



## **From Slow to Fast Rock Deformation and Back**

**August 21 - 26, 2016**

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### **Chair**

Francois Renard

### **Vice Chair**

Julia Morgan

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### **Proctor Academy**

204 Main Street  
Andover, NH, US

## **Conference Description**

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In Earth and planetary materials, deformation processes can be very fast, for example during an earthquake or a meteoritic impact, or very slow, for example when considering convection in the mantle or plate tectonics. Transient behaviors also are observed making a comprehensive description of rheological couplings between scales a great challenge in Earth sciences. The 2016 Rock Deformation Gordon Conference will present cutting-edge research on the various time and spatial scales involved in the deformation of rocks in the Earth and in the solar system. The Conference will feature topics ranging from atomic to planet scales, such as rock rheology in the ductile and brittle regimes, earthquake mechanics, interface dynamics, frictional behavior, mantle dynamics, and flow in porous media. Geoengineering applications to geohazards and the sustainable exploitation of underground georesources will be also considered. Invited speakers represent a variety of scientific disciplines, including rock physics, geology, geophysics, mechanics, physics, and civil engineering. The conference will bring together a collection of junior and senior investigators who are at the forefront of their field, and will provide opportunities for junior scientists and graduate students to present their work in poster format and exchange ideas with leaders in the field. Some presenters from the Gordon Research Seminar, held immediately before the Conference, will be selected for short talks. The collegial and open atmosphere of this Conference, with programmed discussion sessions as well as opportunities for informal gatherings in the afternoons, evenings and during the meals, provides an avenue for scientists from different disciplines to brainstorm together and promotes cross-disciplinary collaborations in the various research areas represented.

## Related Meeting

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This GRC will be held in conjunction with the "Rock Deformation (GRS)" Gordon Research Seminar (GRS). Those interested in attending both meetings must submit an application for the GRS in addition to an application for the GRC. Refer to the [associated GRS program page](#) for more information.

## Conference Program

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### Sunday

2:00 pm - 9:00 pm      Arrival and Check-in

6:00 pm                  Dinner

7:30 pm - 7:40 pm      Welcome / Introductory Comments by GRC Site Staff

7:40 pm - 9:30 pm      **Architecture and Behavior of Faults and Shear Zones**

Discussion Leader: **Christie Rowe** (McGill University, Canada)

7:40 pm - 8:20 pm      **Chris Scholz** (Columbia University, USA)

"Towards a Second Generation Fault Friction Model"

8:20 pm - 8:35 pm      Discussion

8:35 pm - 9:15 pm      **John Platt** (University of Southern California, USA)

"How and Why Strain Localizes in the Ductile Lithosphere"

9:15 pm - 9:30 pm      Discussion

### Monday

7:30 am - 8:30 am      Breakfast

9:00 am - 12:30 pm    **Dynamics of Rock-Rock Interfaces: Forces and Friction**

Discussion Leader: **Diane Moore** (U.S. Geological Survey, USA)

9:00 am - 9:40 am      **Ikuo Katayama** (Hiroshima University, Japan)

"Frictional Properties of Clay Minerals and Implication to Subduction Zone Seismicity"

9:40 am - 10:00 am	Discussion
10:00 am - 10:30 am	Coffee Break
10:30 am - 11:10 am	<b>Andre Niemeijer</b> (Utrecht University, The Netherlands) "Friction and Frictional Stability of Fault Rocks Under Hydrothermal Conditions: Effects of Viscous Deformation Mechanisms and Reactions"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	<b>Anja Royne</b> (University of Oslo, Norway) "The Role of Surface Forces and Confined Fluid Films in the Slow Deformation of Rocks"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
3:00 pm - 4:00 pm	<u>Power Hour</u>
	<i>The GRC Power Hour is an optional informal gathering open to all meeting participants. It is designed to help address the challenges women face in science and support the professional growth of women in our communities by providing an open forum for discussion and mentoring.</i>
	Organizer: <b>Julia Morgan</b> (Rice University, USA)
4:00 pm - 6:00 pm	<u>Poster Session</u>
6:00 pm	Dinner
7:30 pm - 9:30 pm	<b>Geoengineering and Induced Rock Deformation</b>
	Discussion Leader: <b>William Ellsworth</b> (Stanford University, USA)
7:30 pm - 8:10 pm	<b>Gunter Siddiqi</b> (Swiss Federal Office of Energy, Switzerland) "Unlocking Energy Resources Stored in the Subsurface"
8:10 pm - 8:30 pm	Discussion

8:30 pm - 9:10 pm	<b>Shemin Ge</b> (University of Colorado Boulder, USA) "Fluid Induced Earthquakes: Insights from Hydrogeology and Poro-Mechanics"
9:10 pm - 9:30 pm	Discussion
<b>Tuesday</b>	
7:30 am - 8:30 am	Breakfast
8:30 am	Group Photo
9:00 am - 12:30 pm	<b>Slow and Fast Earthquakes</b>  Discussion Leader: <b>Chris Marone</b> (Pennsylvania State University, USA)
9:00 am - 9:40 am	<b>Yves Guglielmi</b> (Lawrence Berkeley National Laboratory, USA) "Exploring Activated Faults Hydromechanical Processes from Semi-Controlled Field Experiments"
9:40 am - 10:00 am	Discussion
10:00 am - 10:30 am	Coffee Break
10:30 am - 11:10 am	<b>Brett Carpenter</b> (University of Oklahoma, USA) "Experimental Simulation of Earthquake Rupture Processes"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	<b>Heidi Houston</b> (University of Washington, USA) "Tidal Influence on Tremor During and Between Major Slow Slip Events: A Window into the Physical Environment Deep in Subduction Zones"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	<u>Poster Session</u>

