

Introduction to the Rheology of Solid Earth

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Class Meetings

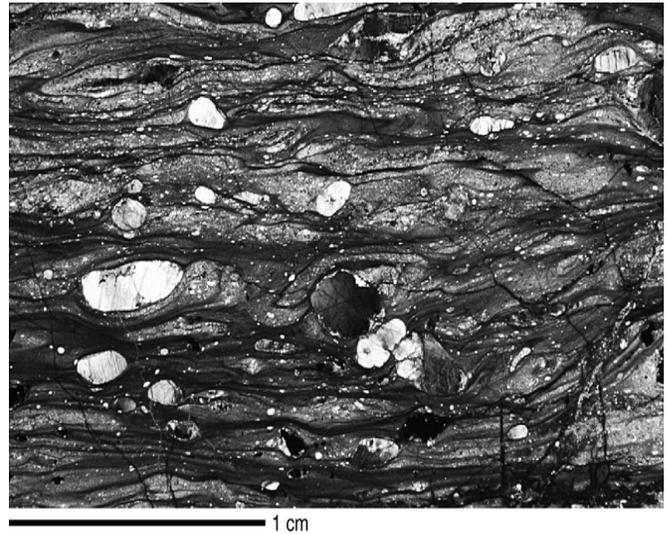
Mo, Wed: 11.00am-12.20pm

Location

IGPP Revelle Conference Room 4301

Course name

SIOG261



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Why Study the Rheology of Solid Earth?

Mineral and Rock Physics is a key component in understanding numerous geological processes that shape the Earth's surface and interior. It combines concepts and principles from geology, geophysics, petrology, and material science. Our knowledge of rheology has significantly improved

over the last 30 years, mainly through experimental studies, providing new insights on Earth deformation and dynamics. Rock physics is needed to characterize reservoirs imaged by geophysical data, and to build mechanical earth models for understanding the planet's interior.

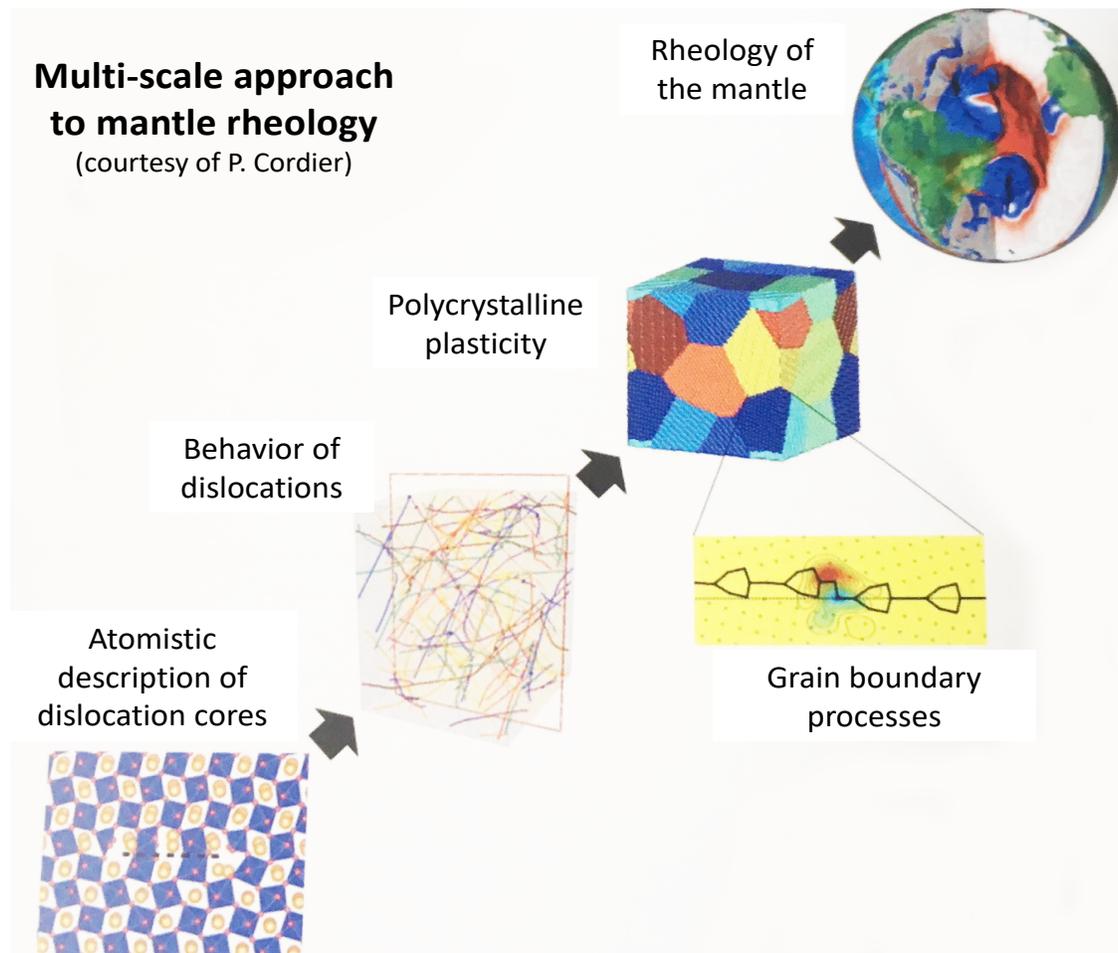
Essential Questions

- What are the deformation mechanisms involved in long-term geological processes, such as plate tectonics and mantle convection?
- What are the experimental techniques used to study rock physics?
- What does rheology teach us about the Earth's mantle?

Course Description

This course provides a framework for understanding the intrinsic properties of rocks, such as mineralogy, diffusion, and deformation (strain, stress, elasticity, anisotropy). It explores fundamental aspects of geological processes (plate tectonics, mantle convection) with an emphasis on rock deformation. The course follows a change in scale: from micro-scale processes, to rock-scale mechanisms (and how they relate to microscopic properties), to planet-scale considerations. A variety of applications and real data examples are presented.

Undergrads students won't be graded the same way as graduate students because expectations are different.



Course Schedule

Week	Topics
1	Introduction (basic concepts, mechanical behavior of rocks)
2	Defects and plastic deformation in solids
3	Techniques (experiments, modeling) (<i>1/20 is a holiday</i>)
4	Deep Earth interior
5	Dislocation glide in Earth's mantle minerals
6	Creep in Earth's mantle minerals
7	Grain boundaries I (<i>2/17 is a holiday</i>)
8	<i>Syntheses presentations</i>
9	Grain boundaries II, Implications for the shallow and deep mantles I
10	Implications for the shallow and deep mantles II
11	<i>Final exam (3/16)</i>

Course Grade

HW (not every week): 10%
Synthesis: 40%
Final exam: 50%
Extra credit: +2%

To Succeed in this Course

- Meet assignment deadlines and requirements
- Ask questions, whether they are content or skill related, further your thinking, be curious
- Take responsibility for your learning

Main Learning Goals of this Course

- Students will be familiar with rheological properties of the Earth's interior
- Students will know the principles of diffusion theory and understand the main deformation mechanisms
- Students will think more critically about the deep Earth's interior in terms of structure and dynamics
- Students will develop skills in expressing themselves orally and in writing