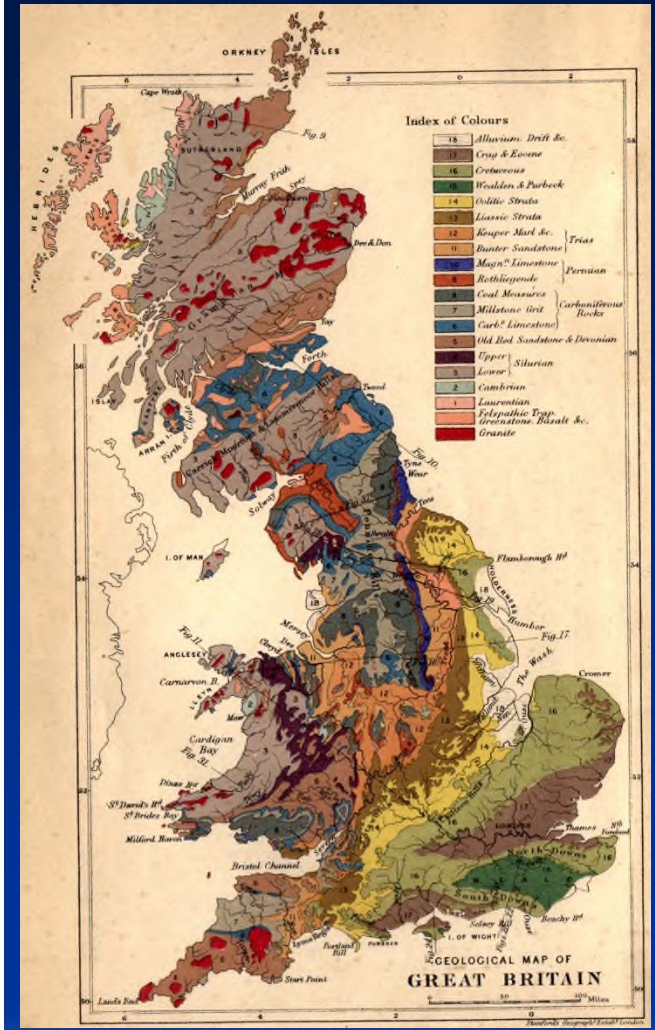
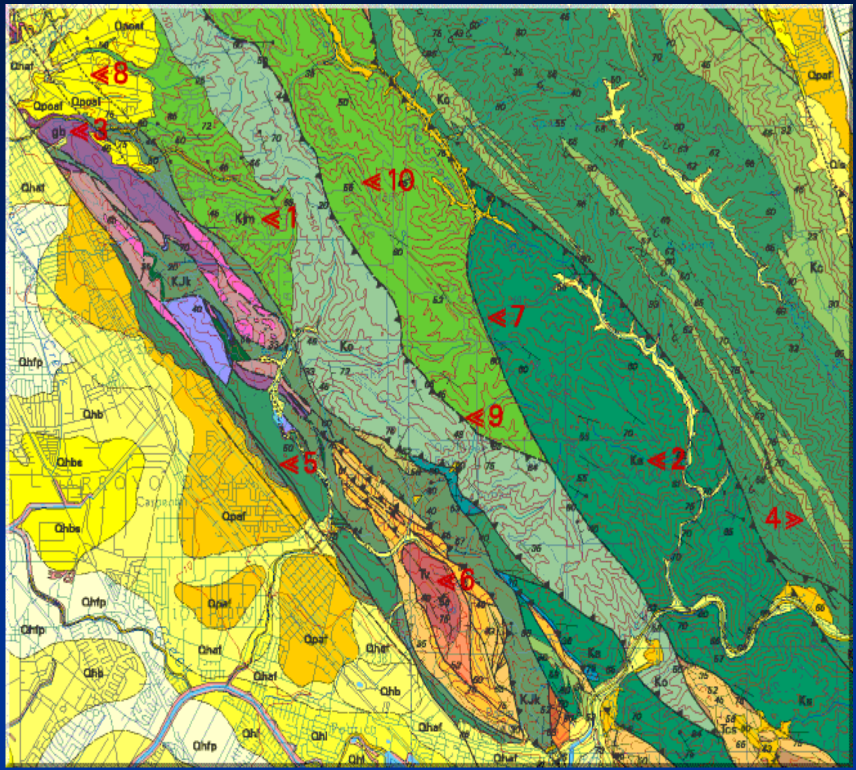
Geology Map Laboratory





Geology 101 Lab

Ray Rector: Instructor

Geologic Map Learning Objectives

The student should understand and know:

1) The terminology and basic symbols of geology maps

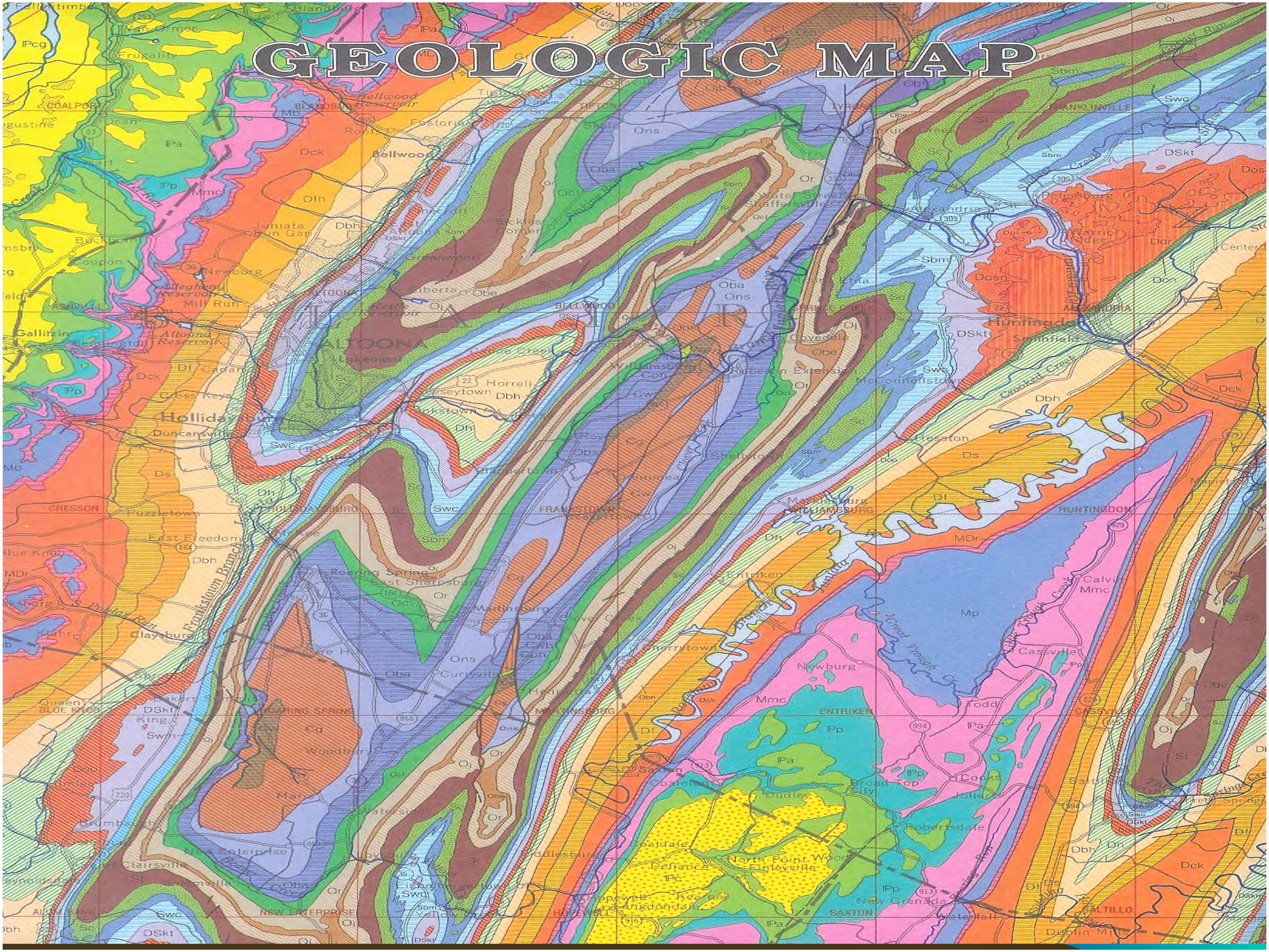
2) How to read and understand a geology map legend

3) The general concepts and field methods used in making a geology map

4) How to successfully recognize structures on a geology map such as contacts, bedding orientation, folds and faults

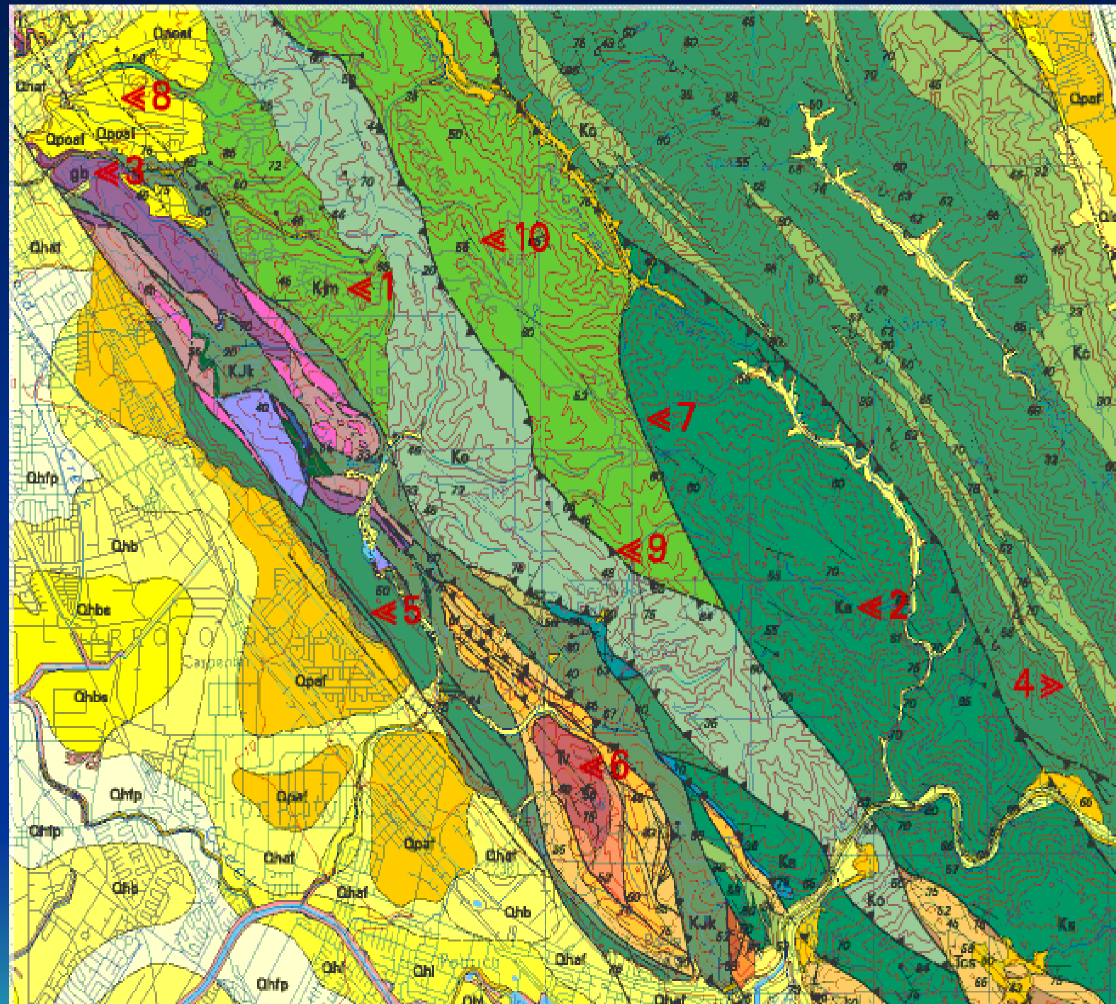
5) How to reconstruct the geologic history of the mapped region based on the geologic map information.

