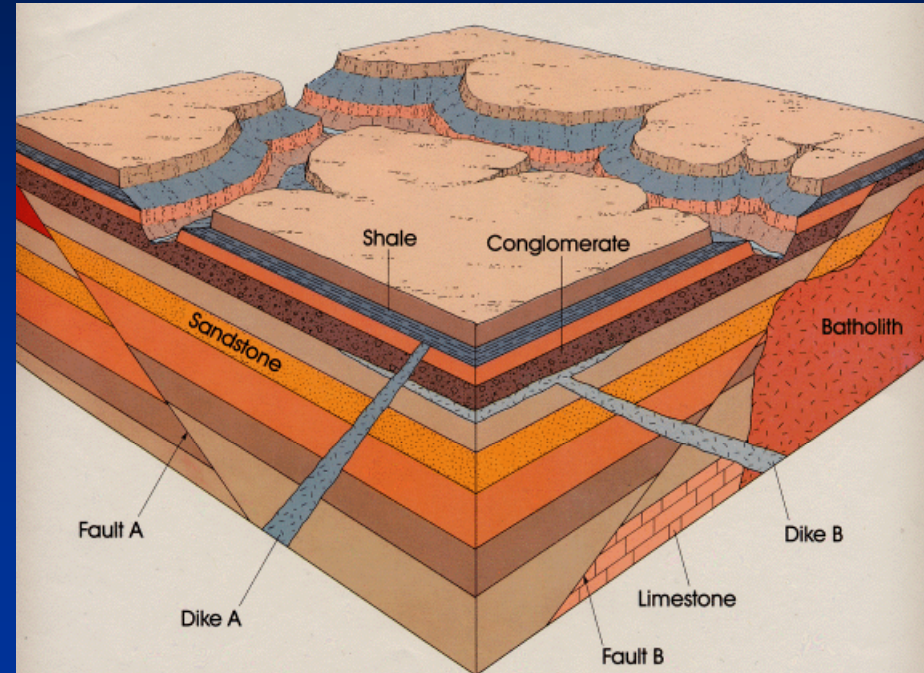


Geology Maps Lab



- EOSC105
Laboratory

Ray Rector: Instructor



Some General Geologic Terms of Structure

Outcrop: Exposure of bedrock at earth's surface



Formation: mappable body of rock with definite age, lithology, and external boundaries (contacts)



Contact: Boundary between adjacent rock bodies or structural elements



Some General Geologic Terms of Structure

Fold: Layered rock units that are bent



Fault: A planar disruption between adjacent blocks of rock with



Contact: Boundary between adjacent rock bodies or structural elements



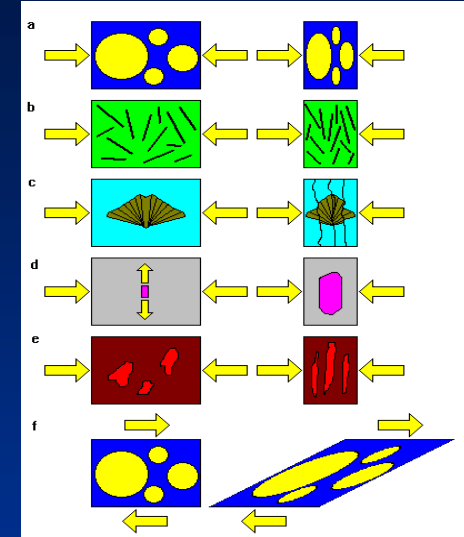
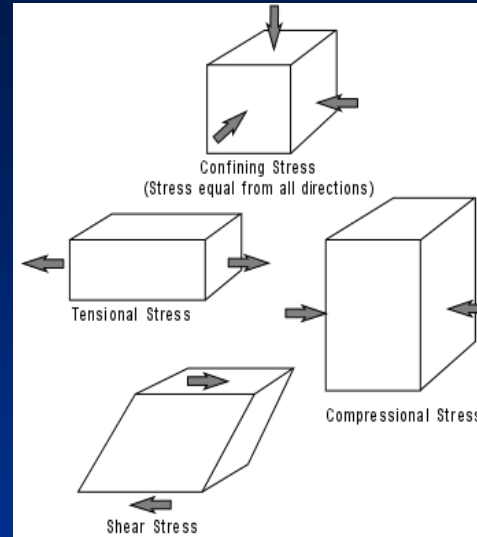
Origin and Nature of Rock Deformation

A. Stress Leads to Strain

- ✓ Stress is an applied force over an area
- ✓ Strain is the deformation of a solid body

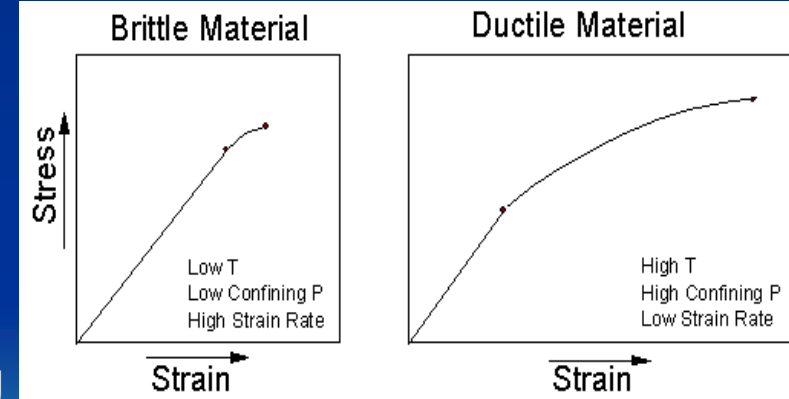
B. Different Types of Stress

- ✓ Tensional = pulling apart forces
- ✓ Compressional = pushing together forces
- ✓ Shear = grinding past each other force



C. Different Types of Strain

- ✓ Brittle = breaking into pieces
- ✓ Ductile = changing shape without breaking
- ✓ Elastic = deformed body returns to normal shape after stress released
- ✓ Plastic = deformed body remains deformed after stress released



Rocks strain in a predictable fashion, according to the amount and duration of strain under a given set of temperature-pressure conditions

Resultant Rock Strain from Specific Stresses

A. Undeformed Strata

- ✓ Original Horizontal layering

B. Compressional Stresses

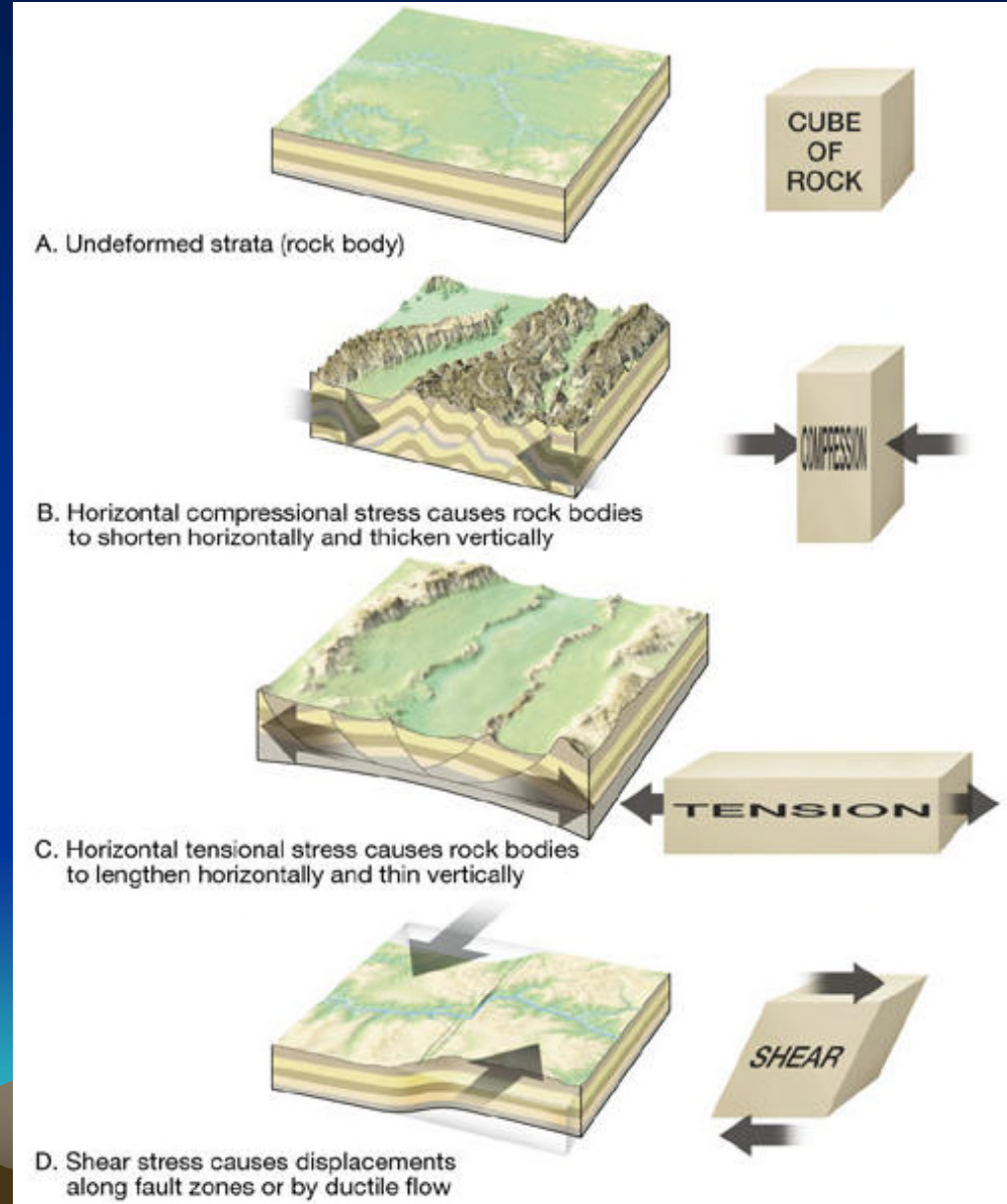
- ✓ Shorten horizontally
- ✓ Thicken vertically
- ✓ Folding and Reverse Faulting

