology and a minor in human capability and poverty studies. I originally intended to study chemistry, but my desire to work outside quickly shifted my focus to geology. As an undergraduate, I worked on a variety of projects including river terrace migration, stable isotope tracers in corals, and the global crisis of arsenic contamination. I then decided to focus my research on general trace metal contaminants in aquifer systems and came to Tulane to work in Dr. Karen Johannesson’s biogeochemistry lab. I have since worked on a number of projects including rare earth element fractionation in modern stromatolites, arsenic contamination in West Bengal, and most recently, trace element cycling in submarine groundwater discharge, which will be the focus of my dissertation.

SUBMARINE GROUNDWATER DISCHARGE
The field of submarine groundwater discharge (SGD) encompasses physical and chemical processes occurring at the land-ocean interface. Studies from the past few decades reveal that a substantial amount of freshwater discharges through subsurface pathways, globally amounting to about 6% of total river discharge. This additional source of terrestrial water contributes nutrients, radionuclides, organic matter, and metals, thereby affecting coastal ecosystems and potentially altering the overall flux of some chemicals to and from the ocean. Scientists quantify the amount of SGD using combinations of excess radon (an element much higher in groundwater than surface water), thermal imagery, resistivity profiles, and mixing models. In addition to estimating the total flux of freshwater, studies attempt to understand how the introduction of groundwater into a coastal aquifer affects its redox state, and ultimately, whether it serves as a sink or a source for contaminants.

SGD IN THE MISSISSIPPI DELTA
Submarine groundwater discharge studies in the US have focused mainly on the east coast or western Florida, where surface discharge is considerably less than through the Louisiana coast. However, buried sandy channel belts in the Mississippi Delta that maintain a hydrologic connection to the river may serve as conduits for SGD to the Gulf of Mexico. My dissertation work investigates how groundwater moving through these pathways changes with respect to redox state and cation chemistry before discharging to the Gulf. I am measuring the redox-sensitive elements arsenic, vanadium, iron, and manganese in ground and surface waters at sites south of New Orleans towards the Gulf. Because much less is known about vanadium as compared to arsenic, iron, and manganese, I have first characterized vanadium geochemistry in two previously studied aquifers – the Carrizo Sands aquifer in Texas and the Oasis Valley aquifer in Nevada – in order to build on the fairly limited information about vanadium in groundwater. Much more is known about vanadium geochemistry in rocks, sediments, surface water, and in the ocean. Understanding the interaction between all of these reservoirs is crucial to SGD studies and elemental flux calculations.
Newly arrived faculty member Brent Goehring shares some thoughts about how his expertise in "cosmo dating" will add a new dimension to the department and Tulane.

I hope that my research will contribute to our understanding of how redox-sensitive metals behave upon fresh-saline mixing and especially how buried channel belts serve as suppliers of groundwater to this mixing zone. This research has implications for SGD fluxes in all deltaic regions, especially river-dominated deltas. In the future, I hope to continue research in the field of hydrogeochemistry and work to solve problems related to both groundwater supply and quality. Research questions in these fields will continue to grow as increasing populations stress aquifer capacity and escalate contaminant loads, and I hope to gain the expertise to assist in solving these challenges.

Researching at Tulane has been a great experience. The EES department has grown steadily post-Katrina and substantially since I first moved to New Orleans. There also seems to be more involvement in the community at all levels from national geology conferences to local geological societies to Tulane graduate organizations. The best part of being a graduate student is the opportunity to have friends in a wide spectrum of research areas. The most challenging transition from undergraduate to graduate school has been narrowing my studies to such a small part of the field of geology, so being able to take classes and converse about other fields is great. Geology is such an interdisciplinary science, and I have gained a variety of skills from different fields through both my graduate classes and collaborations.

ACKNOWLEDGEMENTS

I am so grateful to Tulane and the National Science Foundation for supporting my research. The Coordinated Instrumentation Facility (CIF), especially Dr. Deborah Grimm, has enabled my data analysis and provided a lot of advice and support. I’d like to thank my dissertation committee: Dr. Karen Johanneson, Dr. Alex Kolker, Dr. George Flowers, and Dr. Alan Shiller, as well as my lab mates who have taught me numerous chemical procedures: Jade Haug, Darren Chevis, Ningfang Yang, Dianne Palmore, and Minming Cui. This project is also made possible by my colleagues Alex Breaux, Jihyuk Kim and Dr. Jaye Cable.

Kat Telfeyan sampling on Lac des Allemands.

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WELCOMING BRENT GOEHRING

Newly arrived faculty member Brent Goehring shares some thoughts about how his expertise in "cosmo dating" will add a new dimension to the department and Tulane.