GEOLOGIC MAP



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



Use Rules of Structure To Interpret Geology Maps

1) Strike of beds is always parallel to the direction of the contacts.

2) Rock layers dip towards the youngest exposed rock layers.

3) Oldest rocks exposed in the center of eroded anticlines and domes.

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5) Horizontal folds form parallel sets of belt-like outcrop patterns.

6) Plunging synclines form ”V” of “U" shaped, belt-like outcrop patterns.

- ✓ Fold plunges toward *open* end of “U” pattern.

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8) Steeper the dip of the layer, the more narrow the width of its outcrop.

9) Hanging wall *moves up* relative to foot wall in reverse and thrust faults.

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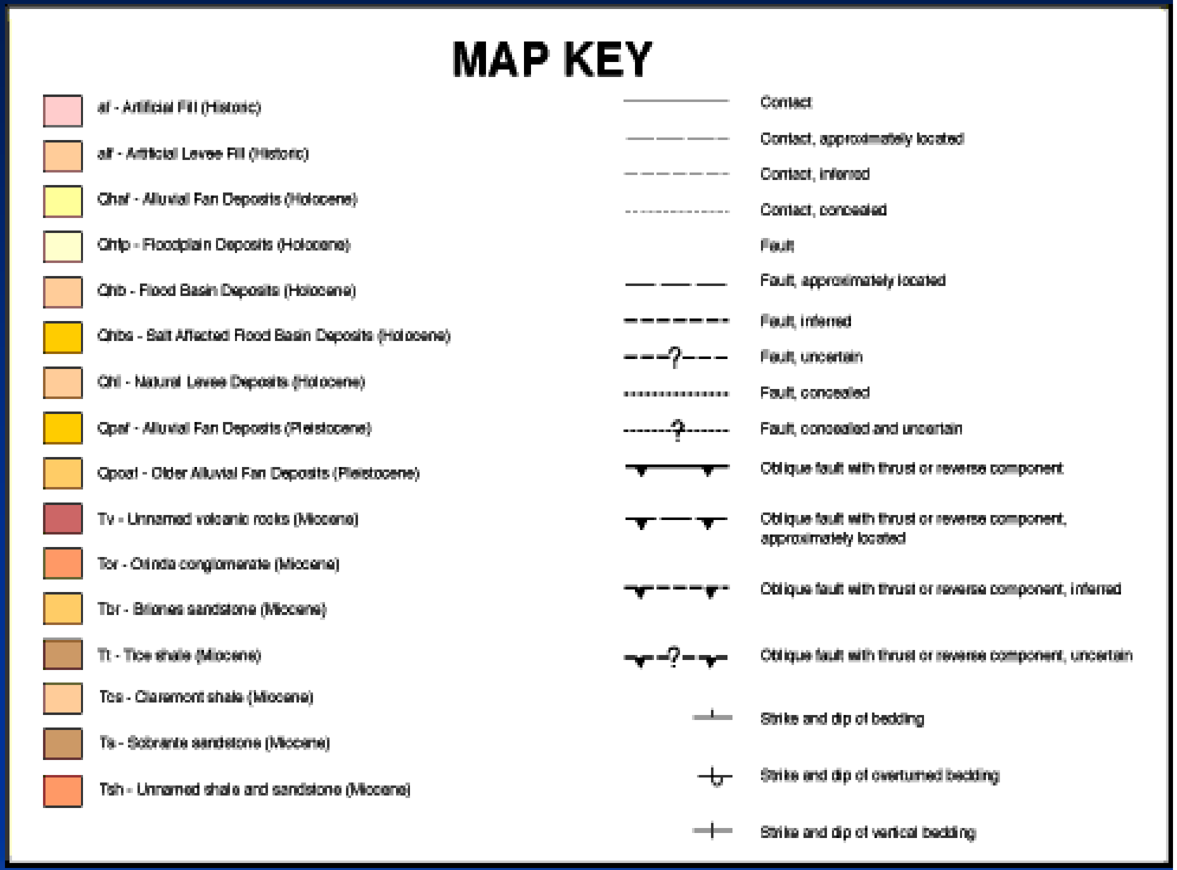
Geology Map Key or Legend

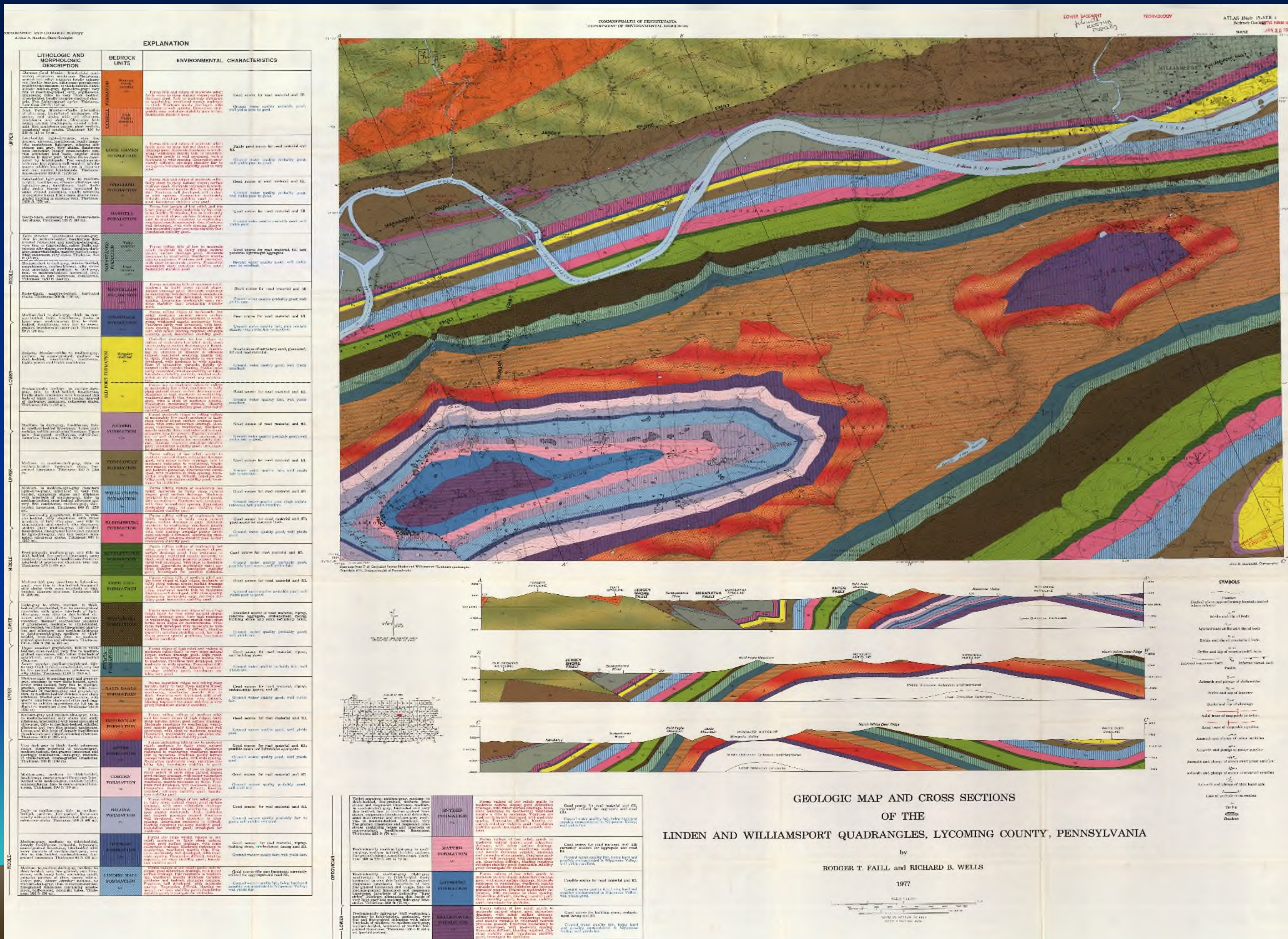
1) The map key lists and explains the geologic rock formations and the structural symbols
   - ✓ Rock Names
   - ✓ Rock Types
   - ✓ Rock Ages
   - ✓ Contacts
   - ✓ Strike and Dip
   - ✓ Faults and Folds



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

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

A Complete Geologic Map



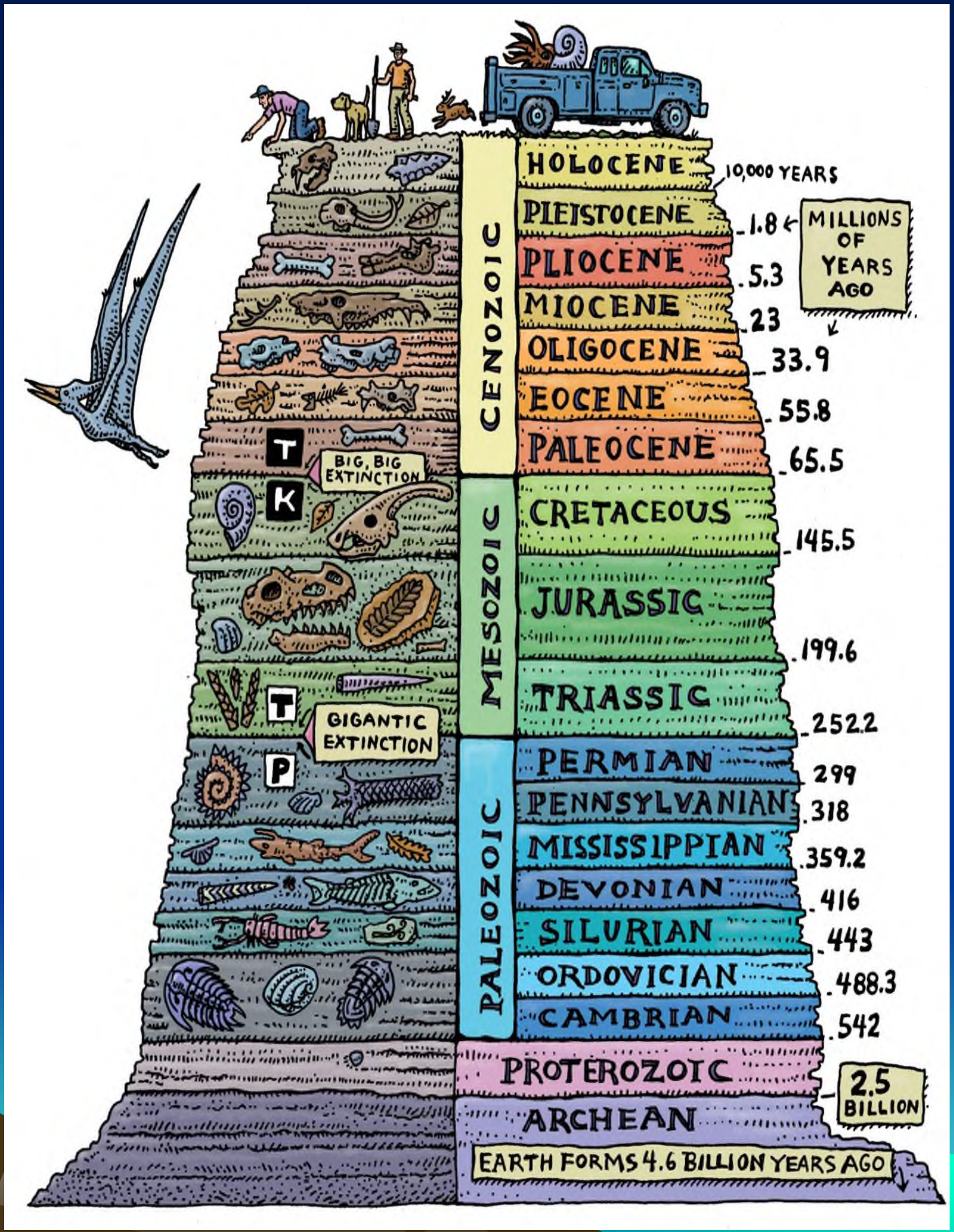
Rock Formations and Geologic Time

1) All rock formations on a geologic map have a specific assigned age

2) Rock formations are listed in an ordered sequence in a geologic map explanation according to age