C. Tensional Stresses

- ✓ Lengthen horizontally
- ✓ Thin vertically
- ✓ Tilting and Normal Faulting

D. Shear Stresses

- ✓ Lateral displacement
- ✓ Strike-slip Faulting



Resultant Rock Strain from Specific Stresses

A. Undeformed Strata

- ✓ Original Horizontal layering

B. Tensional Stresses

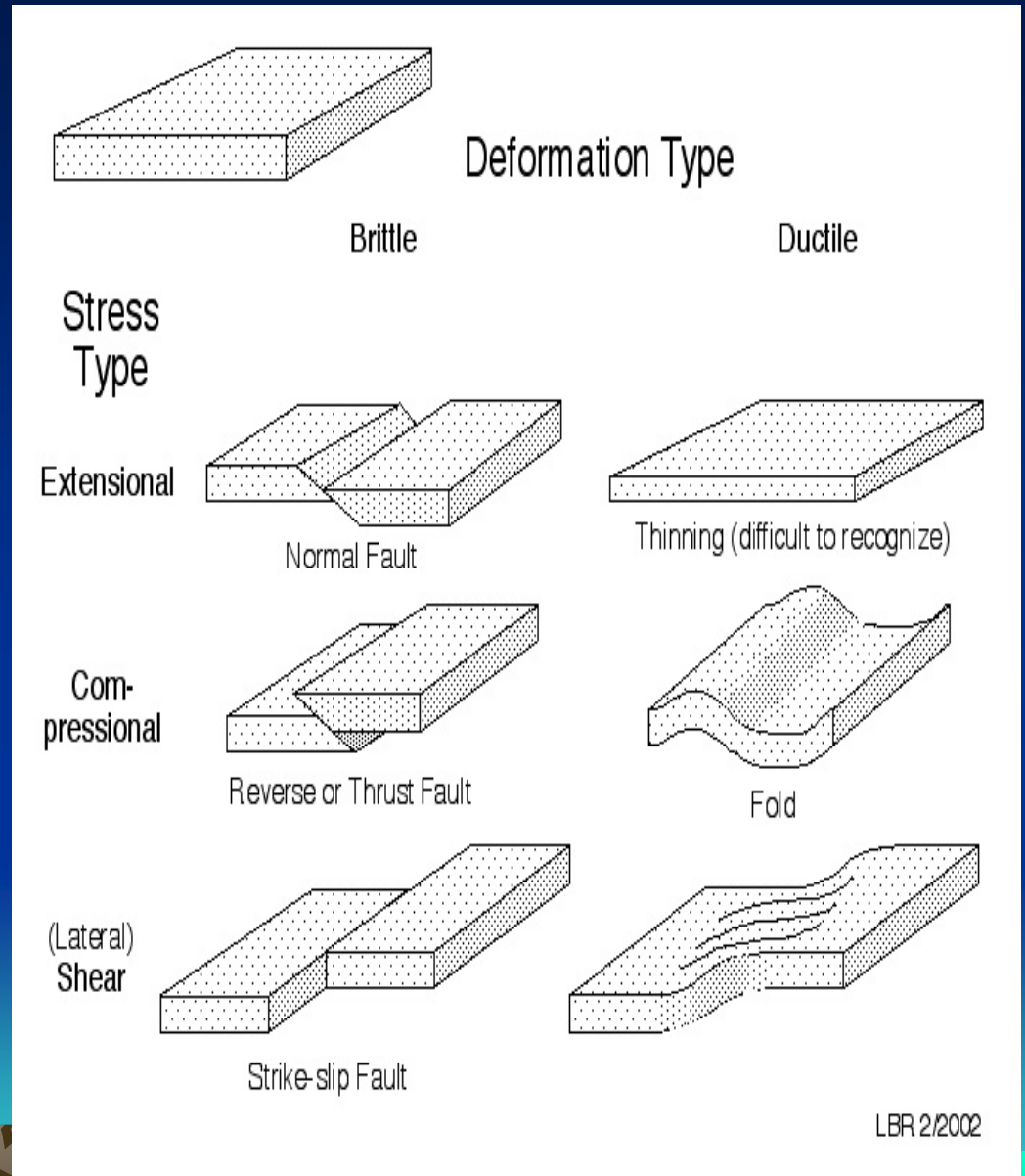
- ✓ Lengthen horizontally
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C. Compressional Stresses

- ✓ Shorten horizontally
- ✓ Thicken vertically
- ✓ Folding and Reverse Faulting

D. Shear Stresses

- ✓ Lateral displacement
- ✓ Strike-slip Faulting



Geologic Structures



Rock Layering



Tilted Rock Layers



Folded Rock Layers

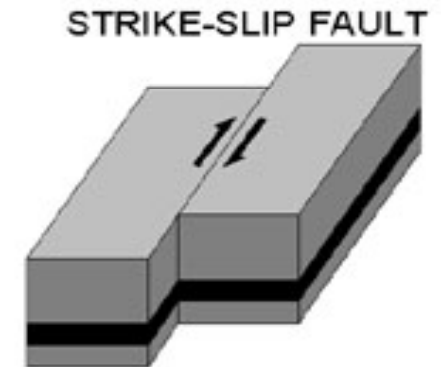
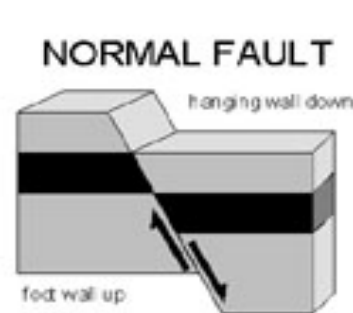
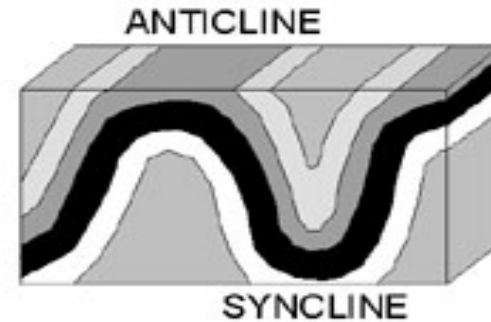