The surface of the Earth is ever evolving and changes in its form are a result of geomorphic processes, such as erosion by rivers, glaciers, and wind. Quantifying the rates and dates of surface processes can provide information on other Earth system components such as climate and climate change, tectonic and volcanic events, as well as human influence in more recent times. My interests in surface processes are broad, with the primary goal of placing rates and dates on changes in the Earth's surface using a set of isotopic tools known as cosmogenic nuclides. I then place the resulting rates and dates in a broader Earth system context, for example by comparing dated glacial features with changes in climate.

Cosmogenic nuclides are the result of interactions of cosmic rays with rock and sediment at or near the Earth's surface and they produce rare isotopes at rates of a handful of atoms per year that can be counted and used as a chronometer and tracers of Earth surface processes. My current research includes studying the rates of Antarctic ice sheet collapse at the end of the last ice age, melting of the ice sheet covering western North America at the end of the last ice age and its potential impacts on human migration routes, and understanding the tectonics of the Alaska Range over the past 6 million years. I am also active in the development of new cosmogenic nuclide techniques and method improvement. In the coming years I will be building a state of the art cosmogenic nuclide laboratory, including only the fourth globally that can extract and prepare samples for measurement of radiocarbon produced in quartz.

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CONGRATULATIONS TO OUR 2014 AWARD RECIPIENTS

Graduate Awardees

The Vokes Fellowship
Recipient: Kat Telfeyan
Kat Telfeyan is the recipient of the Vokes Fellowship awarded by the Earth and Environmental Sciences faculty for her outstanding academic performance and excellence in research.

Outstanding Research Assistant
Recipient: Chris Esposito
Chris Esposito was selected the outstanding research assistant by the Earth and Environmental Sciences faculty for his outstanding contributions to research.

Outstanding Senior Teaching Assistant
Recipient: Pause Boden
Pause Boden was selected the outstanding senior teaching assistant by the Earth and Environmental Sciences faculty for her outstanding contributions to teaching.

Outstanding Teaching Assistant
Recipient: Dianne Palmore
Dianne Palmore was selected the outstanding teaching assistant by the Earth and Environmental Sciences faculty for her outstanding contributions to teaching.

Undergraduate Awardee

The R. A. Steinmayer Award
Recipient: Nick Stracco
Nick “Taco” Stracco is among the top graduates in environmental science in 2014. In addition to his academic excellence, Nick is known to many of his professors and fellow students for his passion and enthusiasm for all things environmental. He is also well-known around campus for his role as the former president of the Tulane Green Club and activism related to issues of environmental justice. Nick is completing an undergraduate thesis on the impacts of mountaintop-removal coal mining on Appalachian communities. Because of this experience, he has plans to visit some of these communities next year to learn more, while pursuing non-profit work related to environmental justice.

EARTH AND ENVIRONMENTAL SCIENCES ALUMNI PARTY
Friday, November 14, 2014 • 6:00 to 9:00 pm • Cudd Hall
RSVP to Marilyn Reine (mreine@tulane.edu, 504-865-5198) by Friday, October 31.

LET US KNOW WHAT YOU'RE UP TO
Send us your photos, news and announcements to share with fellow classmates and alumni.
Email Karen Muse at: kmuse@tulane.edu or fill out our Alumni Update Submission Form.
DEPARTMENT GRADUATES
UNDERGRADUATE STUDENTS
ENVIRONMENTAL SCIENCE: Maria Hochschwender, B.S. - Aug. 2013; Nicholas Stracco, B.S. - May 2014

GRADUATE STUDENTS
EARTH & ENVIRONMENTAL SCIENCES
Cyndhia Ramatchandirane, M.S. - Dec. 2013
Darren Chevis, Ph.D., Jianwei Han, Ph.D. - May 2014
Ciara Chambers, M.S., Dianne Palmore, M.S. - Aug. 2014

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I hereby donate: _____ to the Tulane Geology Fund
______ to the W. Kent McWilliams Fund
______ in honor of Harold Vokes

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Thank you in advance for your generosity and continued support of Tulane EES!

A BIG THANK YOU
The following donors made generous contributions to the department, enabling us to to establish an endowed professorship, enhance scholarships and to support field trips and student research, as well as Ron Parsley's retirement party. We are most grateful!
Martha and Brian Andersen (Rock Hill, SC) • Mary and Robert Carson (Walla Walla, WA) • Mathilda and Michael Cochran (Houston, TX) • Robert Marshall (Houston, TX) • Eileen and Kenneth Mallon (Houston, TX) • Scott Heape (Addison, TX) • Karen and Stephen Nelson (New Orleans, LA) • Betsy and Gregory Suppes (Johnstown, PA) • Shirley and Harald Werner, Jr. (Kenner, LA) • Thomas Westbrook (Metairie, LA)
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