3) The geologic ages of rock formations are assigned by geologic period

4) Geologic periods are further divided into lower (older), middle, and upper (younger)

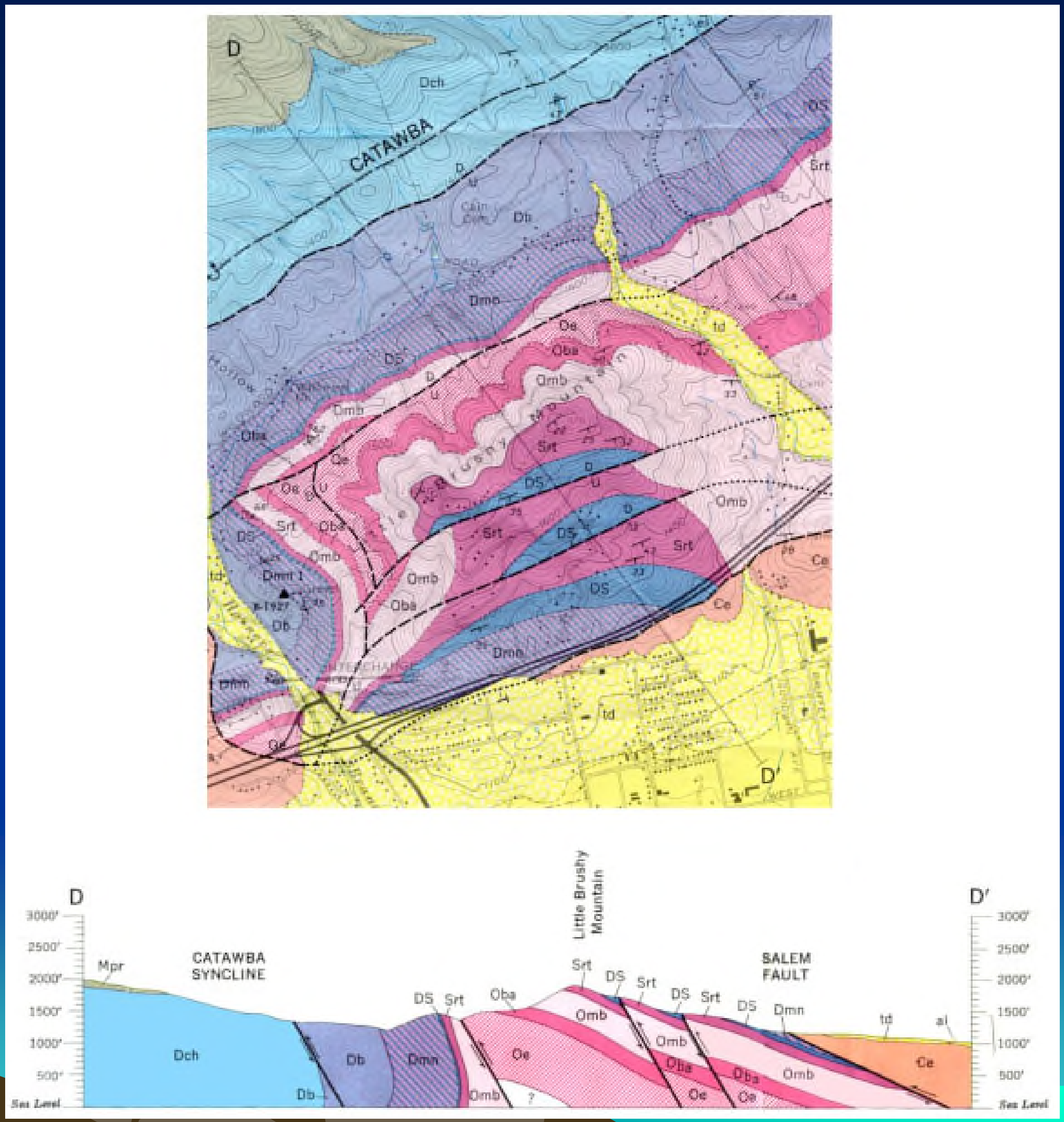


Geologic Map with Cross Section

1) A geologic cross section depicts a scale-balanced side profile of a specific transect across a geology map

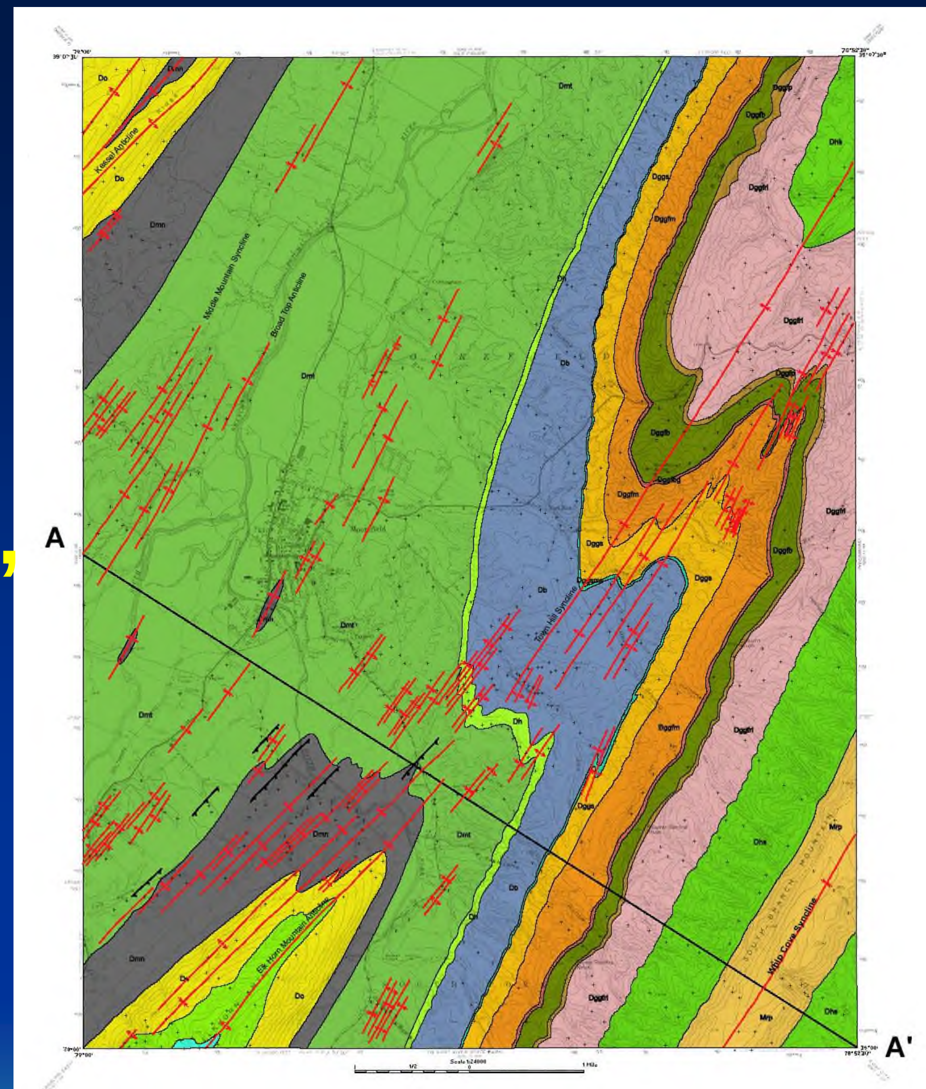
2) The cross section includes rock formations and structural elements

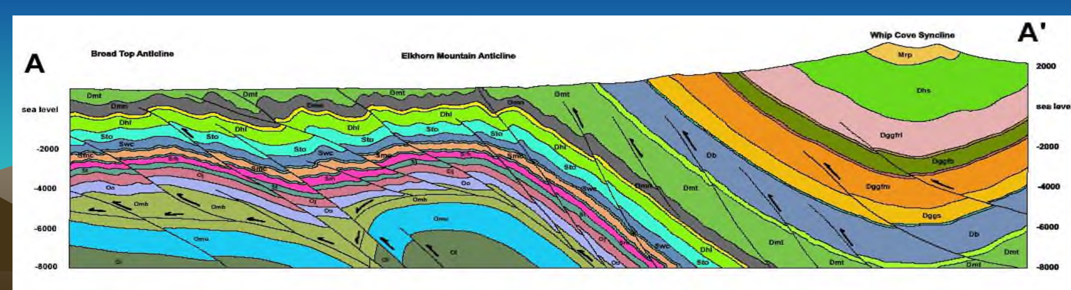
3) Geology depicted in a cross section is an interpretation based on map view field data



