GORDON RESEARCH CONFERENCES *frontiers of science*
512 Liberty Lane, West Kingston, RI 02892
Phone: 401 783-4011 Fax: 401 783-7644
E-Mail: grc@grc.org
World Wide Web: http://www.grc.org

founded in 1931

Nancy Ryan Gray, Ph.D.
Director

2008 GORDON RESEARCH CONFERENCE
on ROCK DEFORMATION

FINAL PROGRESS REPORT

DOE
GRANT NO.: DE-FG02-08ER15970

The Gordon Research Conference on **ROCK DEFORMATION** was held at Tilton School, Tilton, New Hampshire, August 3-8, 2008. The Conference was well-attended with 89 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. Attached is a copy of the formal schedule and speaker program and the poster program. In addition to these formal interactions, "free time" was scheduled to allow informal discussions. Such discussions are fostering new collaborations and joint efforts in the field.

Thank you for your support of this Conference. As you know, in the interest of promoting the presentation of unpublished and frontier-breaking research, Gordon Research Conferences does not permit publication of meeting proceedings. If you wish any further details, please feel free to contact me. Thank you.

Sincerely,
James Hirth, Chairperson
BROWN UNIVERSITY

ROCK DEFORMATION

Real-Time Rheology
August 3-8, 2008
Tilton School
Tilton, NH
Chair:
Greg Hirth

Vice Chair:
David J. Prior

The GRC on Rock Deformation highlights the latest research in brittle and ductile rock mechanics from experimental, field and theoretical perspectives. The conference promotes a multi-disciplinary forum for assessing our understanding of rock strength and related physical properties in the Earth. The theme for the 2008 conference is "Real-time Rheology". Using ever-improving geophysical techniques, our ability to constrain the rheological behavior during earthquakes and post-seismic creep has improved significantly. Such data are used to investigate the frictional behavior of faults, processes responsible for strain localization, the viscosity of the lower crust, and viscous coupling between the crust and mantle. Seismological data also provide information on the rheology of the lower crust and mantle through analysis of seismic attenuation and anisotropy. Geologists are improving our understanding of rheology by combining novel analyses of microstructures in naturally deformed rocks with petrologic data. This conference will bring together experts and students in these research areas with experimentalists and theoreticians studying the same processes. We will discuss and assess where agreement exists on rheological constraints derived at different length/time scales using different techniques - and where new insight is required. To encompass the elements of these topics, speakers and discussion leaders with backgrounds in geodesy, experimental rock deformation, structural geology, earthquake seismology, geodynamics, glaciology, materials science, and mineral physics will be invited to the conference. Thematic sessions will be organized on the dynamics of earthquake rupture, the rheology of the lower crust and coupling with the upper mantle, the measurement and interpretation of seismic attenuation and anisotropy, the dynamics of ice sheets and the coupling of reactive porous flow and brittle deformation for understanding geothermal and chemical properties of the shallow crust that are important for developing ideas in CO_2 sequestration, geothermal and petrochemical research and the mechanics of shallow faults.

SUNDAY

2:00 pm - 11:00 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	**EARTHQUAKES AND THE RHEOLOGY OF THE LITHOSPHERE**
	Discussion Leader: **Terry Tullis** (Brown University)

7:40 pm - 8:20 pm	**Susan Owen** (Jet Propulsion Laboratory) "Geodetic constraints on lithosphere deformation and fault mechanics"
8:20 pm - 8:35 pm	Discussion
8:35 pm - 9:15 pm	**Greg Beroza** (Stanford University) "Constraints from Seismology on the Deep Roots of Faulting"
9:15 pm - 9:30 pm	Discussion
MONDAY	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	**RHEOLOGICAL PROPERTIES OF FAULTS DURING EARTHQUAKES**
	Discussion Leader: **Tom Heaton** (Caltech)
9:00 am - 9:40 am	**Nick Beeler** (U.S. Geological Survey) "Lab-inferred properties of seismic faults and their expression in seismological and geophysical data"
9:40 am - 10:00 am	Discussion
10:00 am	Coffee Break / Group Photo
10:30 am - 11:10 am	**Judi Chester** (Texas A&M University) "Geologic perspective on earthquake rupture from field and laboratory studies"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	**Yehuda Ben-Zion** (University of Southern CA) "Collective Behavior of Earthquakes and Faults"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 6:00 pm	Free Time
6:00 pm	Dinner
7:30 pm - 9:30 pm	**POSTER SESSION 1**
	Discussion Leader: **Dave Prior** (University of Liverpool)
TUESDAY	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	**DEFORMATION OF ICE SHEETS AND GLACIERS**
	Discussion Leader: **Erland Schulson** (Dartmouth College)
9:00 am - 9:40 am	**David Goldsby** (Brown University) "Creep of Glaciers and Ice Sheets"
9:40 am - 10:00 am	Discussion
10:00 am	Coffee Break
10:30 am - 11:10 am	**Neal Iverson** (Iowa State University) "Viscous and frictional deformation resistance at glacier beds"
11:10 am - 11:30 am	Discussion