Faulted Rock Layers

Folds and Faults



Landform Slides



General Geologic Terms of Folds

Folds: Buckled layers of rock formed by compressive stresses

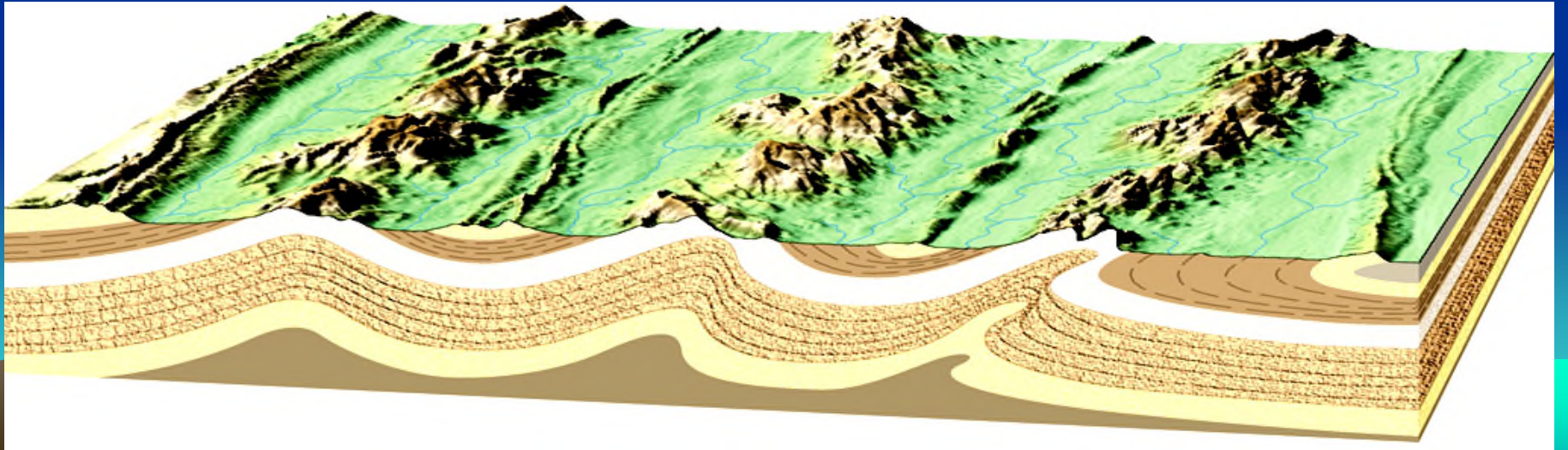
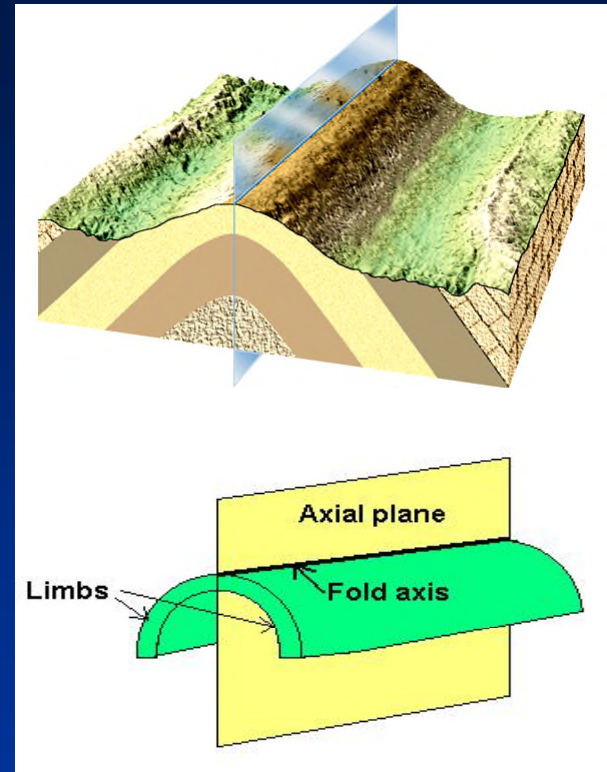


Anticline: Upwards-buckled fold with oldest rock at center and outward-dipping limbs

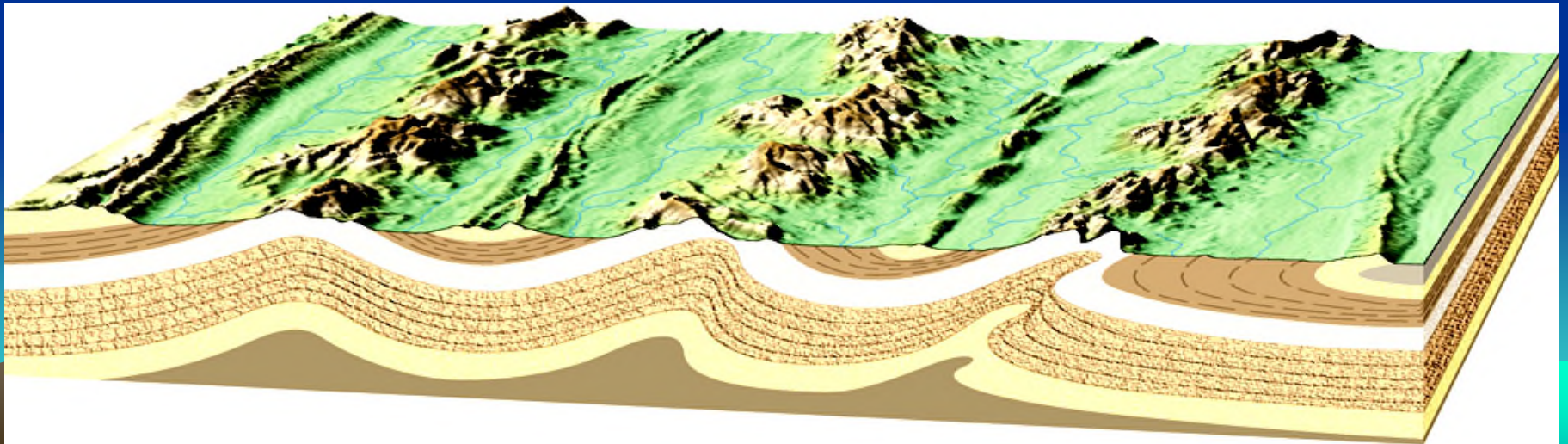
Syncline: Downwards-buckled fold with oldest rock at center and outward-dipping limbs



Fold Basics

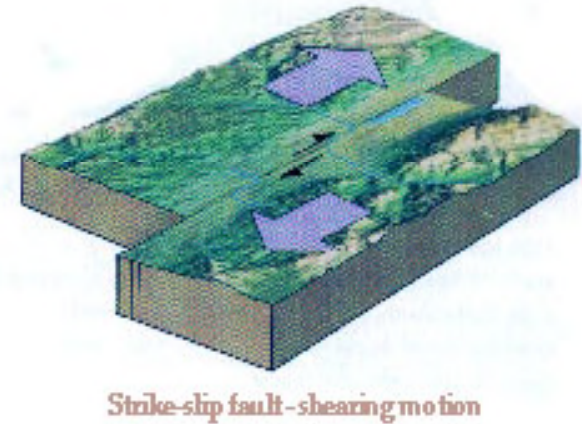
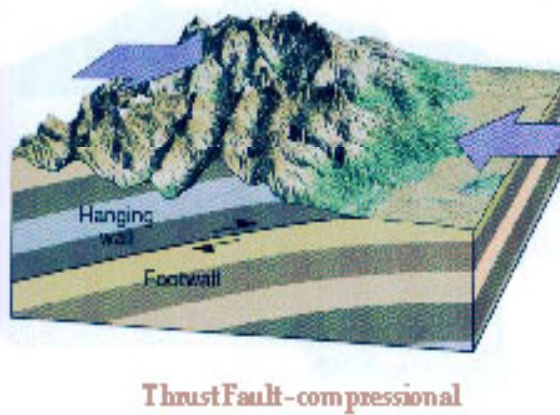
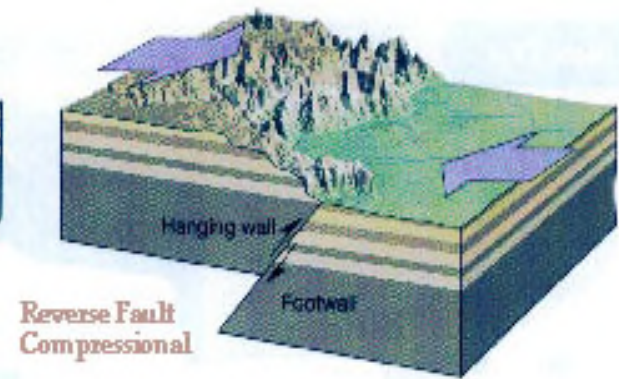
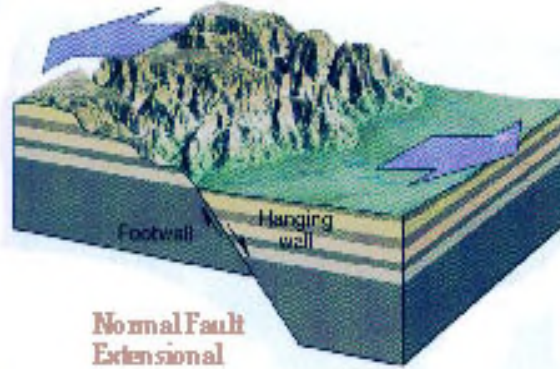
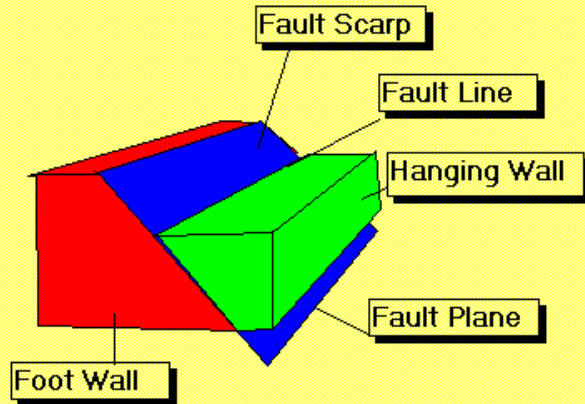