Geologic Map with Cross Section

Moorefield Quadrangle, Hardy County, West Virginia





Geologic Map Explanation

Series	Stage	Stratigraphic Units	Description
Mississippian	Osagean / Kinder.	Pocono Group: Rockwell and Purslane Formations, Undif-ferentiated (Mrp)	Pocono Group (Rockwell and Purslane Formations, Undifferentiated, 700-900 ft.) Light gray to dark gray, medium-grained, quartz sandstone with minor conglomerates, iron stained sandstone in lower part. Upper part consists of light gray to white quartz sandstone with minor quartz pebble conglomerate zones.
Devonian	Famennian	Hampshire Formation (Dhs)	Hampshire Formation (2300-2800 ft.) Non-marine, fine-grained, red and reddish gray sandstone and shale with minor tan and light green shale and sandstone beds present; unfossiliferous, except for rare terrestrial plant fossils such as **Archaeopteris**. Formation thins to west side of Town Hill syncline.
Devonian	Famennian	Greenland Gap Group, Foreknobs Formation: Red Lick Member (Dggfrl)	Foreknobs Formation, Red Lick Member (1400-1550 ft.) Very fine-to-fine-grained sandstone with interbedded brownish gray to red shale, siltstone, occasional conglomerates and marine fossiles. Upper contact placed at last occurrence of marine fossils. Prominent quartz and mudstone conglomerate at approximate contact with Hampshire Formation. Formation is thickest on west limb of Whip Cove syncline.
Devonian	Frasnian	Greenland Gap Group, Foreknobs Formation: Pound Member (Dggfp)	Foreknobs Formation, Pound Member (65-220 ft.) Massive, coarse to medium-grained light gray to white sandstone. Planar wedge-shaped cross beds and conglomeratic zones are common. Formation thins to the north and east in the quadrangle. Serves as a ridge-forming unit
Devonian	Frasnian	Greenland Gap Group, Foreknobs Formation: Blizzard Member (Dggfb)	Foreknobs Formation, Blizzard Member (625-670 ft.) Gray interbedded thin-to-medium-bedded sandstone and siltstone with some shale. Thickness tends to be constant throughout the quadrangle. Tends to form topographic lows between the ridge-forming Pound and Briery Gap members.
Devonian	Frasnian	Greenland Gap Group, Foreknobs Formation: Briery Gap Member (Dggfbg)	Foreknobs Formation, Briery Gap Member (60-130 ft.) Massive, medium-to-coarse grained light gray to white sandstone. Ripple marks, planar wedge-shapped cross beds and conglomeratic zones are common. Formation thins to the north and east in the quadrangle. Serves as a ridge-forming unit.
Devonian	Frasnian	Greenland Gap Group, Foreknobs Formation: Mallow Member (Dggfm)	Foreknobs Formation, Mallow Member (1250-1400 ft.) Medium-gray siltstones, thin-bedded fine-to-medium-grained sandstone, alternating with shale. Lowest strata consist of 25-30 ft. interval of mainly siltstones and fine-to-medium-grained sandstones, which serves as contact with underlying Scherr Formation. Formation thins to the north and east in the quadrangle. Lowermost Mallow unit serves as a low ridge-former.
Devonian	Frasnian	Greenland Gap Group, Scherr Formation (Dggs)	Scherr Formation (775-800 ft.) Mainly siltstone and shale, with some fine-grained sandstone, all light olive gray. Siltstones may reach 2-2.5 feet in thickness. Siltstones and sandstones less abundant than in overlying Mallow Member. Basal member is Minnehaha Springs.