11:30 am - 12:10 pm	**Sridhar Anandakrishnan** (Pennsylvania State University) "Slip Slidin' Away: Slow Slip Events (SSE) on the ice streams of West Antarctica"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 6:00 pm	Free Time
6:00 pm	Dinner
7:30 pm - 9:30 pm	**SEISMIC ATTENUATION AND RHEOLOGY OF THE UPPER MANTLE**
	Discussion Leader: **Doug Wiens** (Washington University)
7:30 pm - 8:10 pm	**Marshall Sundberg** (Brown University) "Experimental Constraints on Attenuation in Peridotite: Physical Processes and Implications for Seismology and Rheology"
8:10 pm - 8:30 pm	Discussion
8:30 pm - 9:10 pm	**Colleen Dalton** (Boston University) "Seismic Constraints on Upper-Mantle Attenuation"
9:10 pm - 9:30 pm	Discussion
WEDNESDAY	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	**DEFORMATION AND RHEOLOGY OF THE LOWER CONTINENTAL CRUST**
	Discussion Leader: **Brendan Meade** (Harvard University)
9:00 am - 9:40 am	**Georg Dresen** (GeoForschungsZentrum Potsdam) "Rheology of the Lower Crust-A Lab and Field Perspective"
9:40 am - 10:00 am	Discussion
10:00 am	Coffee Break
10:30 am - 11:10 am	**Roland Burgmann** (Univ. of California, Berkeley) "Space Geodetic Probing of Lower Crustal Rheology"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	**Alex Copley** (Cambridge University) "Using large-scale active deformation to infer crustal rheology"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 6:00 pm	Free Time
6:00 pm	Dinner
7:30 pm - 9:30 pm	**POSTER SESSION 2**
	Discussion Leader: **Dave Prior** (University of Liverpool)
THURSDAY	

7:30 am - 8:30 am	Breakfast
8:30 am - 9:00 am	Business Meeting (Nominations for the next Vice Chair; Fill out Conference Evaluation Forms; Discuss future Site & Scheduling preferences; Election of the next Vice Chair)
9:00 am - 12:30 pm	**LINKING MANTLE ANISOTROPY AND RHEOLOGY**
	Discussion Leader: **Neil Ribe** (IPG Paris)
9:00 am - 9:40 am	**Martyn Drury** (Utrecht University) "Anisotropy and rheology of upper mantle rocks"
9:40 am - 10:00 am	Discussion
10:00 am	Coffee Break
10:30 am - 11:10 am	**Donna Blackman** (IGPP, Scripps Institution of Oceanography) "Tracking deformation of mantle minerals during regional mantle flow and insights available from seismic anisotropy"
11:10 am - 11:30 am	Discussion
11:30 am - 12:10 pm	**Einat Lev** (MIT) "Anisotropic viscosity in geodynamical flow models"
12:10 pm - 12:30 pm	Discussion
12:30 pm	Lunch
1:30 pm - 6:00 pm	Free Time
6:00 pm	Dinner
7:30 pm - 9:30 pm	**LOOKING FORWARD: FUTURE DIRECTIONS IN LINKING RHEOLOGY AND REACTIVE POROUS FLOW**
	Discussion Leader: **Wenlu Zhu** (University of Maryland)
7:30 pm - 8:10 pm	**Steven Karner** (ExxonMobil) "Coupled thermo-hydro-chemo-mechanical processes in crustal rocks: Future directions for applied research involving real-time rheologic constraints"
8:10 pm - 8:30 pm	Discussion
8:30 pm - 9:10 pm	**Peter Kelemen** (Lamont-Doherty Earth Observatory) "Chemical and physical feedback mechanisms during alteration of peridotite and the potential for enhanced, natural CO_2 sequestration in tectonically exposed mantle"
9:10 pm - 9:30 pm	Discussion
FRIDAY	
7:30 am - 8:30 am	Breakfast
9:00 am	Depart

