TOWARDS THE RICE CENTER FOR A SUSTAINABLE EARTH

Building a habitable planet in a complex and interconnected world through scientific discovery and communication

Our Mission:

The world is more complex, interconnected, and uncertain than ever before. The future of our planet, the health of our society, and the welfare of its seven billion inhabitants will require creative solutions that balance resources, environment, health, and economy. Sustainable paths forward will require collective, non-partisan action coupled with the ability to see the world and all its components and fully interdependent.

Our Objectives:

- To train the next generation of students how to think about complex systems through research and learning about the Earth and its environment.
- To identify and develop science-based solutions to the world’s most pressing problems through the convergence of Whole Earth Systems science expertise at Rice University and Houston’s unique combination of energy, medical, chemical and space sectors.

www.earthscience.rice.edu/sustainearth

Building bridges between Rice and Houston-based industries and community

Great ideas come from interactive environments where people come together to work on problems of mutual interest. Many of the best ideas cannot come solely from academia in isolation; the world is now too complex. We believe in opening a dialog between leaders in industry, business, government, and academia.

Industry-Rice Earth Science Symposia (IRESS)

In parallel with the Rice Center for a Sustainable Earth, we are holding the annual IRESS symposia between the Department of EEPS and the Houston energy industry. These symposia are now in their fifth year. We tackle problems of mutual interest between industry and academia. Recently, we have brought top scientists together to discuss sequence stratigraphy, sediment transport and the development of passive margins. In 2018, we will be investigating whole Earth carbon cycling.

“We hope you can help with this effort to quantify our impact on the planet. After all, we can’t fix what we don’t understand.”
– Mary Anne and Bill Dingus ’81

HELP US BUILD THIS CENTER!

Over the next five years, we will be building the center, with the ultimate goal of building an Institute of Earth, Environment and Energy. We will work with Houston’s energy, medical, chemical and space sectors to train the next generation of undergraduate and graduate students in complex systems thinking through Whole Earth Systems Science. We will pursue four grand challenges facing Houston and the Gulf Coast. However, we cannot do this alone. We will need your help. Come join us on this exciting journey of learning about our planet and how to make it more habitable.

Texas-sized grand challenges

The city of Houston is the ideal place to develop new ways of tackling energy and environmental problems. How the Gulf Coast will move forward in the face of environmental change may ultimately be the template for sustainable growth for the world.

Towards a natural resource strategy

Build a natural resource (minerals, hydrocarbons, water, biodiversity) strategy for sustainable exploration, extraction, application and end-of-life processes.

The Texas coast: past, present & future

Develop accurate predictions on the future of the Texas coast to build economically sound strategies that prepare Houston’s response to environmental change.

Fluid flow in everyday life

Share the science and technologies of fluid flow from volcanoes, groundwater systems, hydrocarbon migration, ocean circulation to blood flow.

Planetary habitability and exploration

Build a team of planetary scientists with the intent to grow Rice University’s legacy in planetary and space exploration.

Fundraising challenge has begun!

Initial momentum is building for our institute. To kickstart development, Mary Anne and William Dingus (BA ’81) formalized a challenge gift to the department this year 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. We are grateful for this 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 you are interested in giving or helping, contact Department of EEPS Chair Cin-Ty Lee (ctlee@rice.edu) or Natural Science Development Officer Jerry Haus (jerry.haus@rice.edu).
The 4th annual Industry-Rice Earth Science Symposia gathered together a highly interdisciplinary group of speakers, including sedimentologists, geophysicists, paleoclimatologists, structural geologists, geodynamicists, and even planetary geologists.

by Cin-Ty Lee

Manik Talwani (Rice University) kicked off the sessions, weaving a story of the formation of the continental margin in Bangladesh based on geophysics and geology. Talwani was followed by Donna Shillington from Lamont Doherty Earth Observatory (LDEO) who gave a tour of different modes of incipient rifting around the world, followed by Roger Buck (LDEO), talking about the role of magmas in facilitating rifting. Roger also touched on the infamous seaward dipping reflectors. Shanan Peters from the University of Wisconsin presented a history of erosion and sedimentation over the last billion years of Earth history, showing that there have been fundamental changes in sediment production and storage capacities in the late Proterozoic.

Nick Christie-Blick (LDEO) began the afternoon with a provocative talk on potential pitfalls of interpreting sequence stratigraphy, leading to a friendly sparring match with Pete Vail, and eventually the audience. Kevin Bohacs (ExxonMobil) then talked about mud and how sequence stratigraphic concepts can still be applied to these more distal sediments. This was followed by Chris Paola (Minnesota), who talked about the physics of transporting sediments, particularly mud, far out onto the continental shelf and beyond.

Our keynote speaker for the evening was Kirsten Siebach from Caltech. She took us on an amazing journey to Mars to show Curiosity’s journey into Gale crater and the discovery of fluvio-deltaic deposits and lacustrine mudstones. Siebach has been part of uncovering an explosion of new evidence, including a greater igneous diversity than predicted and long-lived liquid water in rivers and lakes at the surface, creating environments potentially habitable to life.