Devonian	Frasnian	Greenland Gap Group, Scherr Formation: Minnehaha Springs Mmbr (Dggsms)	Scherr Formation, Minnehaha Springs Member (25-30 ft.) Lowermost member of the Scherr Formation. Sequence of olive gray coarse siltstone at the base of the Scherr. Serves as boundary between underlying Brallier Formation and Greenland Gap Group. Locally may form a slight topographic high.
Devonian	Frasnian	Brallier Formation (Db)	Brallier Formation (1450-1600 ft.) Medium dark gray shales, interbedded with thin-bedded siltstones, most commonly not exceeding 4-6 inches in thickness. Back Greek Siltstones Member 100-125 feet above base is 25-30' sequence of thick siltstones, with some sandstones. Not present north of Moorefield. Upper conact with Scherr Formation at Minnehaha Springs Member.
Devonian	Frasnian	Harrell Shale (Dh)	Harrell Shale (250-300 ft.) Dark gray, thinly laminated platy weathering shale. Lower member is the Burket, a black shale sequence which is atop the Pokejoy Limestone Member of the Manhantago. Upper contact of formation is gradational and placed at first siltstone of the Brallier Formation.
Devonian	Giv.	Mahantango Formation (Dmt)	Mahantango Formation (1600-1800 ft.) Dark Gray siltstone and non fissile shale, minor fine-grained sandstone; spheroidal weathering common. Upper contact placed at top of Pokejoy Limestone below the Burket Member of the Harrell Shale.
Devonian	Eif. / Ems.	Marcellus-Needmore Shales (Dmn)	Marcellus-Needmore Shale (500-600 ft.) Black to dark gray, marine fissile shale of the Marcellus overlies medium to dark gray and greenish gray to brownish black shale of the Needmore; 25-30 ft. thick argillaceous limestone (i.e. Purcell Member) in middle of Marcellus; dark gray limestone nodules and beds near base of Needmore.
Devonian	Siege.	Oriskany Sandstone (Do)	Oriskany Sandstone (100-140 ft.) White to light gray, medium to coarse-grained, quartz sandstone with quartz conglomeratic zones; crossbedded; abundant marine fossils (brachiopods); carbonate and silica cement.
Devonian	Gedin.	Helderberg Group (Dhl)	Helderberg Group (400-500 ft.) Massive-bedded, coarse-grained, gray limestone; abundant marine fossils; dark and light colored chert layers in upper one-third; minor karst development; lower part is Silurian.
Silur.	Pridol.	Tonoloway Limestone (Sto)	Tonoloway Limestone (400-500 ft.) Fine-grained, laminated, gray argillaceous marine limestone; minor shale layers; mudcracks common on bedding surfaces; fossiliferous.

RM/JB 04/03

Units listed below do not outcrop

- Swc — Will's Creek (300-375 ft.)
- Sb — Bloomsburg (25-40 ft.)
- Smc — McKenzie Formation (300-325 ft.)
- Sk — Keefer Sandstone (20-30 ft.)
- Srh — Rose Hill Formation (400-450 ft.)
- St — Tuscarora Sandstone (150-250 ft.)

Ordovician System

- Oj — Juniata Formation (300-400 ft.)
- Oo — Oswego Formation (350-450 ft.)
- Om — Martinsburg Formation (1,500-2000 ft.)
- Omu — Middle Ordovician
- Ol — Lower Ordovician

Explanation of Symbols

- Anticline
- Syncline
- Overturned Anticline
- Overturned Syncline
- Reverse Fault (teeth on upper plate)
- Bedding Orientation Observation

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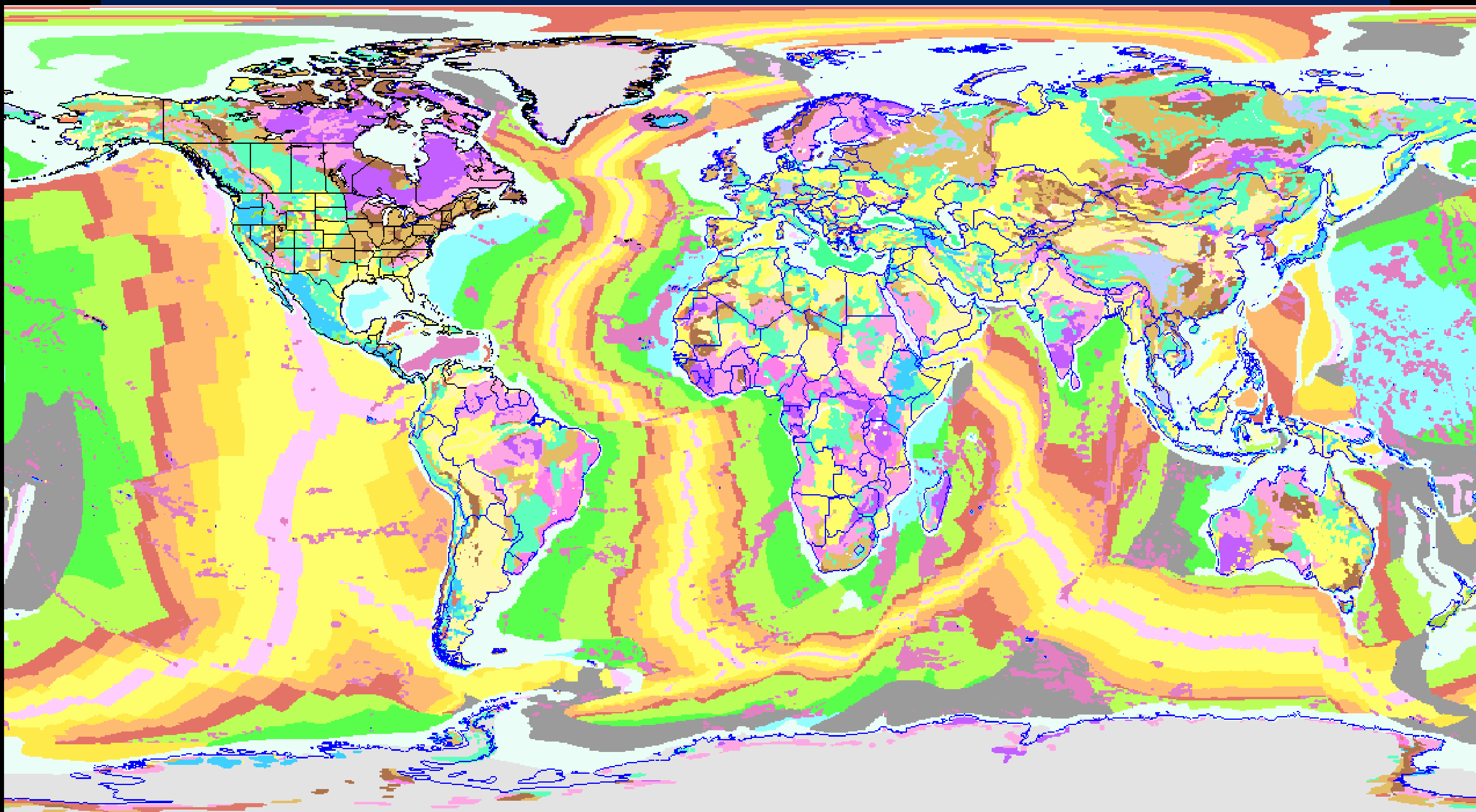
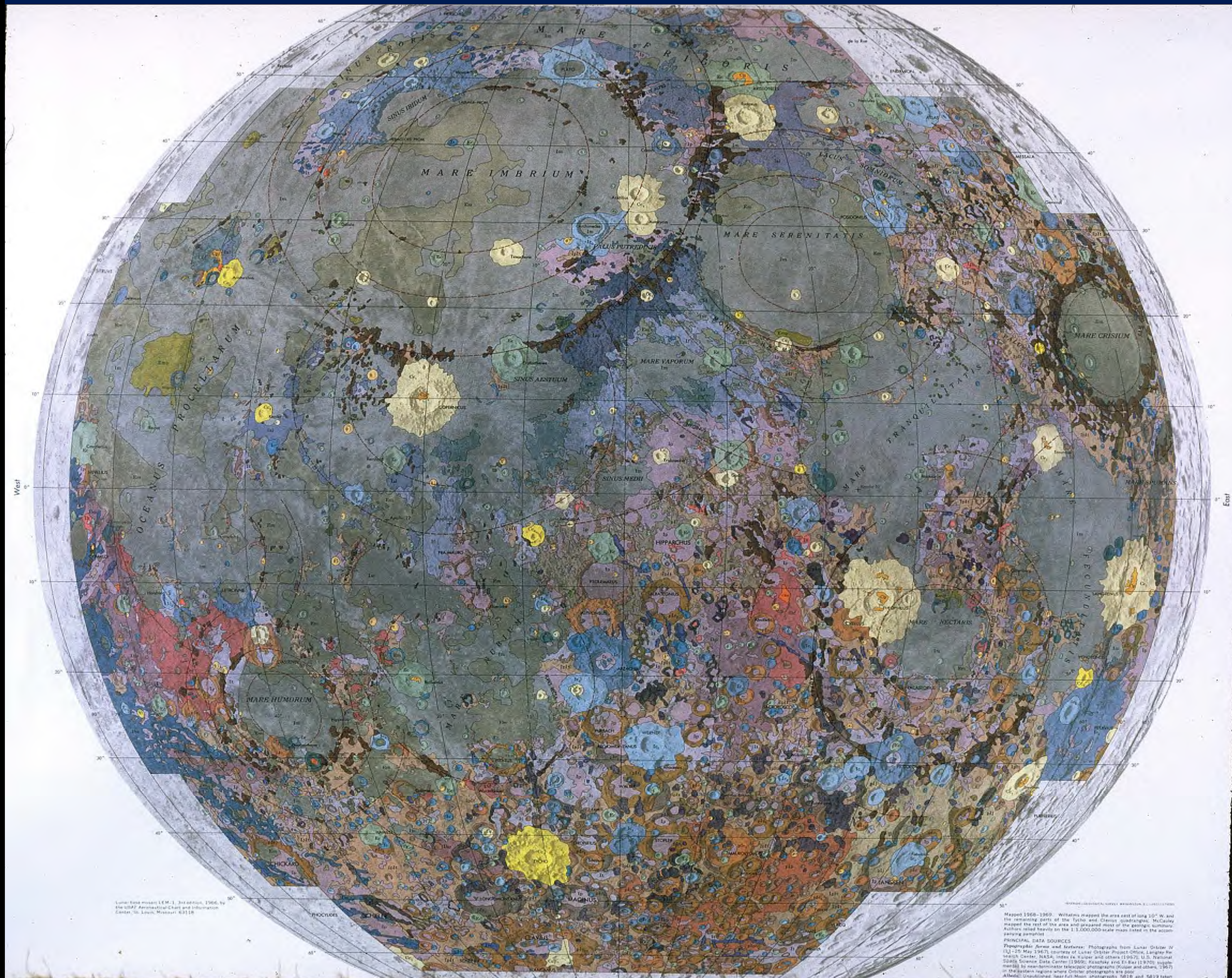
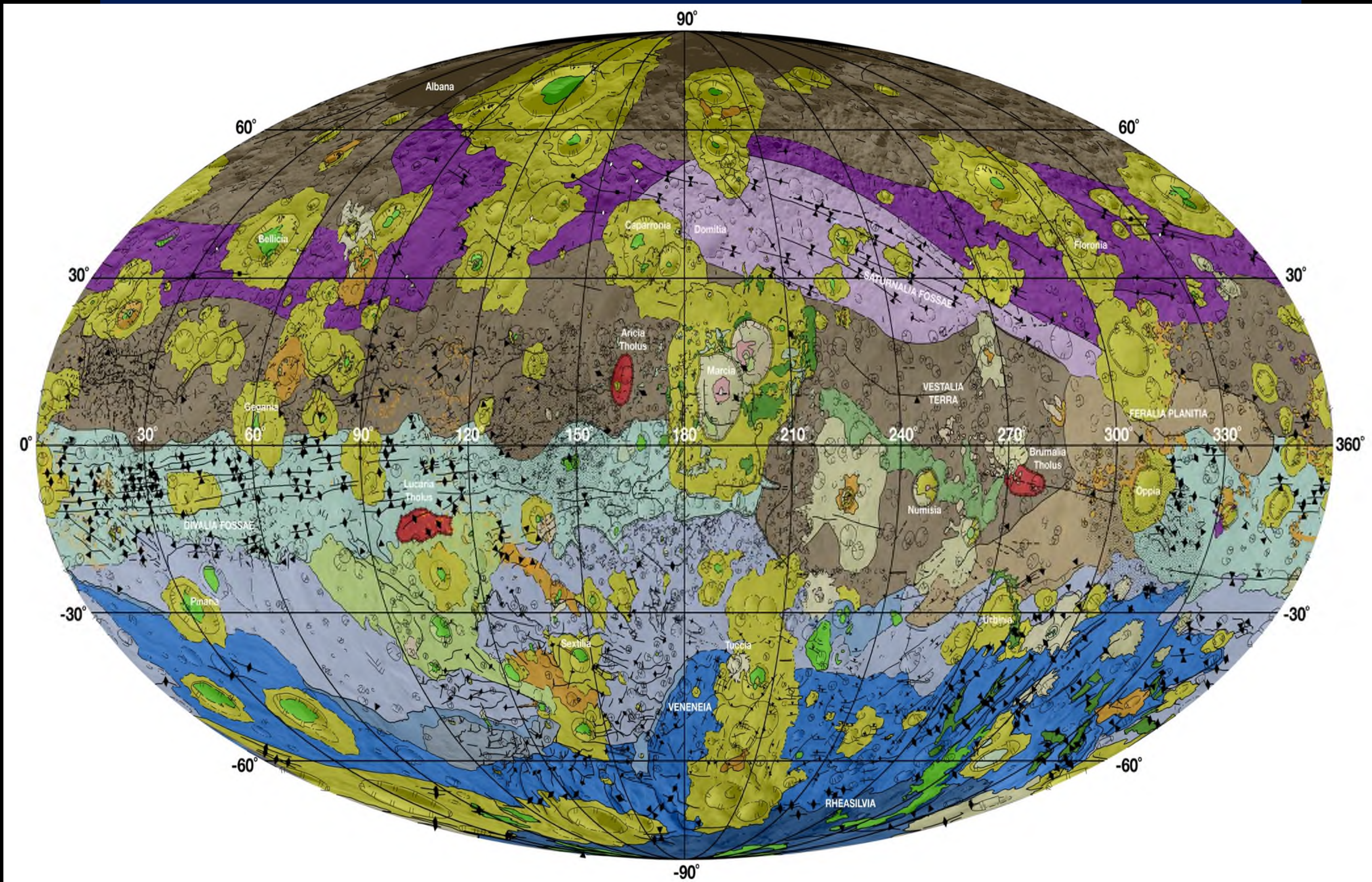
Geologic Map of Earth