6:00 pm

Dinner

7:30 pm - 9:30 pm

## **Pore Fluid and Rock Deformation**

Discussion Leader: **Bjorn Jamtveit** (University of Oslo, Norway)

7:30 pm - 8:10 pm

**Wenlu Zhu** (University of Maryland, USA)

"Physical and Chemical Effects of Pore Fluid on Rock Deformation: Constraints from 4D Image Analysis"

8:10 pm - 8:30 pm

Discussion

8:30 pm - 9:10 pm

**Einat Aharonov** (Hebrew University of Jerusalem, Israel)

"Shake-and-Sink: Liquefaction Without Pressurisation"

9:10 pm - 9:30 pm

Discussion

## **Wednesday**

7:30 am - 8:30 am

Breakfast

9:00 am - 12:30 pm

## **Plasticity of Grains and Ductile Rheology**

Discussion Leader: **Teng-Fong Wong** (The Chinese University of Hong Kong, Hong Kong SAR China)

9:00 am - 9:40 am

**Patrick Cordier** (University of Lille, France)

"From the Defects to the Rheology"

9:40 am - 10:00 am

Discussion

10:00 am - 10:30 am

Coffee Break

10:30 am - 11:10 am

**Lars Hansen** (University of Oxford, United Kingdom)

"Deformation Mechanisms in Olivine: New Insights From High-Resolution Investigations"

11:10 am - 11:30 am

Discussion

11:30 am - 12:10 pm

**Pamela Burnley** (University of Nevada, Las Vegas, USA)

"*In-Situ* Synchrotron X-Ray Diffraction Measurements of Deforming Materials: Insights and Implications"

12:10 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm Poster Session

6:00 pm Dinner

7:00 pm - 7:30 pm Business Meeting

*Nominations for the Next Vice Chair; Fill in Conference Evaluation Forms; Discuss Future Site and Scheduling Preferences; Election of the Next Vice Chair*

7:30 pm - 9:30 pm **Evolving Microstructures and Effect on Rheology**

Discussion Leader: **Philip Skemer** (Washington University in St. Louis, USA)

7:30 pm - 8:10 pm **Maurine Montagnat** (CNRS / Université Grenoble Alpes, France)  
"New Insights on Ice Deformation Mechanisms from Strain Field Measurements and Electronic Microscopy (EBSD) Observations"

8:10 pm - 8:30 pm Discussion

8:30 pm - 9:10 pm **Andrew Cross** (Washington University in St. Louis, USA)  
"Microstructural Controls on the Rheology of Mid-Crustal to Upper-Mantle Ductile Shear Zones"

9:10 pm - 9:30 pm Discussion

## **Thursday**

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **Coupling Scales in Modelling Rock Deformation**

Discussion Leader: **Julia Morgan** (Rice University, USA)

9:00 am - 9:40 am **David Bercovici** (Yale University, USA)  
"Origin of Plate Tectonics: From Grain to Global Scales"

9:40 am - 10:00 am	Discussion
10:00 am - 10:30 am	Coffee Break
10:30 am - 11:10 am	<b>Marine Denolle</b> (Harvard University, USA) "Strong Ground Motion in the Shallow Crust"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	<b>Liran Goren</b> (Ben-Gurion University of the Negev, Israel) "Slip Sliding Away: Nucleation and Long Runout of Large Landslides"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	<u>Poster Session</u>
6:00 pm	Dinner
7:30 pm - 9:30 pm	<b>Young Investigator Presentations: From Slow to Fast Deformation and Back</b>  Discussion Leader: <b>Michele Cooke</b> (University of Massachusetts Amherst, USA)
7:30 pm - 7:50 pm	<b>Carolyn Boulton</b> (University of Liverpool, United Kingdom) "Coseismic Slip Induces Physico-Chemical Processes that Promote Fault Zone Weakening"
7:50 pm - 8:00 pm	Discussion
8:00 pm - 8:20 pm	<b>Melodie French</b> (Rice University, USA) "Dilatancy-Induced Slow Rupture Propagation in Serpentinite"
8:20 pm - 8:30 pm	Discussion
8:30 pm - 8:50 pm	<b>Thomas Ferrand</b> (École Normale Supérieure, France) "Dehydration-Driven Stress Transfer Triggers Intermediate-Depth Earthquakes"

8:50 pm - 9:00 pm	Discussion
9:00 pm - 9:20 pm	<b>Mong-Han Huang</b> (Jet Propulsion Laboratory, California Institute of Technology, USA) "Inferred Rheology from Postseismic Deformation Following the 2010 Mw 7.2 El Mayor-Cucapah Earthquake"
9:20 pm - 9:30 pm	Discussion
<b>Friday</b>	
7:30 am - 8:30 am	Breakfast
9:00 am	Departure

## Contributors

 <p><b>Gordon Research Conferences</b></p>	 <p><b>Carl Storm Underrepresented Minority Fellowship</b></p>	
		