Fold Basics

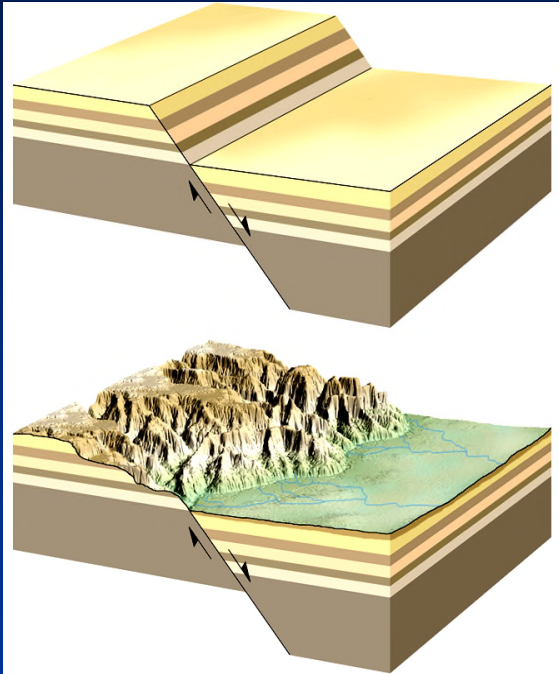


Fault Terminology

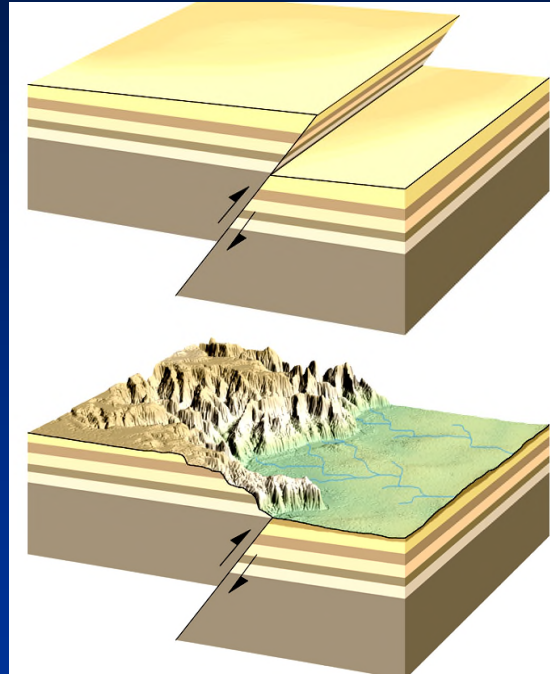
Features of Faults



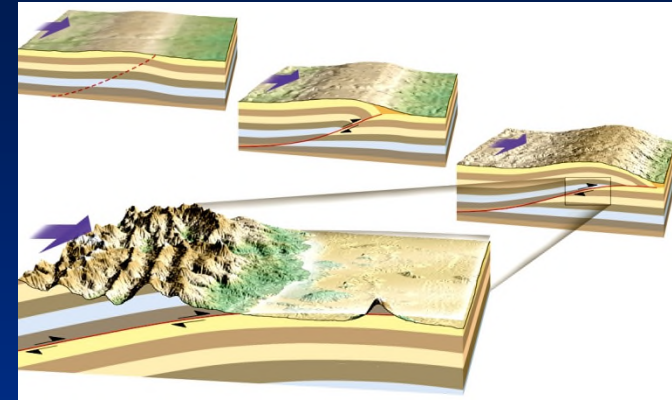
Types of Faults



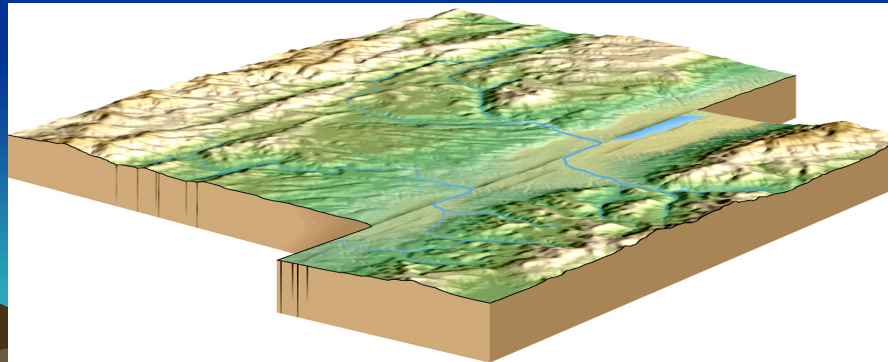
Normal Fault



Reverse Fault



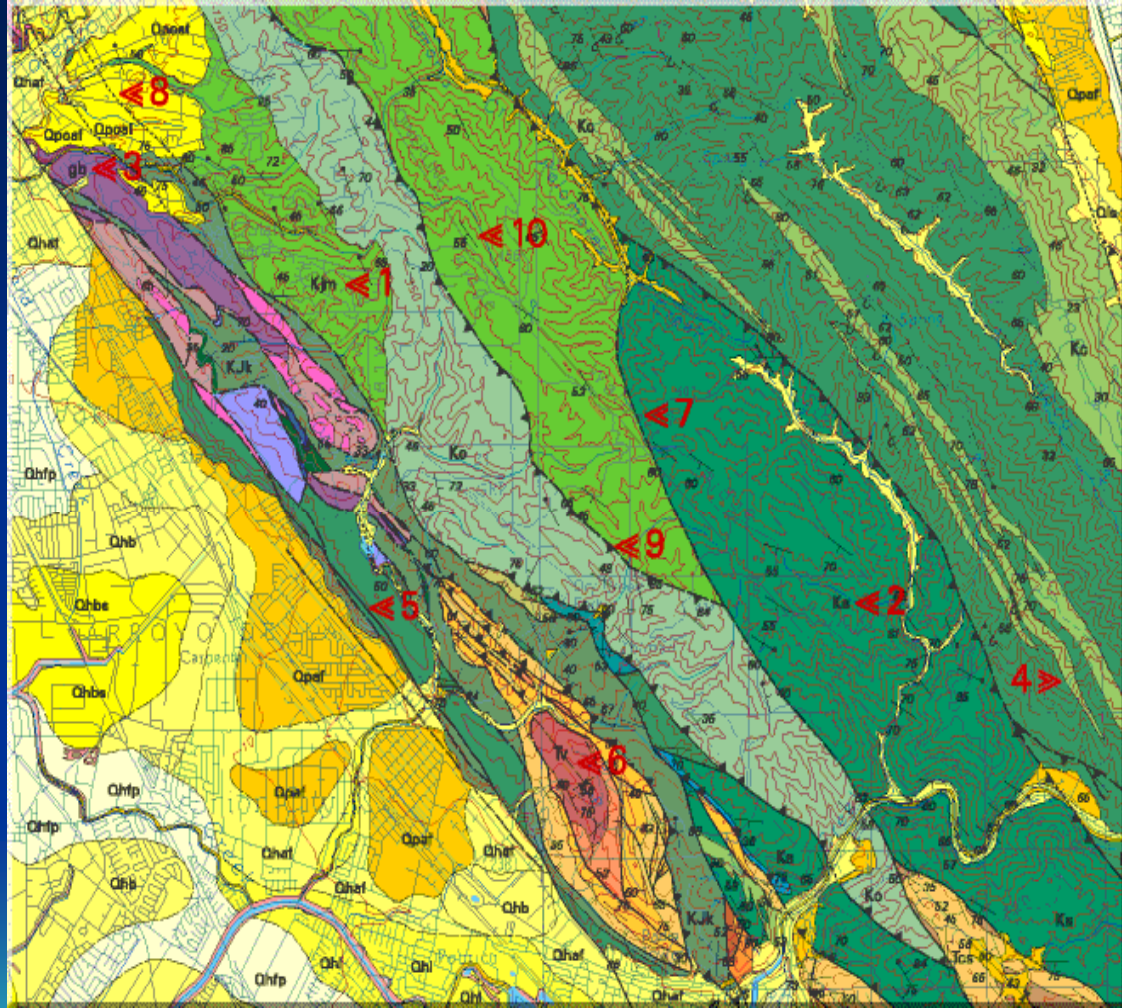
Thrust Fault



Strike-Slip Fault

What is a Geology Map

- 1) A map that displays the types of rocks and sediment exposed at the surface
- 2) Displays the spatial orientation of rock units and rock structures like folds and faults.
- 3) Geology information is typically overlain on a topographic base map



