

MYRES 2012 Proposal: Landscapes into Rock

Theme

Sedimentary deposits comprise important archives of information necessary to 1) quantitatively reconstruct paleolandscape dynamics across a range of timescales, and 2) identify ancient tectonic and climatic conditions on Earth. An outstanding challenge for geoscientists is to decode this archive in order to understand the evolution of Earth's environments over a range of temporal and spatial scales. To this end, the research interests of geomorphologists and stratigraphers have started to converge on processes that produce, transport, and deposit sediment over millennial timescales and beyond. From a landscape perspective, these processes include rare, potentially catastrophic events, which are not well sampled in the historical record, but are necessary for modeling and predicting landscape responses to changing climate and tectonic regimes. In the rock record, such processes can act as a filter and bias, obscure or obliterate climatic and tectonic signals preserved in stratigraphy.

Understanding long-timescale landscape dynamics and the fidelity of the sedimentary record therefore demands new collaborative efforts between geomorphologists, geodynamicists and stratigraphers. Developing interdisciplinary approaches in this area is nontrivial, however, as the complex relationship between geomorphology and stratigraphy is poorly understood. Consequently new research must focus on understanding how surface-process dynamics become fossilized in stratigraphy. A MYRES workshop is an ideal opportunity to help bridge interdisciplinary gaps and foster collaborations necessary for young researchers to develop approaches that straddle long-timescale geomorphology and process-based stratigraphy.

Meeting format and goals

MYRES 2012: Landscapes into Rock would be a four-day workshop in Salt Lake City, Utah, USA. This setting offers a convenient, affordable meeting place near a major airport and the Book Cliffs, one of the world's best natural laboratories for viewing the stratigraphic record of landscape response to climate, tectonics, and eustatic change. The first three days of the workshop would each focus on a different key topic:

- 1) The erosional engine: When, where, how and with what characteristics is sediment released from upland catchments?
- 2) Dynamics of sediment-routing systems: How is sediment transported, routed and deposited through Earth-surface systems over a range of temporal and spatial scales?
- 3) Assembling the stratigraphic record: How are surface-process dynamics recorded in sedimentary basins, and how can this information be used to reconstruct paleolandscapes and ancient tectonic and climatic conditions?

Presentations and group discussions each day would be guided by a set of five integrative themes that link the focus topics together. These themes highlight the following key challenges:

- How can we up- or downscale between disparate datasets in time and space?
- What tools and data are needed to constrain uncertainty in interdisciplinary studies?
- How is material transferred into the sedimentary archive?
- What methods should we use for geomorphic and stratigraphic prediction?
- How sensitive are geomorphic and stratigraphic systems to external forcing?

The workshop would conclude with a field trip through Book Cliffs strata that preserve Mesozoic landscapes. This excursion will be aimed at facilitating integration and synthesis of the themes and questions discussed during the meeting.

The primary goals of the workshop are to

- 1) Support community building and promote knowledge transfer between early-career geomorphologists, stratigraphers, and geodynamicists
- 2) Identify key research targets and priorities for the next five-to-ten years
- 3) Develop a white paper that outlines specific paths forward for this field

Participants from a wide range of backgrounds would be encouraged to attend in order to develop inter- and intra-disciplinary interaction between modelers, experimentalists, and field-based geomorphologists and stratigraphers.

Potential support and partners

This proposal is particularly timely because it builds on recent meetings and publications which have emphasized the importance of (i) understanding the coupling between Earth-surface processes and stratigraphy on a physical level, and (ii) constraining the deep-time record of landscape dynamics for paleoenvironment reconstruction. These contributions include the 2009 US National Academies report *Landscapes on the Edge: New Horizons for Research on Earth's Surface*, and the 2010 Geological Society of London William Smith Conference. Such publicity has highlighted the need for further work and raised the profile of this topic within public funding agencies and industry.

MYRES 2012: Landscapes into Rock could seek financial and logistical support from a number of public and private organizations in the United States. These include the Sedimentary Geology and Paleobiology, Geomorphology and Land-use Dynamics, and GeoPRISMS programs within the National Science Foundation, the National Center for Earth-Surface Dynamics (NCED), Society for Sedimentary Geology (SEPM), Community Surface Dynamics Modeling System (CSDMS), and energy companies such as ExxonMobil, ConocoPhillips, Chevron, and Shell. Additionally, the workshop could leverage well-developed community organizations such as NCED, SEPM, and the Gilbert Club to help promote the meeting and provide a platform for communicating important results and sustaining ongoing collaborations beyond the workshop itself.

Proposers

Elizabeth Hajek
Assistant Professor
Department of Geosciences
Pennsylvania State University
ehajek@psu.edu

Kyle Straub
Assistant Professor
Earth and Environmental Sciences
Tulane University
kmstraub@tulane.edu

Alexander Whittaker
Lecturer in Tectonics
Earth Science and Engineering
Imperial College
a.whittaker@imperial.ac.uk

Benjamin Sheets
Assistant Professor
School of Oceanography
University of Washington
sheets@uw.edu