

Inspiration from loss

Another year has passed. This is now our second issue of *Outcroppings*. We have much to report as a department. First and foremost, it is with great sadness that I report the passing of our beloved Hans Ave Lallemand on 14 November 2016 (see *In Memorium*, page 11). He started at Rice in 1970 and retired in 2006. He was the core of our structural geology program during that time and trained many students in the art of mapping and structural analysis. Many of you may remember spring recess out mapping the Mariscal anticline in Big Bend National Park with Hans. We celebrated Hans's life with his immediate family, alums and friends of the department; it was sad to lose a member of our department, but it was truly inspiring to see so many people that were touched by Hans and Marjo. Hans's passing reminded all the faculty why we are here: to mentor the next generation.

The torch of research excellence

Our department continues to influence the scientific community through publications in high impact journals. With Megan Duncan (PhD '16) and Yuan Li (post-doctoral fellow), Rajdeep Dasgupta published two papers in *Nature Geoscience*, one on the origin of volatiles during the early accretion of Earth (see *Carbon through accretion* page 26) and the other on the deep carbon cycle and how it influenced the rise of Earth's atmospheric oxygen. Hongbo Li (post-doc), current grad student Andrew Moodie and Jeff Nittrouer published a seminal paper in *Science Advances* on sediment dynamics of the Yellow River in China, providing both data and theory on how to manage rivers. Post-doc Min Chen, along with Fenglin Niu, and others in the department, published in *Nature Communications* a seismic study showing deep lithospheric foundering beneath Tibet. There were many other papers published by members of our department, but not enough room here to describe them all (see *Science Briefs*, page 24).

New faces

There were also a number of new faces that joined us this year. We brought on **Linda Welzenbach** as our science editor/coordinator for the department. She has assumed editorship of *Outcroppings*. Linda hails from twenty years of experience in geology curation and outreach at the Smithsonian Institution, so she brings with her many new talents and insights. Linda is helping us achieve one of our key goals, which is to find ways to better communicate the department's research to a wide community and, most importantly, to show that science has a humanistic side to it. Linda is replacing our beloved Larisa La Mere (BS '16), who served as *Outcroppings* very first editor. Larisa took a year off doing missionary work and is now enrolled in a soil science graduate degree at Oregon State University.

Melodie French started as a new assistant professor, coming from a post-doc at the University of Maryland. After half a year of planning and renovations, she now has a fully operational laboratory, where she focuses on simulating the fracture properties of rocks and sediments. We also established the Wiess post-doctoral fellowship for the first time, and after a very competitive search, we were lucky to bring Jonathan Delph into our ranks in 2016 as the first Wiess fellow. He received his PhD from the University of Arizona and is working with the seismology group on the deep structure of volcanoes. Our 2017 Wiess Fellow is Cailey Condit, who just arrived to work on metamorphism and rock deformation.

Of alums and adjuncts

We were also lucky to see many of our alums and friends of the department come back to help teach. Kevin Biddle (PhD '78) and Kurt Rudolph joined forces to teach a new course on decision making in the energy industry. Gary Gray taught our introductory structure

course. Kevin, Kurt, Gary and Lori Summa will soon be developing a new course on petroleum systems, where students will learn the art of integrating and synthesizing a wide array of diverse datasets and, most importantly, how to work together in a team, a skill that has always been difficult to learn in traditional academic settings. Malcolm Ross (PhD '95) continues to teach GIS for our students. We very much look forward to working with all of our adjuncts towards building a curriculum that will prepare our students to work in the real world.

From networking to student-organized activities

This year we continued to improve our networking programs for the benefit of our students. Graduate student Pankaj Khanna started the first Rice Industry Geosciences Seminar (RIGS) in partnership with our student chapter of the AAPG. The purpose of RIGS is to bring in former alums to give advice to our students and provide a venue for our students to give presentations to a broad audience. Through all this, Martha Lou Broussard (BA '57) has continued to be indispensable to our department. Her connections and her commitment to the department helped us reach out to our alums and friends like never before. Martha Lou organized the Rice reunion at this year's AAPG convention in Houston, bringing so many generations of Rice students, faculty and friends back together again.