Geology Map Key or Explanation

1) The map key lists and explains the geologic rock formations and the structural symbols

- ✓ Rock Names
- ✓ Rock Types
- ✓ Rock Ages
- ✓ Contacts
- ✓ Strike and Dip
- ✓ Faults and Folds

MAP KEY	
 af - Artificial Fill (Historic)	 Contact
 alf - Artificial Levee Fill (Historic)	 Contact, approximately located
 Qhuf - Alluvial Fan Deposits (Holocene)	 Contact, inferred
 Qhfp - Floodplain Deposits (Holocene)	 Contact, concealed
 Qhfb - Flood Basin Deposits (Holocene)	 Fault
 Qhbs - Salt Affected Flood Basin Deposits (Holocene)	 Fault, approximately located
 Qhl - Natural Levee Deposits (Holocene)	 Fault, inferred
 Qpaf - Alluvial Fan Deposits (Pleistocene)	 Fault, uncertain
 Qpof - Older Alluvial Fan Deposits (Pleistocene)	 Fault, concealed
 Tv - Unnamed volcanic rocks (Miocene)	 Fault, concealed and uncertain
 Tor - Orinda conglomerate (Miocene)	 Oblique fault with thrust or reverse component
 Tbr - Briones sandstone (Miocene)	 Oblique fault with thrust or reverse component, approximately located
 Tt - Tice shale (Miocene)	 Oblique fault with thrust or reverse component, inferred
 Tcs - Claremont shale (Miocene)	 Oblique fault with thrust or reverse component, uncertain
 Ts - Sobrante sandstone (Miocene)	 Strike and dip of bedding
 Tsh - Unnamed shale and sandstone (Miocene)	 Strike and dip of overturned bedding
	 Strike and dip of vertical bedding

2) Each rock unit has a unique letter symbol and is color-coded

3) Map key is vital to understanding the accompanying geology map

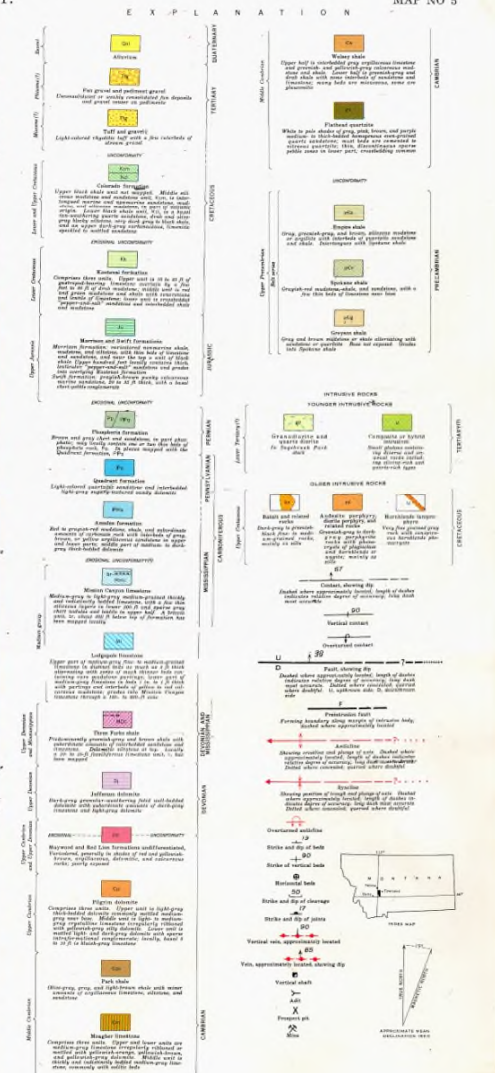
Geologic Maps – Devil's Fence Quad



Scale 1:31,250

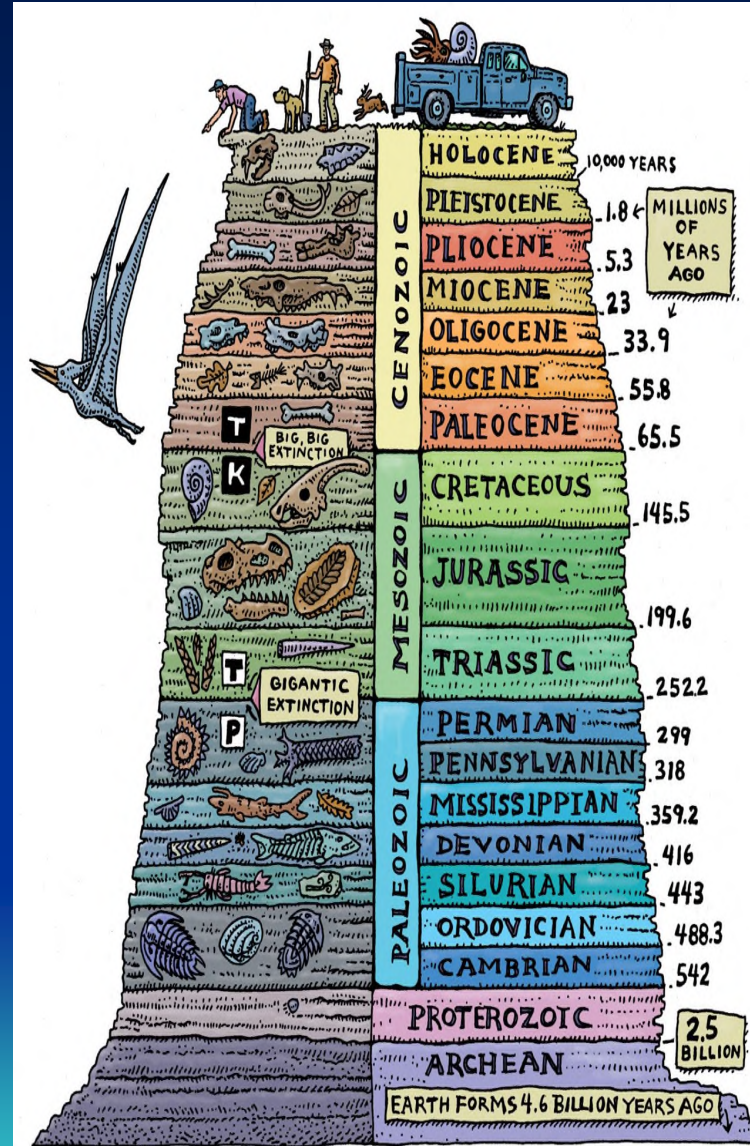
2 Miles Contour interval 40 feet
Datum is mean sea level

Base from U. S. Geological Survey from map of Devils Fence quadrangle, Montana.



