Ductile Deformation

Plastic deformation of crystalline materials

- Atomic bonds must be rearranged without breaking the integrity of the rock
- Plastic strength of real rocks is LESS than that predicted by theory for perfect crystals
- **Crystal Defects** permit plastic deformation

Crystal Defects

- Impurities
- Vacancies
- Dislocations

Dislocations

- Lines of missing bonds

Dislocations under a microscope

How can solid rock flow like taffy?

Marecys Nappe, Swiss Alps
Movement of Dislocations
- Only one row of bonds breaks at a time
- Movement is controlled by crystallographic planes

Plastic Deformation Experiment
- Uses mothballs (Octochloropropane)
- Experiment lasted 19 hours at room temperature.
- Behavior is similar to Quartz in the middle crust
Deformation Mechanism Map for Quartz