Geologic Map of Moon

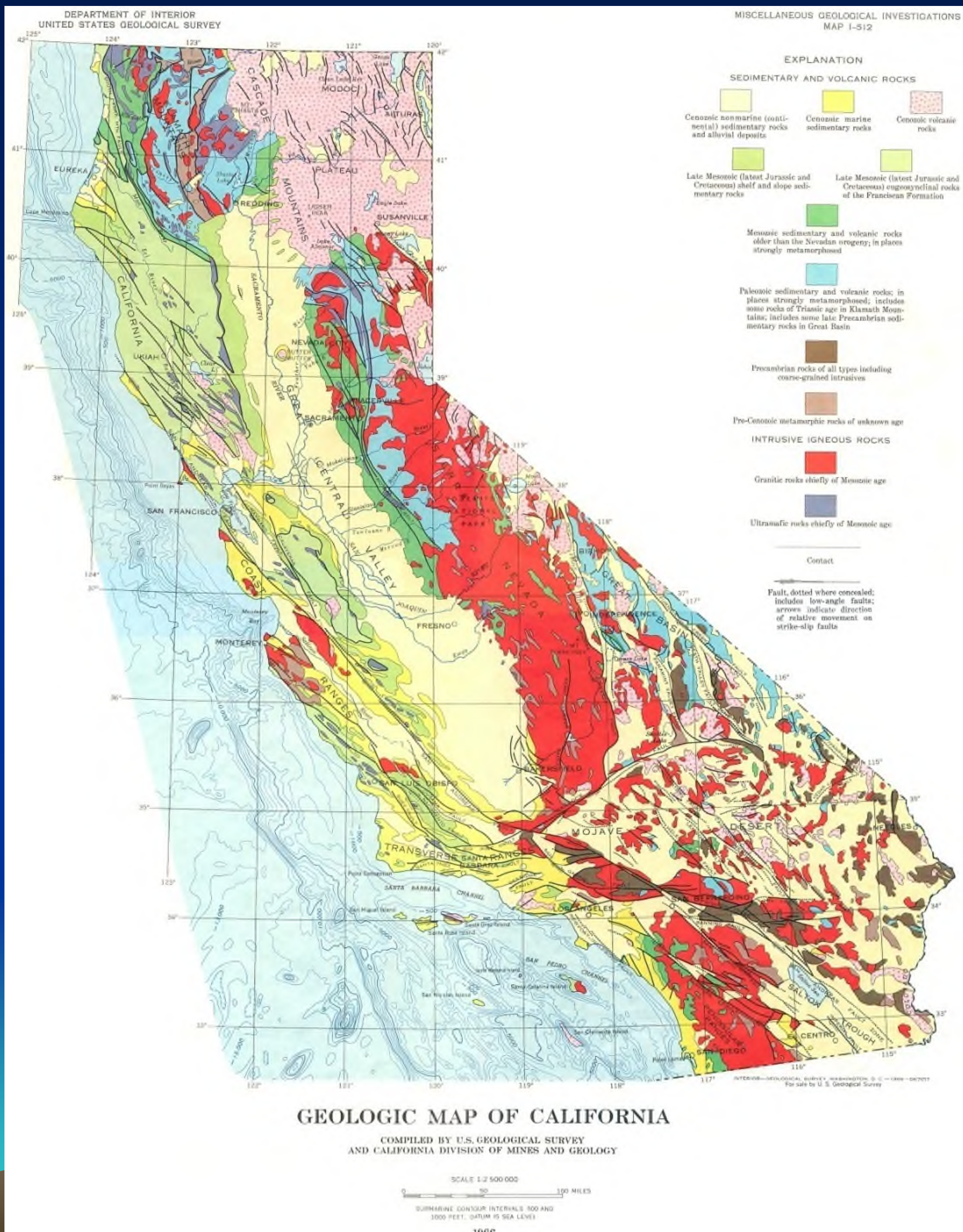


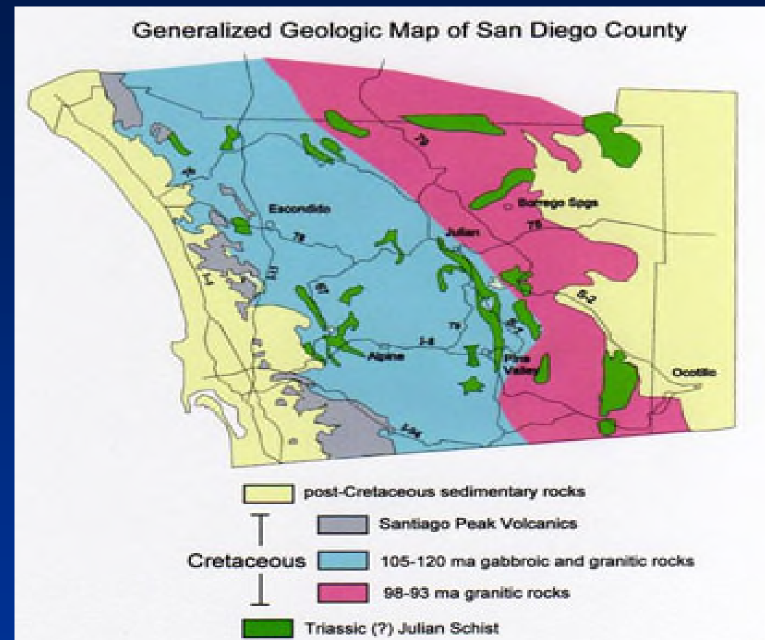
Geologic Map of Mars

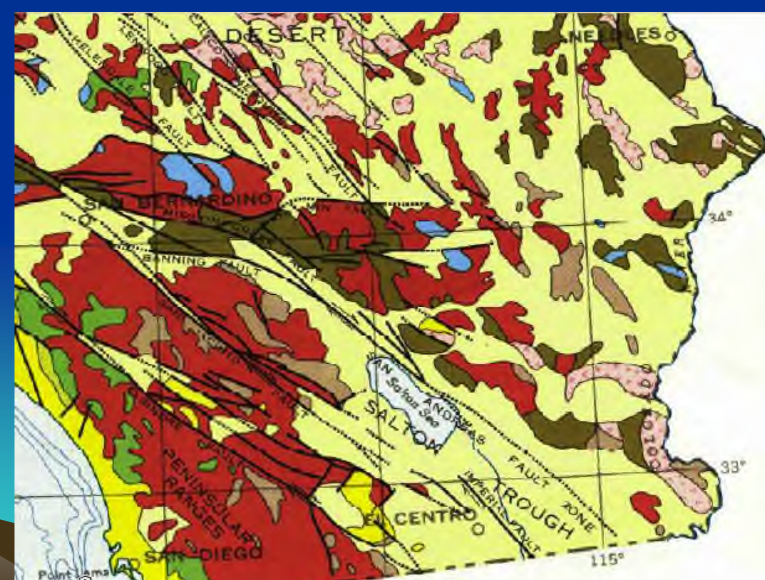


Geologic Map of North America

Geologic Map of California





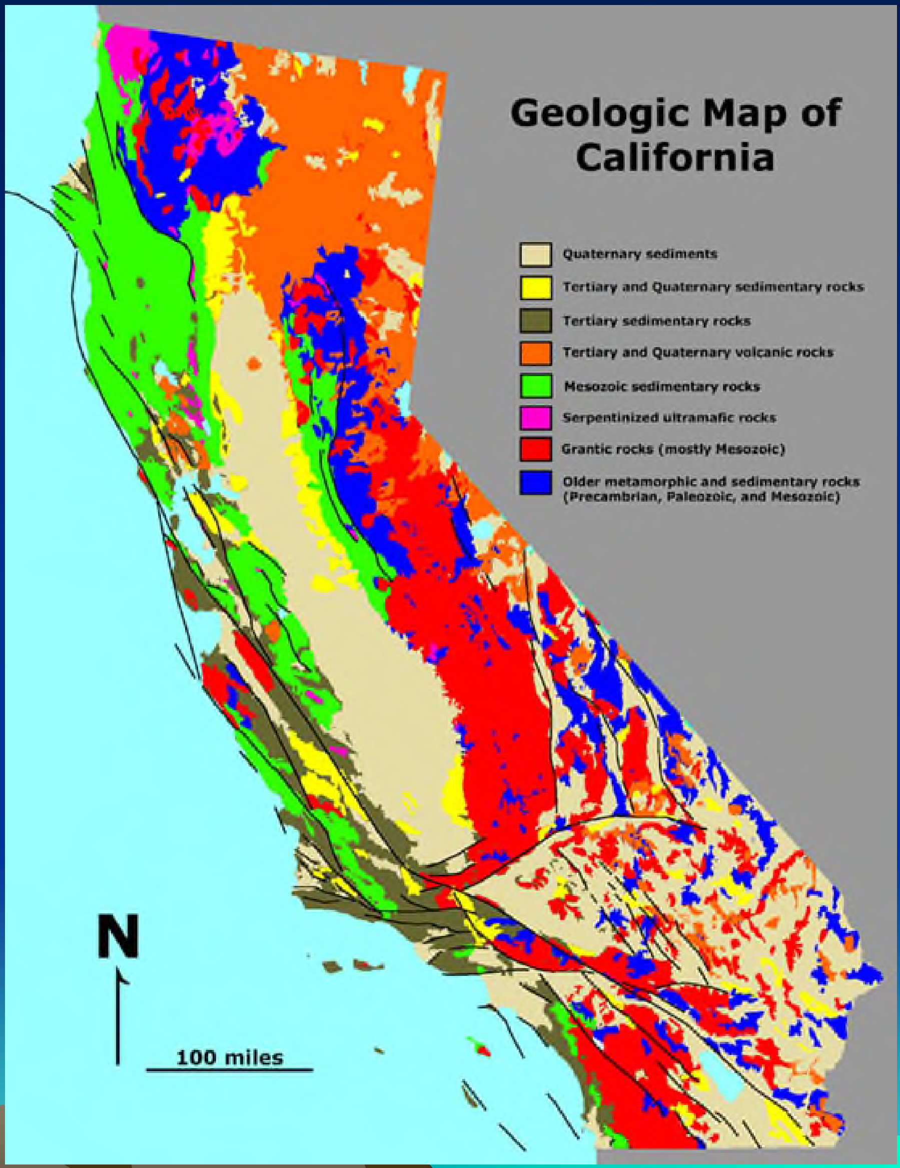


Usefulness of Geology Maps

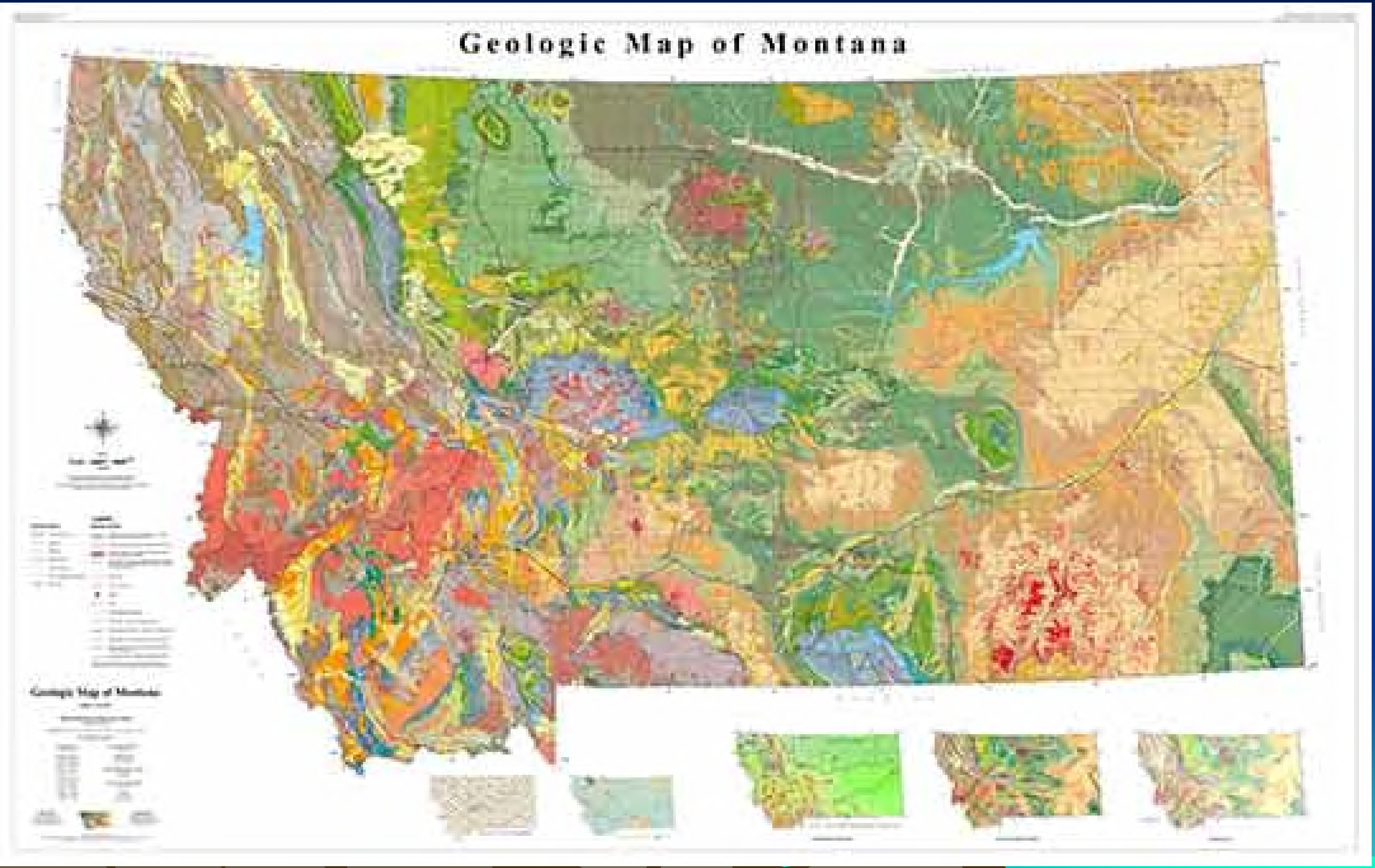
1) Geology maps have many vital uses:

- ✓ Mineral Prospecting
- ✓ Engineering
- ✓ Earthquakes
- ✓ Historical geology
- ✓ Landform studies
- ✓ Soil development
- ✓ Biological studies

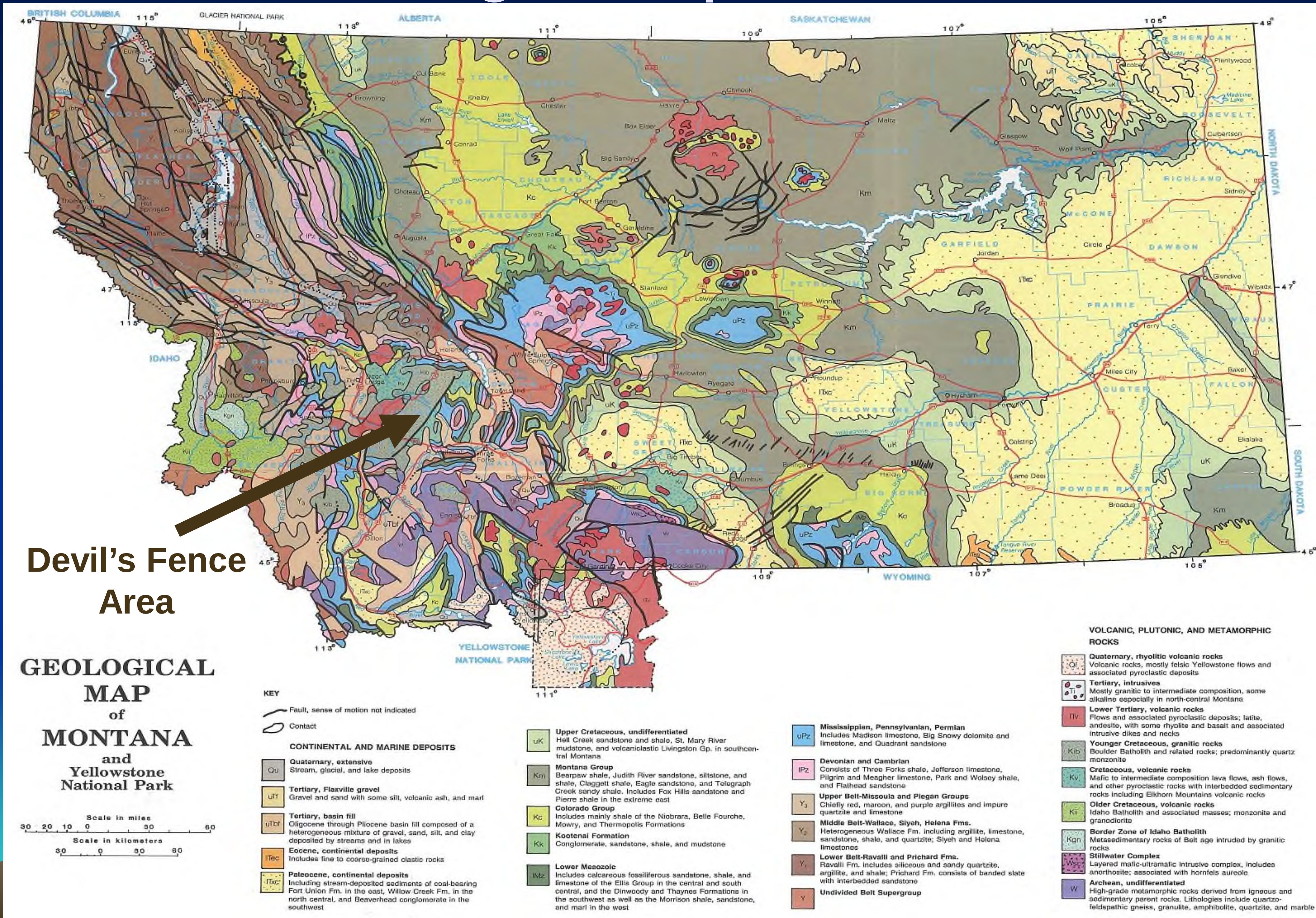
2) Geology maps are even useful when buying a home. Why?