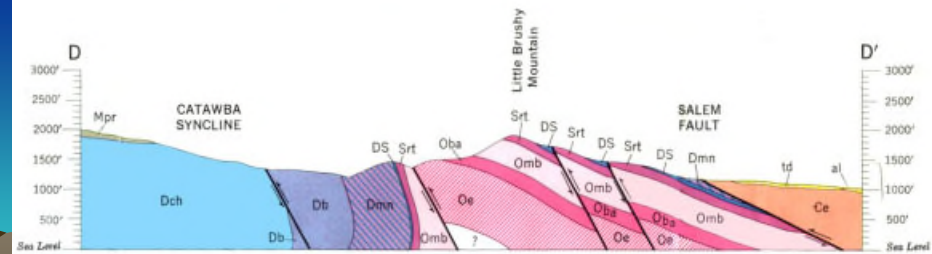
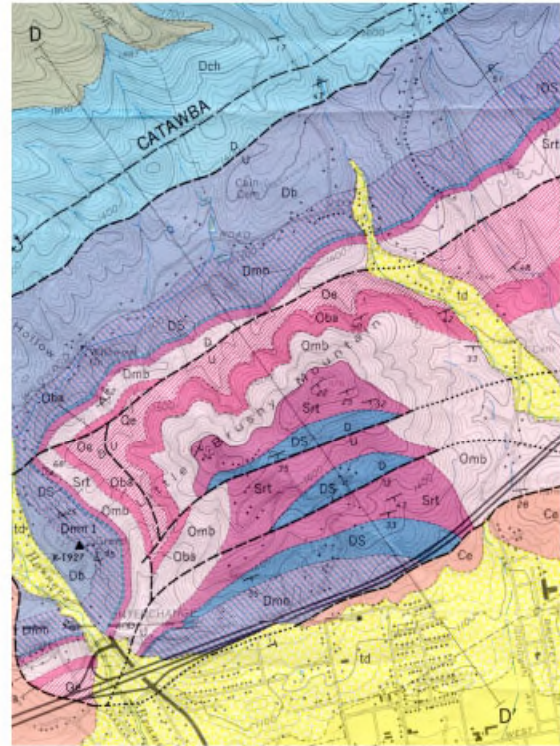
Rock Formations and Geologic Time

- 1) All geologic rock formations have a specific assigned age
- 2) All geologic rock formations have a specific range of lithology
- 3) Rock formations are listed in a temporally-ordered sequence in the “explanation” of a geologic map
- 4) Each rock formations has an assigned geologic period
- 5) Geologic period assignments of formations are further divided into lower (older), middle, and upper (younger)



Rock Formations and Contacts on a Geologic Map

- 1) Rock formations, contacts and structural elements are illustrated in a geologic map and cross sections
- 2) A geology map depicts the types of rock that crop out at the earth's surface over a given area of the earth, including the type of contact between adjacent rock formations.
- 3) Contacts types include depositional, erosional, intrusion, and tectonic/fault

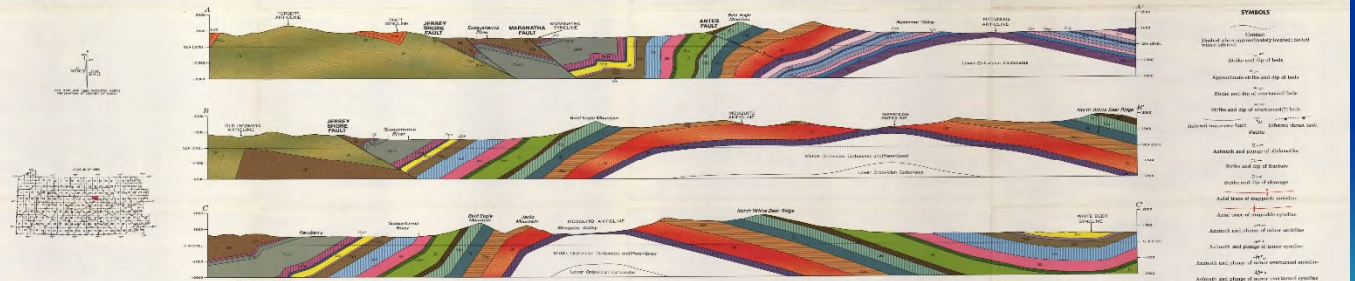
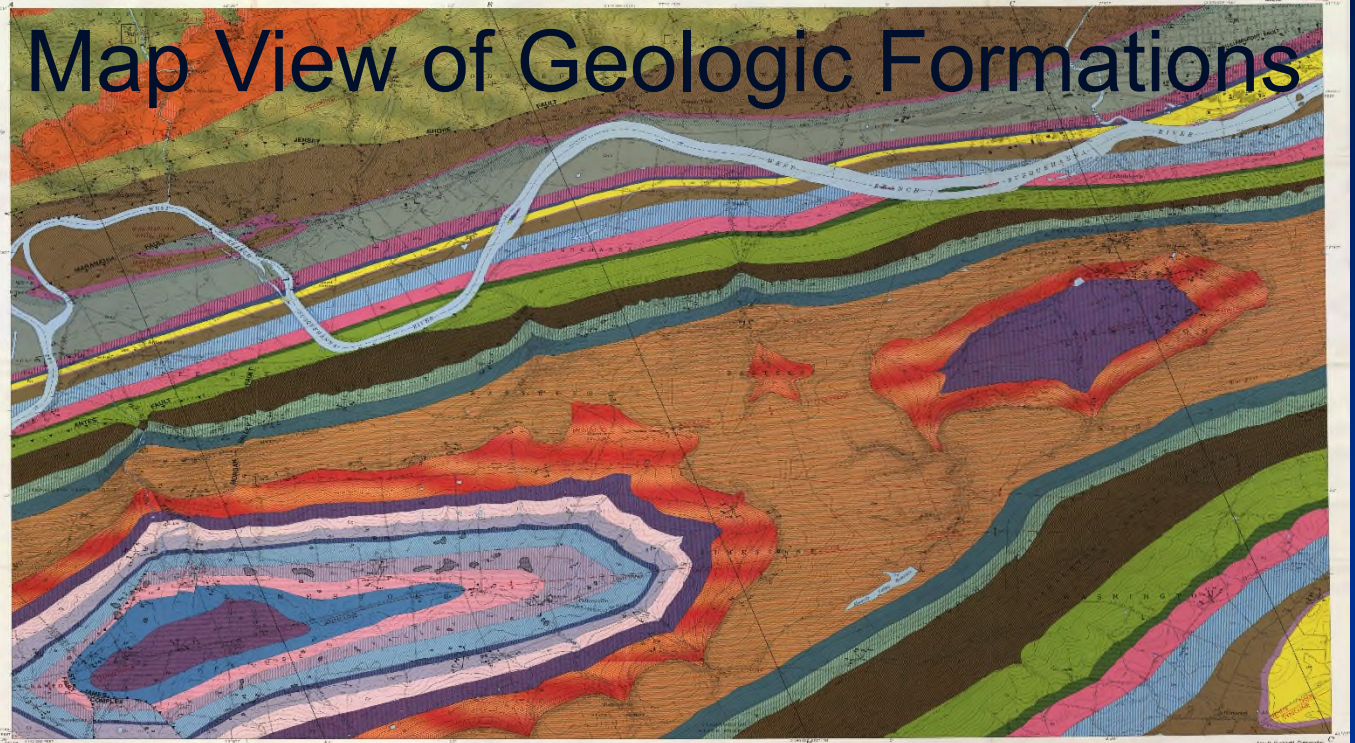


A Complete Geologic Map

Formation Explanation

LITHOLOGIC AND MINERALOGIC CHARACTERISTICS	BEDROCK UNITS	ENVIRONMENTAL CHARACTERISTICS
CONGLOMERATE Conglomerate, sandstone, shale, and siltstone. The conglomerate is composed of rounded pebbles of quartz, feldspar, and other minerals in a matrix of sand and silt. The sandstone is composed of sand grains cemented together. The shale is composed of thin layers of clay and silt.	CONGLOMERATE Conglomerate, sandstone, shale, and siltstone.	CONGLOMERATE Conglomerate, sandstone, shale, and siltstone. The conglomerate is composed of rounded pebbles of quartz, feldspar, and other minerals in a matrix of sand and silt. The sandstone is composed of sand grains cemented together. The shale is composed of thin layers of clay and silt.
SANDSTONE Sandstone, shale, and siltstone. The sandstone is composed of sand grains cemented together. The shale is composed of thin layers of clay and silt. The siltstone is composed of silt grains cemented together.	SANDSTONE Sandstone, shale, and siltstone.	SANDSTONE Sandstone, shale, and siltstone. The sandstone is composed of sand grains cemented together. The shale is composed of thin layers of clay and silt. The siltstone is composed of silt grains cemented together.
SILTSTONE Siltstone, shale, and sandstone. The siltstone is composed of silt grains cemented together. The shale is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together.	SILTSTONE Siltstone, shale, and sandstone.	SILTSTONE Siltstone, shale, and sandstone. The siltstone is composed of silt grains cemented together. The shale is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together.
SHALE Shale, sandstone, and siltstone. The shale is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	SHALE Shale, sandstone, and siltstone.	SHALE Shale, sandstone, and siltstone. The shale is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
QUARTZITE Quartzite, sandstone, and siltstone. The quartzite is composed of quartz grains cemented together. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	QUARTZITE Quartzite, sandstone, and siltstone.	QUARTZITE Quartzite, sandstone, and siltstone. The quartzite is composed of quartz grains cemented together. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
GNEISS Gneiss, sandstone, and siltstone. The gneiss is composed of alternating layers of quartz, feldspar, and mica. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	GNEISS Gneiss, sandstone, and siltstone.	GNEISS Gneiss, sandstone, and siltstone. The gneiss is composed of alternating layers of quartz, feldspar, and mica. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
SLATE Slate, sandstone, and siltstone. The slate is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	SLATE Slate, sandstone, and siltstone.	SLATE Slate, sandstone, and siltstone. The slate is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
PHYLLITE Phyllite, sandstone, and siltstone. The phyllite is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	PHYLLITE Phyllite, sandstone, and siltstone.	PHYLLITE Phyllite, sandstone, and siltstone. The phyllite is composed of thin layers of clay and silt. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
MICA-SCHIST Mica-schist, sandstone, and siltstone. The mica-schist is composed of alternating layers of mica and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	MICA-SCHIST Mica-schist, sandstone, and siltstone.	MICA-SCHIST Mica-schist, sandstone, and siltstone. The mica-schist is composed of alternating layers of mica and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
AMPHIBOLITE Amphibolite, sandstone, and siltstone. The amphibolite is composed of alternating layers of amphibole and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	AMPHIBOLITE Amphibolite, sandstone, and siltstone.	AMPHIBOLITE Amphibolite, sandstone, and siltstone. The amphibolite is composed of alternating layers of amphibole and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
DIORITE Diorite, sandstone, and siltstone. The diorite is composed of alternating layers of diorite and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	DIORITE Diorite, sandstone, and siltstone.	DIORITE Diorite, sandstone, and siltstone. The diorite is composed of alternating layers of diorite and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.
GRANITE Granite, sandstone, and siltstone. The granite is composed of alternating layers of granite and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.	GRANITE Granite, sandstone, and siltstone.	GRANITE Granite, sandstone, and siltstone. The granite is composed of alternating layers of granite and quartz. The sandstone is composed of sand grains cemented together. The siltstone is composed of silt grains cemented together.