We also want to thank Wey-Yi Foo (president of Geounion) and the students for taking the lead in running Loony NoonZ, a seminar where faculty, post-docs, students and occasional visitors can give freewheeling talks using a whiteboard only, no PowerPoint slides. Students were proactive in many other activities, including the development of field trips. Particularly noteworthy was Pankaj Khanna's initiating and organizing an AAPG field trip to Spain (see *Aimsa*, Spain page 32).

Catalyzing ideas with industry

We held the 4th annual Industry-Rice Earth Science Symposia (IRESS) in February of this year (see Symposia, page 7). The theme this year was titled "The building of a passive margin". We spared no expense to bring in the best from academia and industry to tackle how passive margins develop from a truly diverse set of expertise. We brought in geophysicists, geodynamicists, sedimentologists, paleoclimatologists, and more to revisit old paradigms and propose new directions for research. Pete Vail was present on the last day of the meeting when discussions were centered around sequence stratigraphy. What we learned is that understanding the stratigraphic record of passive margin sediments requires a deep understanding of sediment delivery and the development of accommodation space, and in particular, how these processes are influenced on both long and short timescales from deep Earth processes and climatic/hydrologic change. Fundamental advances are still to be made in passive margin studies, provided deep Earth and surface Earth scientists come together. We hope Rice, with its collective strengths in whole Earth systems science will lead this field.

Where are we going this coming year?

So much change happened this past year, but we are only beginning. As of July 1, 2017, the name of our department is officially changing to the Department of Earth, Environmental and Planetary Sciences (DEEPS). This name change was necessary to better reflect the current strength of our faculty and the evolving nature of Earth science as a field. But it is also aspirational. This past year, we established an environmental science undergraduate major in our department. The next coming years will see us grow this program in terms of students and more faculty in environmental science. Mark Torres, an environmental geochemist, will be the first new faculty along these lines; arriving this fall as assistant professor from his post-doctoral fellowship at Caltech. We also established that re-capturing our legacy in planetary science and exploration should be one of our highest priorities over the next decade. We were not expecting to make a hire in this field immediately, but for this year's IRESS, we had invited Kirsten Siebach

to give the dinner keynote on the stratigraphy of Mars based on her work on the Mars Curiosity mission. Her visit went so well that our faculty unanimously decided we should try to bring her into our ranks. Kirsten will be joining us as assistant professor next year, kick-starting our growth in planetary science much earlier than we had planned. The lesson we learned was that it is important to have a long term vision so that one is prepared to recognize an opportunity if it arises early.

Towards our goals in planetary science, we are also in the process of establishing a second departmental post-doctoral fellowship in partnership with the Lunar and Planetary Institute at Clear Lake. We hope that this fellowship will bring NASA and Rice closer through collaboration. We are currently trying to come up with a name for the fellowship, so if you have any suggestions, please do let us know.

We have also begun to recognize the growing importance of data science, especially in the geosciences. Now, more than ever, we need to train students who are capable of working with and synthesizing large datasets. On the one hand, this requires computational skills, but it also requires domain knowledge. Several petroleum companies have expressed interest in seeing universities take the lead in training a new generation of data scientists with geoscience domain knowledge. This year Rice started its first initiative in data science, with the first step of establishing a number of new faculty lines. Unfortunately, we were unsuccessful in getting one of these lines. However, together with the Professional Master's program at Rice, we are laying the foundation for the first Data Science Professional Science Master's program at Rice through our Subsurface Geoscience Professional Science Master's program. This will represent a fundamentally new direction for us, but if we are successful, it will pave the way for more data science programs throughout the University.

We also anticipate a number of infrastructure changes in our building this next year. A new wet laboratory is being built out for Mark Torres. A computer facility and space "command center" will be built out for Kirsten Siebach. The Chevron Visualization Center is moving out of Chemistry and into the third floor of our building. We anticipate that the new Visualization Center will draw far more users, including high profile planetary exploration research.