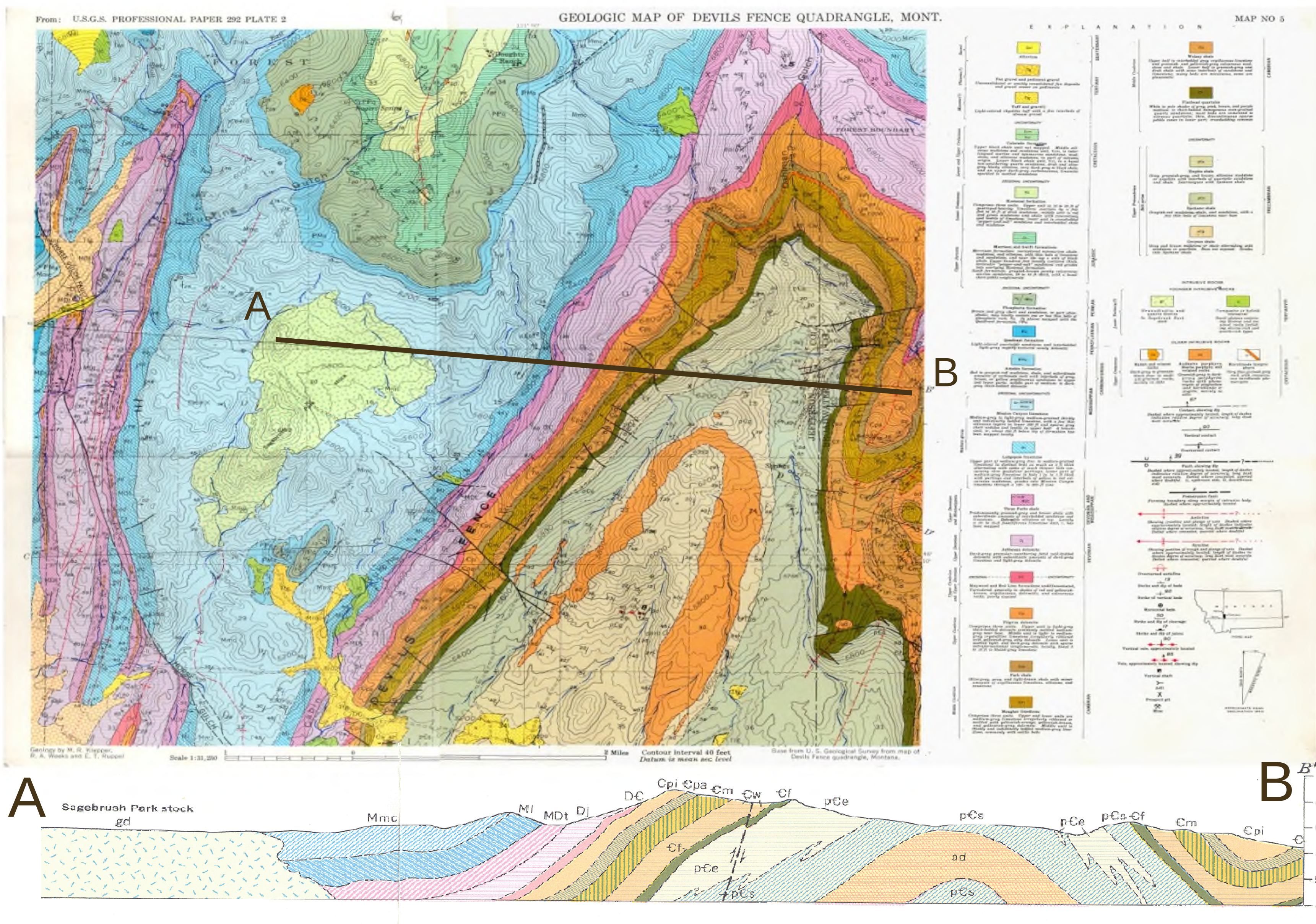
Geologic Map of Montana



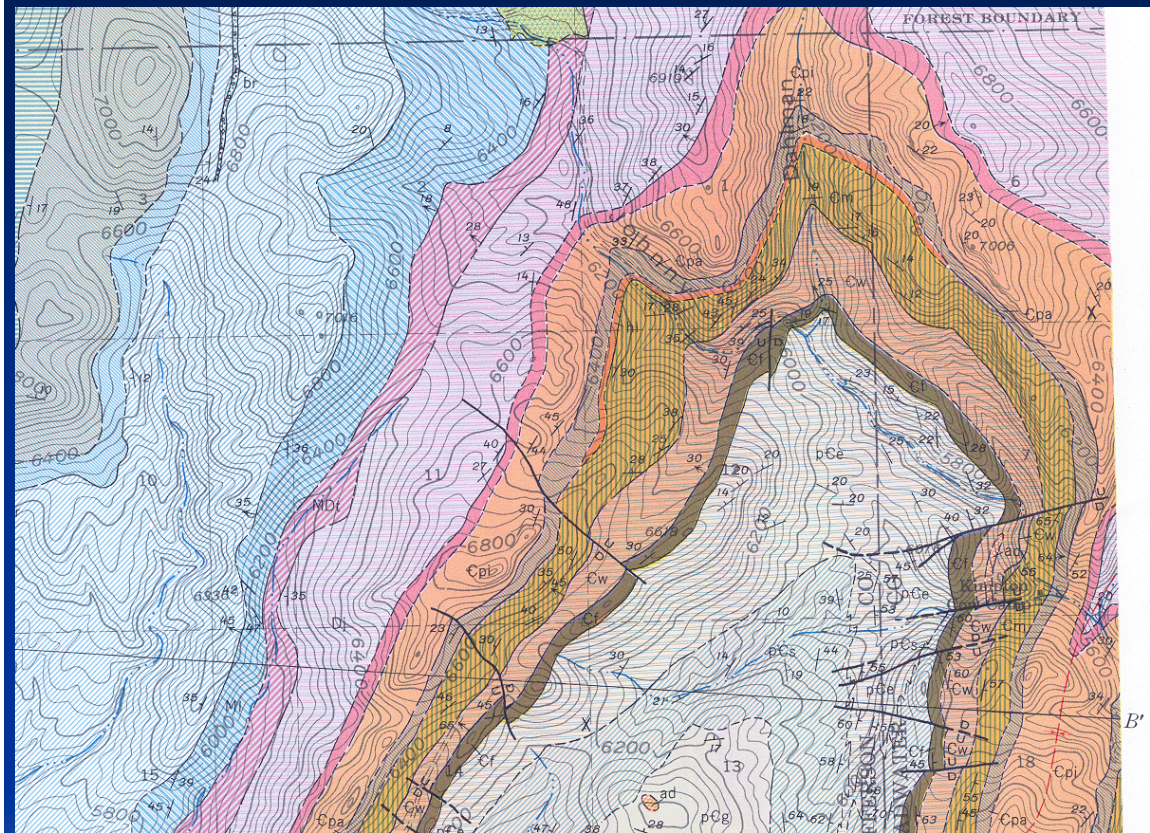
Geologic Map of Montana

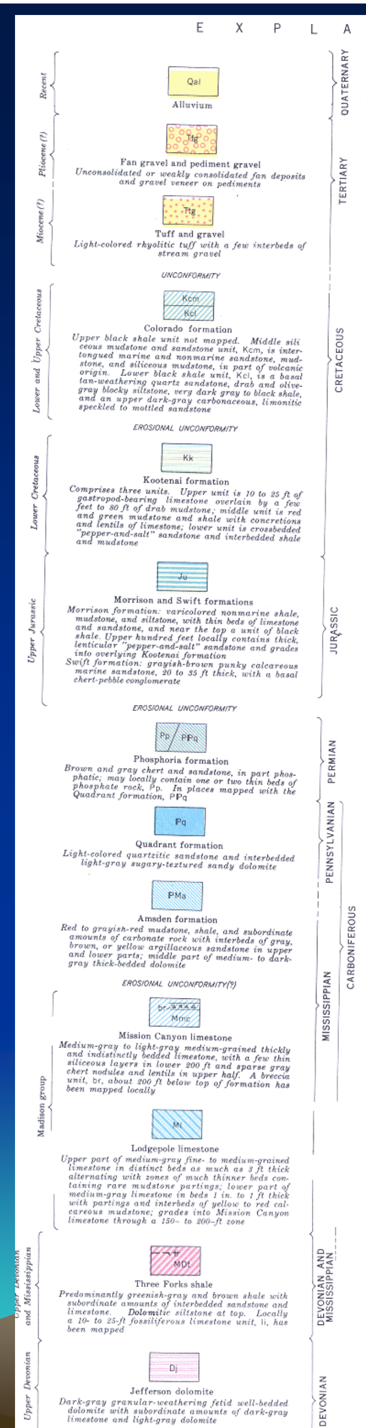


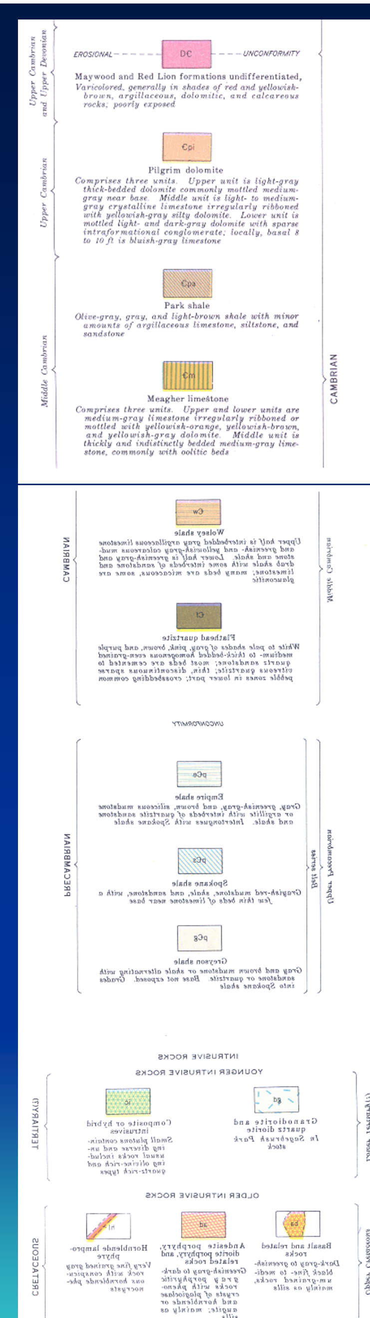
Geologic Maps – Devil's Fence Quad



Devil's Fence Geology Map with Explanation

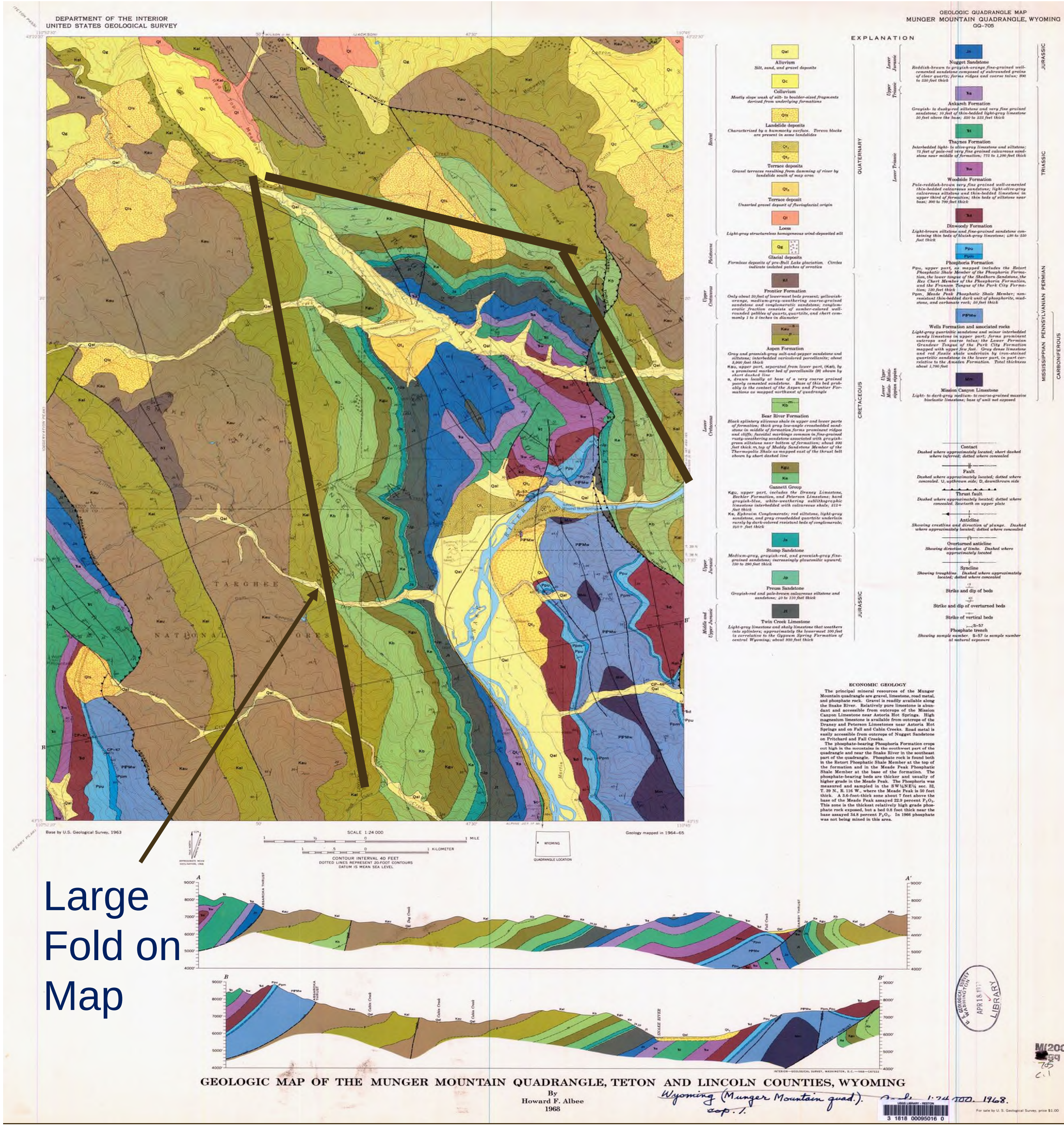