Registration List		
Name	**Organization**	**Participation**
Greg Hirth	Brown University	Chair
David J. Prior	University Of Liverpool	Vice Chair
Brendan J. Meade	Harvard University	Discussion Leader
Neil M. Ribe	Institut De Physique Du Globe	Discussion Leader
Terry Tullis	Brown University	Discussion Leader
Douglas Wiens	Washington University	Discussion Leader
Sridhar Anandakrishnan	Pennsylvania State University	Speaker
Nick Beeler	Us Geological Survey	Speaker
Yehuda R. Ben-Zion	University Of Southern California	Speaker
Greg Beroza	Stanford University	Speaker
Donna Blackman	Igpp	Speaker
Roland Burgmann	University Of California, Berkeley	Speaker
Judith S. Chester	Texas A & M University	Speaker
Alex C. Copley	University Of Cambridge	Speaker
Colleen A. Dalton	Boston University	Speaker
Georg H. Dresen	Gfz-Potsdam	Speaker
Martyn Drury	Utrecht University	Speaker
David L. Goldsby	Brown University	Speaker
Neal Iverson	Iowa State University	Speaker
Stephen L. Karner	Exxonmobil Upstream Research Company	Speaker
Peter Kelemen	Columbia University	Speaker
Einat Lev	Massachusetts Institute Of Technoloy	Speaker
Susan Owen	Jet Propulsion Laboratory	Speaker
Erland M. Schulson	Dartmouth College	Speaker
Marshall I. Sundberg	Brown University	Speaker
Elodie Amiguet	Cnrs	Poster Presenter
Verity E. Borthwick	Stockholm University	Poster Presenter
Emily E. Brodsky	Uc Santa Cruz	Poster Presenter
Kevin Brown	University Of California	Poster Presenter
Linda J. Chernak	Brown University	Poster Presenter
Anne B. Davaille	Cnrs/ University Paris6 And Paris 11	Poster Presenter
Yaron Finzi	Ubc	Poster Presenter
Donald W. Forsyth	Brown University	Poster Presenter
Florian Fusseis	University Of Western Australia	Poster Presenter
Jafar Hadizadeh	University Of Louisville	Poster Presenter
Lars N. Hansen	University Of Minnesota	Poster Presenter
David Healy	Curtin University Of Technology	Poster Presenter
Thomas H. Heaton	California Institute Of Technology	Poster Presenter
Ben Holtzman	Ldeo, Columbia University	Poster Presenter
Caleb W. Holyoke	Texas A&M University	Poster Presenter

Janelle M. Homburg	Columbia University/Ldeo	Poster Presenter
Justin W. Hustoft	Yale University	Poster Presenter
Ian Jackson	Research School Of Earth Sciences	Poster Presenter
Yoshihiro Kaneko	California Institute Of Technology	Poster Presenter
Shun-Ichiro Karato	Yale University	Poster Presenter
Steven B. Kidder	California Institute Of Technology	Poster Presenter
Daniel S. King	University Of Minnesota	Poster Presenter
Hongbo Long	Stony Brook University	Poster Presenter
Luca Menegon	University Of Padova	Poster Presenter
Jun Muto	Brown University	Poster Presenter
Arben Pitarka	Urs Corporation	Poster Presenter
Andrew P. Rathbun	Penn State University	Poster Presenter
Amir Sagy	Geological Survey Of Israel	Poster Presenter
Jon E. Samuelson	Pennsylvania State University	Poster Presenter
Andrew D. Schneider	University Of Oregon	Poster Presenter
Colin A. Shaw	Montana State University	Poster Presenter
Philip A. Skemer	Brown University	Poster Presenter
Audrey Tison	Ruhr Universitat Bochum	Poster Presenter
Victor C. Tsai	Harvard University	Poster Presenter
Sergio Vinciguerra	Istituto Nazionale Di Geofisica E Vulcanologia	Poster Presenter
Jessica M. Warren	Carnegie Institution Of Washington	Poster Presenter
Neta Wechsler	University Of Southern California	Poster Presenter
Shijie Zhong	University Of Colorado	Poster Presenter
Wei Zhu	Suny At Stony Brook	Poster Presenter
Mandy Braatz	Ruhr-University Bochum, Germany	Attendee
Misha J. Bystricky	Universite De Toulouse	Attendee
Reid F. Cooper	Brown University	Attendee
William B. Durham	Massachusetts Institute Of Technology	Attendee
Brian Evans	Mass. Inst. Tech.	Attendee
Lindsay L. Farrell	Rice University	Attendee
Brad Hager	Mit	Attendee
David L. Kohlstedt	University Of Minnesota	Attendee
Andreas Kronenberg	Texas A&M University	Attendee
John M. Logan	University Of Oregon	Attendee
Matteo Maggi	"Alma Mater Studiorum" University Of Bologna	Attendee
Elisabeth S. Nadin	California Institute Of Technology	Attendee
Mervyn S. Paterson	Australian National University	Attendee
Alan W. Rempel	University Of Oregon	Attendee
Jim R. Rice	Harvard University	Attendee
Allan M. Rubin	Princeton University	Attendee
Brandon Schmandt	University Of Oregon	Attendee
Stephen E. Schneider	University Of Minnesota	Attendee

Ayako Suzuki	University Of Minnesota	Attendee
Jan Tullis	Brown University	Attendee
Nicholas J. Van Der Elst	University Of California, Santa Cruz	Attendee
Yun Wang	Brown University	Attendee
Joseph C. White	University Of New Brunswick	Attendee
Nicholas B. Woodward	Us Department Of Energy	Attendee
Wenlu Zhu	University Of Maryland	Attendee