IRESS made possible through the generous support of sponsors:
Outstanding questions

What we learned from IRESS was that there is still much unknown about passive margins and that interdisciplinary approaches are needed to continue to make progress. A number of outstanding questions remain. What is the nature of the ocean-continent transition and what controls it? In some cases, the ocean-continent transition is sharp in terms of elevation and crustal thickness. In other cases, the transition is more gradual. What role does the style of tectonism and magmatism play in controlling the nature of this transition? A key question that remains unanswered is how does magmatic flux vary from the initiation of rifting to the formation of an ocean basin? It is widely thought that there is an rapid pulse of magmatism just before initiation, often attributed to the emplacement of a large igneous province, but to what extent has this been tested? Why are not all passive margins graced with flood basalts? Are these magmas related to plumes, and if so, do plumes trigger rifting? Alternatively, are these magmatic pulses associated instead with preferential melting of fertile mantle lithosphere formed during ancient orogenic events? To what extent does the composition and structure of the lithospheric mantle play in controlling the nature of rifting and magmatism?

Rifting, or more specifically crustal thinning, is key to generating accommodation space for sediments. Superimposed on such subsidence are the effects of dynamic topography, which can modulate the subsidence. On shorter timescales, changes in ocean volume due to the waxing and waning of ice sheets also modulate accommodation space (glacio-eustasy). Sequence boundaries, we learned, are the manifestations of the complex interplay between sediment supply and accommodation space. At one extreme, sequence boundaries and changes in relative sea level are interpreted in terms of glacio-eustasy, but we learned that sediment supply plays a very important role at times. Sequence stratigraphy as a method is independent of causal interpretations and will continue to be a useful methodology for hydrocarbon exploration. However, one can’t help but wonder whether fundamental changes in the erosional capacity of continents, driven by changes in tectonism, play an important, if not dominant role, in controlling large and sustained changes in apparent relative sea level. To what extent is passive margin development and the generation of a clastic platform dependent on far-field processes? For example, the development of the Amazon delta is ultimately driven by uplift in the Andes, as this is the source of sediment. Climatic shifts in air circulation could impart higher frequency signals in the erosional response of mountains, which could manifest as a rapid change in relative sea level on the passive margin. Clearly, an important, but challenging step forward, will be to develop methods for dating sequence boundaries, particularly unconformities, in order to determine if sequence boundaries are truly coeval and global, allowing us to separate glacio-eustatic effects from tectonic or climate-induced changes on erosion and sediment supply. At the most basic level, we still do not know whether sequence boundaries represent globally synchronous events. New dating approaches will be necessary to resolve this problem.

What appears to be emerging is that understanding the stratigraphic record of passive margin sediments will require deep and surface Earth geo-scientists to come together. Deep Earth processes control the first order shape of the continental margin. Together with climate, deep Earth processes also drive erosion and sediment delivery. Glacio-eustasy and the morphodynamics of fluvial, deltaic and shelfal systems are superimposed on these deep Earth controls. All of these processes impact the global cycling of carbon and other volatiles. Active tectonism drives the long term inputs of carbon dioxide into the atmosphere, whereas weathering and sedimentation, particularly on continental margins and ocean basins are the carbon sinks. Next year, we will move towards carbon cycling on passive margins.

We want to thank all the alums, friends, faculty and students of the Department of EEPS for all the hard work in making IRESS successful.
In November of 2016, over 24 international scientists converged on Lake Chelan (LC) Valley to present hydrological and sedimentological research on Lake Baikal and the Selenga River in Russia—a lake that holds 20 percent of the world’s fresh water. Professor Jeff Nittrouer, Prof. Sergey Chalov (Lomonosov Moscow State, Russia), and Dr. Daniel Karthe (Helmholtz Centre, Germany), and local scientist Phil Long co-organized the conference and workshop at Lake Chelan to bring attention to the developing Lake Chelan Research Institute (LCRI).

Nittrouer selected Lake Chelan for this biennial meeting for the purpose of introducing the Selenga-Baikal community to a similar fluvial-lacustrine environment and to engage the LCRI on current research practices that can be applied to study of Lake Chelan. LCRI got the benefit of access to more than 20 years of data, enabling them to see long-term trends and the use of lake monitoring and research.

Over 100 alumni, faculty past and present, and friends of the Earth Sciences department attended the Rice Reception on Tuesday evening. Included in the crowd were Larry Meckel (BA 1959), the 2017 Sidney Powers Memorial Award winner, and his wife, Barbara. John Anderson was being honored at the meeting with a special session and many of his former students were also there. Cin-Ty Lee introduced himself as the new Department Chair and talked about his vision for the department. Everyone enjoyed seeing long lost friends and the good food and drinks. We hope to see even more alumni at the 2020 AAPG meeting. — Martha Lou Broussard

DEEPS would like to extend a note of thanks and gratitude to Martha Lou Broussard who works tirelessly and enthusiastically to support our Alumni and to organize such successful events such as the AAPG Alumni reception.