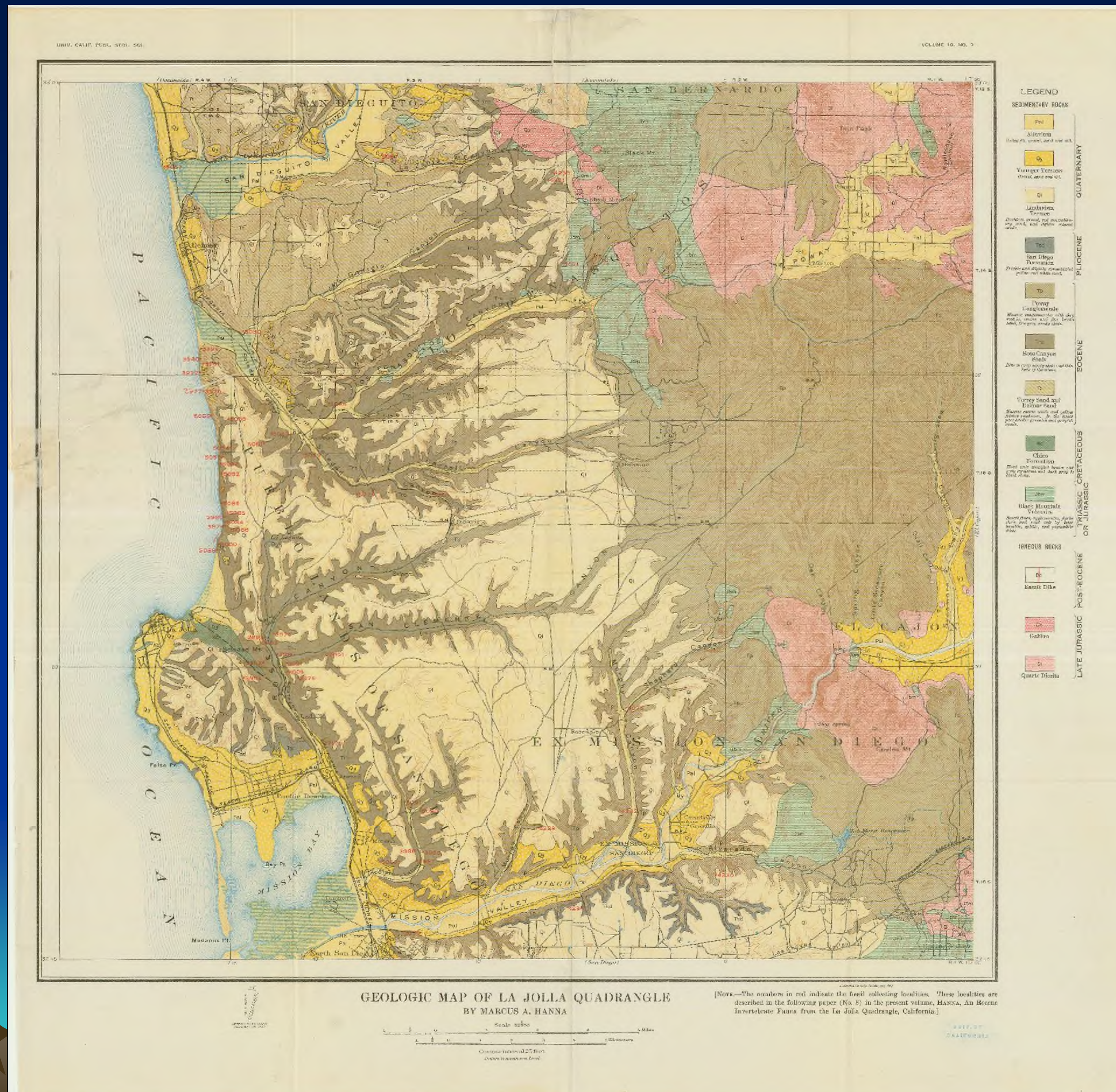
Devil's Fence Topographic Feature

Mungar Mountain Geology Map



Large Fold on Map

Geology Map La Jolla Quad



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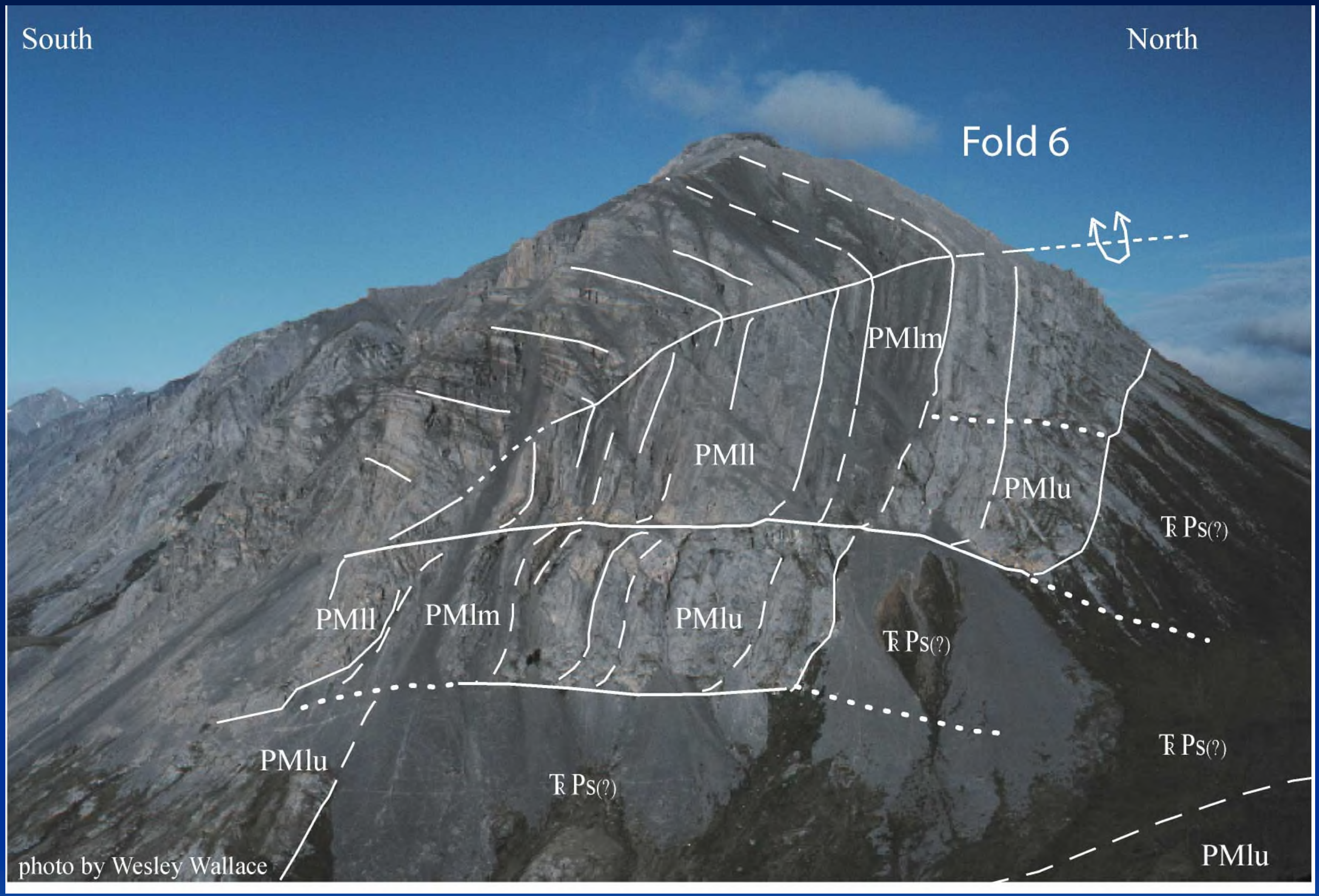

http://www.nature.nps.gov/geology/usgsnps/gmap/gmap1.html#unique

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