Map View of Geologic Formations

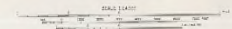


Cross Sections of Formations

LINDEN AND WILLIAMSPORT QUADRANGLES, LYCOMING COUNTY, PENNSYLVANIA

By
RODGER T. FALL and RICHARD B. WELLS

1977

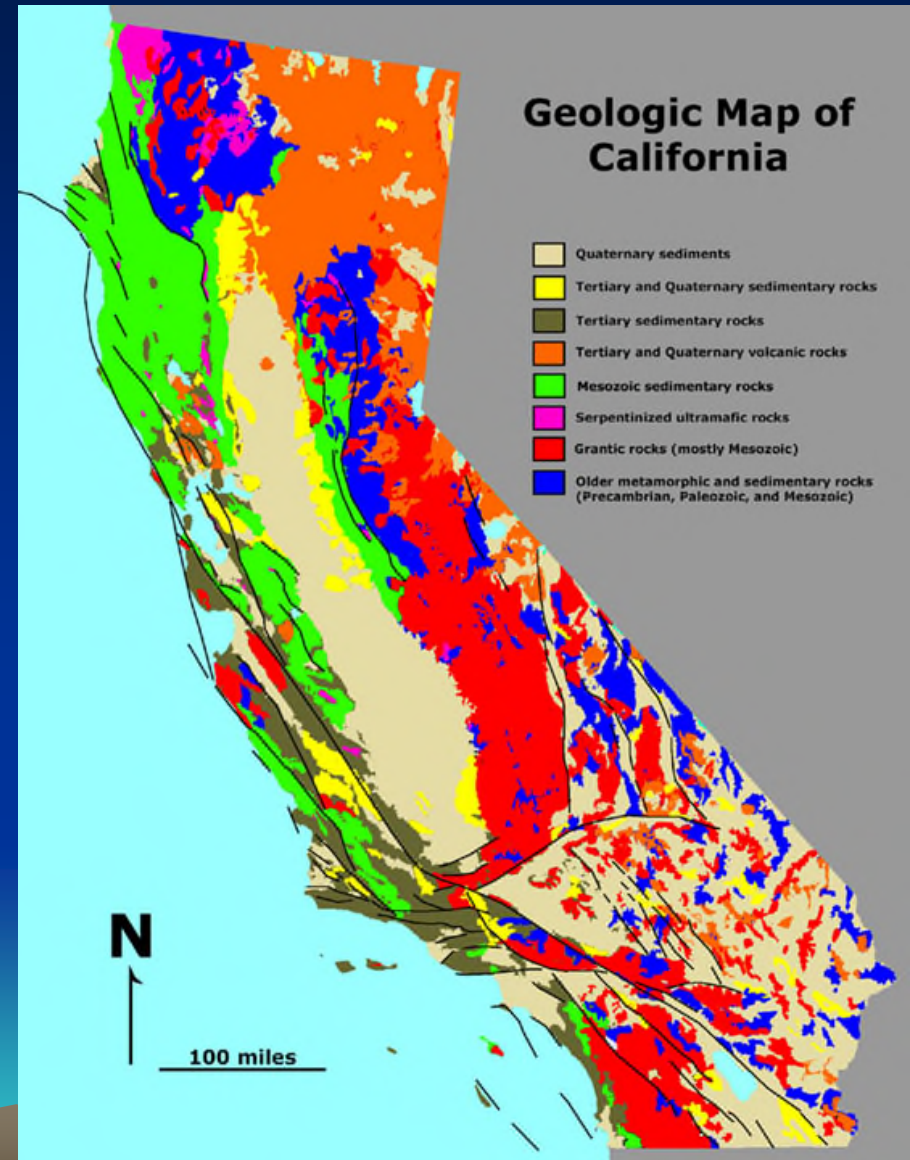


Usefulness of Geology Maps

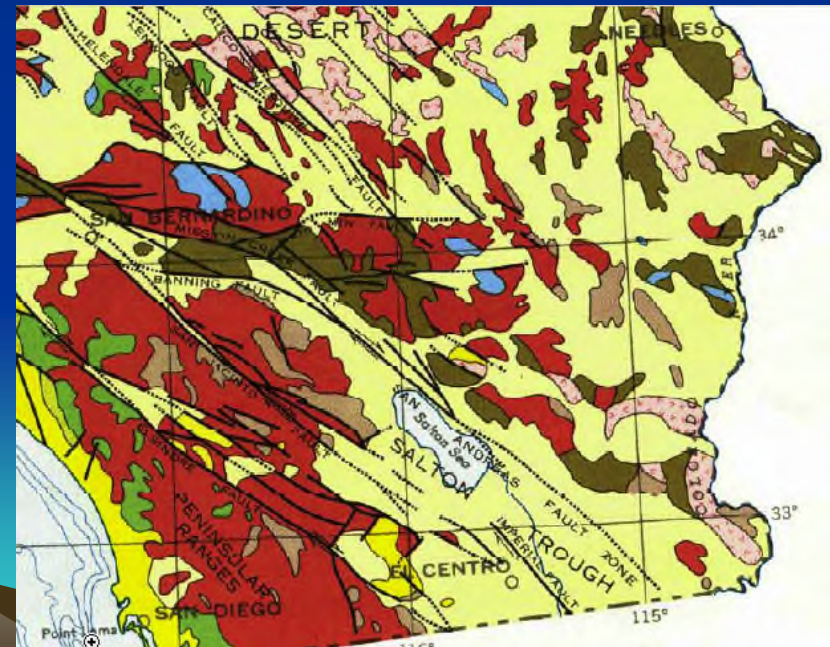
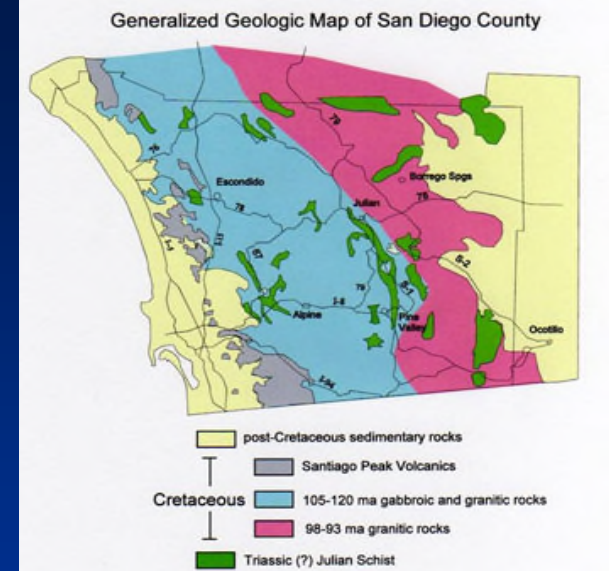
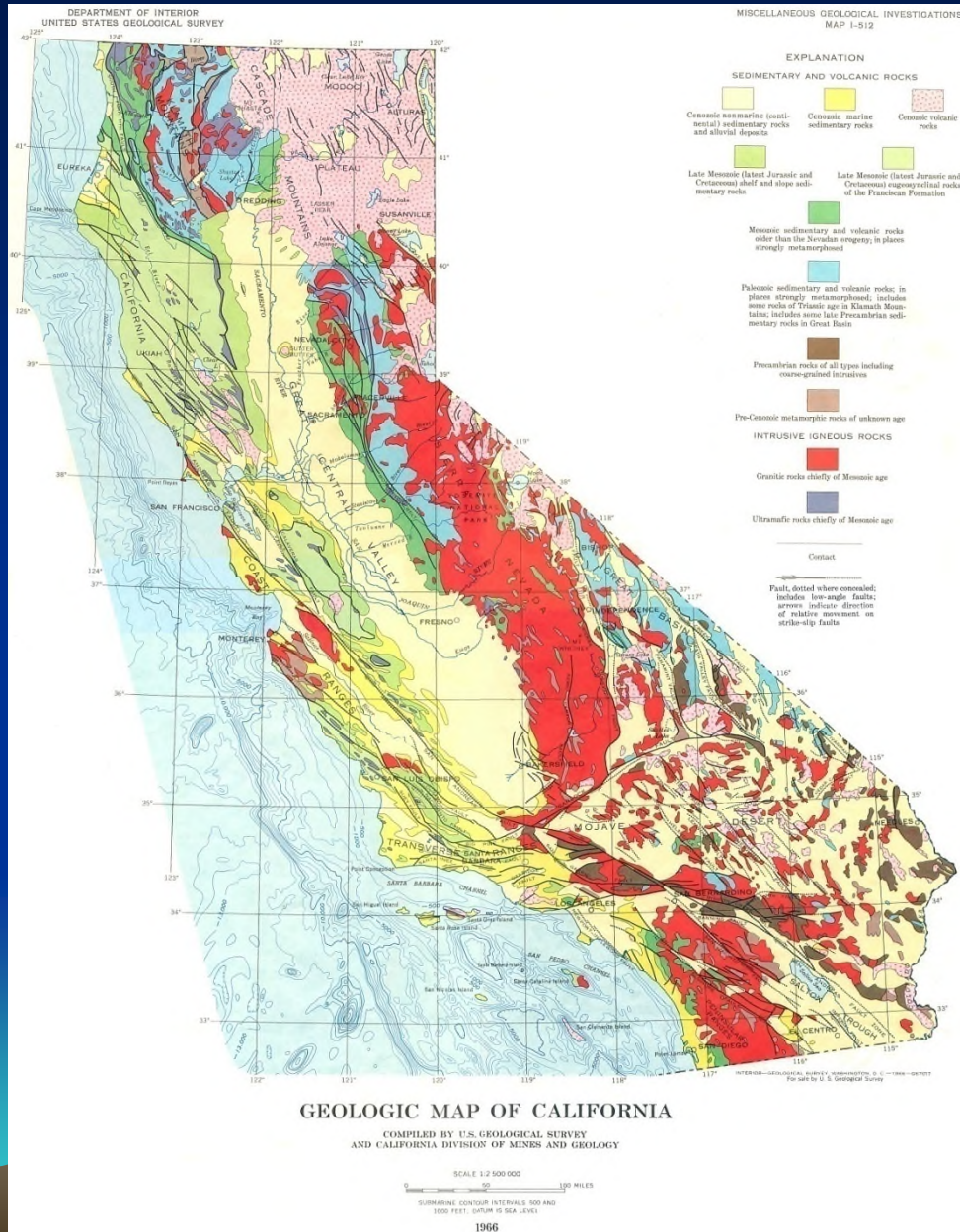
1) Geology maps have many vital uses:

- ✓ Mineral Prospecting
- ✓ Engineering
- ✓ Faulting/Earthquakes
- ✓ Natural Hazards
- ✓ Historical geology
- ✓ Landform studies

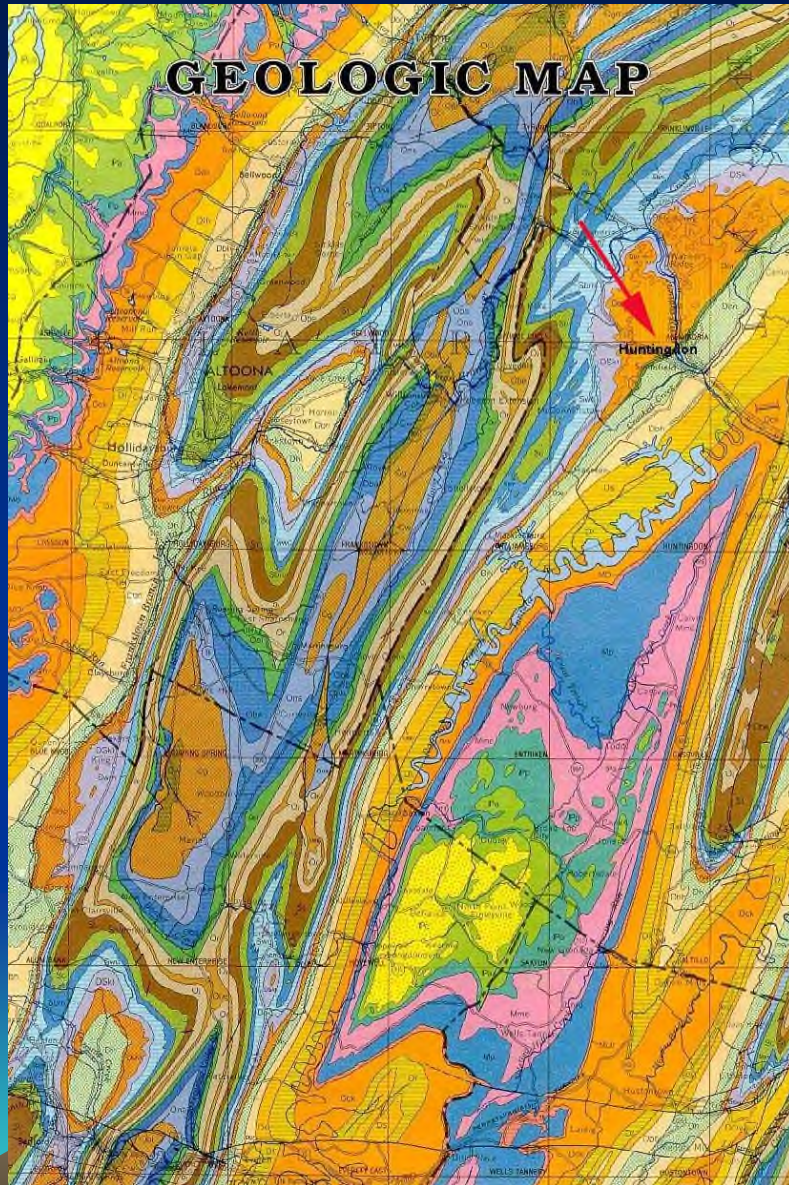
2) Geology maps are even useful when buying a home. Why?



Geologic Maps of California



Geologic Maps – Artwork?



Union County Geology

The map below is a scan from the Geologic Map of Pennsylvania (1980) focusing on Union County. The location of Bucknell University is represented by the green circle located along the eastern portion of the map. Descriptions for the rock types have been modified from the original map to more accurately describe the geology of the Union County area (from mapping by Dr. Richard P. Nickelsen, Bucknell University).

EXPLANATION FOR THE ROCK TYPES IN THE LEWISBURG AREA

Dh Hamilton Group

Gray, brown and olive shale, siltstone; marine fossils; char. by coarsening upward cycles. Black carbonaceous shale with Tioga Bentonite at base.

Doo Onondaga and Old Port Formations

Gray calcareous shale; argillaceous limestone; marine fossils. Dark gray chert interbedded with calcareous shale and limestone; very fossiliferous.

Dskt Keyser and Tonoloway Formations

Gray coarse-grained limestone; highly fossiliferous. Gray, fine-grained platy limestone; poorly fossiliferous.

Swc Willis Creek Formation

Greenish gray shale, mudstone and minor limy beds; all rock types limy; unfossiliferous.

Sbm Bloomsburg and Mifflintown Formations

Red sandstone, shale and mudstone. Gray shaly fossiliferous limestone; dark gray shale; coarse calcareous sandstone.

Sc Clinton Group (mostly Rose Hill Fm.)

Greenish gray shale with interbeds of lt. gray sandstone; highly fossiliferous in places. Includes ferruginous sandstone.

Continued at bottom right...