One consequence of expanding our expertise and building new labs is that sacrifices have to be made. We are completely maxed out in terms of laboratory space and office space for faculty and students. This is a good problem to have, but it also means that expansion is a problem. Unfortunately, we have had to move Andre Droxler's lab to accommodate our recent hires. But as unfortunate as this sounds, there is a silver lining. We will be building out his lab in the Space Science building, just across from our building. This new space will be a state-of-the-art facility for interactive research meetings and sample archiving. This space will come with large-screen visualization as well as open areas to lay out maps and sedimentary cores for examination, providing a special meeting place for industry and earth scientists to come together. Andre will take the lead in establishing this new lab as an industry-Rice facility.

Another positive outcome of limited space is that we are being forced to be as efficient as possible. Sharing of space is becoming the cultural norm in our department, which turns out to facilitate interactions between students. We are building a rock preparation facility that will be shared by all faculty. We know that very soon, we will reach our maximum efficiency, so we are desperately looking how to expand are physical footprint to accommodate our growth in the next several years. Over this next year, we will continue to make headway on our most ambitious goal ever. That is, to start an Institute of the Earth, Environment, and Energy. This institute will conduct research in the area of four grand challenges: coastal sustainability, energy and natural resources, physics and chemistry of fluids, and planetary exploration. All

of these grand challenges are relevant to the Gulf Coast, with Rice and the city of Houston being ideal for tackling these challenges because of the diverse set of relevant expertise, from energy to medical to space. A guiding principle of our proposed institute will be to instill a whole Earth systems philosophy and generate an entirely new generation of students comfortable and adept in thinking in complex systems. The ultimate goal is to inform on how to build a habitable planet through a balanced and integrated view of energy, natural resources and environment. We hope to train not just scientists, but medical doctors, policy makers, politicians, lawyers, journalists, etc. in the art of systems thinking, through Earth and environmental science. Imagine an institute on par in terms of research excellence and societal impact as Rice's Baker Institute of Public Policy, working in parallel with the Baker Institute to lead the nation in building a more habitable planet. Together, there would be nothing like it in the world, with the Institute of Earth, Environment and Energy providing data and the Baker Institute providing policy advice. I am convinced that the only place in the world where such an endeavor can be successful is here in Houston. The institute is something that our department must take the lead on.

We recognize that the institute is clearly a moonshot goal and there is a chance we will fail, simply because of the amount of resources needed to build an institute will be colossal. In many ways, however, we are already building it by the small, forward-looking steps our department and faculty are taking as described above (IRESS, Environmental Science major, new faculty in planetary exploration and environmental science, data science professional masters, scientific communication, etc.). But we remain idealistically hopeful because of the energy in our faculty, alums and friends. Already, many of you have stepped up to help in terms of gifts or volunteering your time, advice and ideas. For example, the success of IRESS has been made possible by your support in the form of the IRESS endowment, with the goal of establishing an industry-Rice symposia that sustains itself for perpetuity. We are truly grateful. With such teamwork, we will succeed.

Initial momentum is building for our institute through the building of the Rice Center for a Sustainable Earth (www.earthscience.rice.edu/sustaineearth). To kickstart development, Mary Anne and William Dingus (BA '81) formalized a challenge gift to the department to help establish an endowment called **Human Impacts on the Earth**. Their gift will match any donation or pledge of \$2,500 to the fund. If we make this challenge we will have a \$500,000 endowment to support research and education activities focused on understanding how to maintain a habitable planet. Towards these ends, our priorities center around research support for students, enhancing opportunities for female geoscientists, building new analytical and computational facilities, adding new faculty lines through endowed chairs, establishing post-doctoral fellowships in partnership with industry or the planetary community in Houston, and fostering more industry ties. We are grateful for Mary Anne's and Bill's generous gift and we hope you might consider contributing to this endowment or getting involved with the department by providing advice, helping our students, and more.

If interested in giving or helping, please contact DEEPS Chair Cin-Ty Lee (ctlee@rice.edu) or Natural Science Development Officer Jerry Haus (jerry.haus@rice.edu). More information on Giving can also be found here: earthscience.rice.edu/giving/

It is an honor to serve the department and all its illustrious alums.



Fondly and sincerely,
Cin-Ty Lee