

Name _____

EOSC 110 – Day 20 Geological Maps Activity

Complete this activity in groups of 4.

You will need one question set each and one colour Geological Map for the group. Please do not write on the colour map, you have a smaller black and white version in your handout you can scribble on.

The Visible Geology exercise completed over the Reading Week will have given you experience with simplified structures, here we will now look at the greater geological complexities found in nature.

We will use this exercise to discover what we can learn about an area (in this case Wyoming) from its geology to help understand the geological and tectonic history.

Learning Goals:

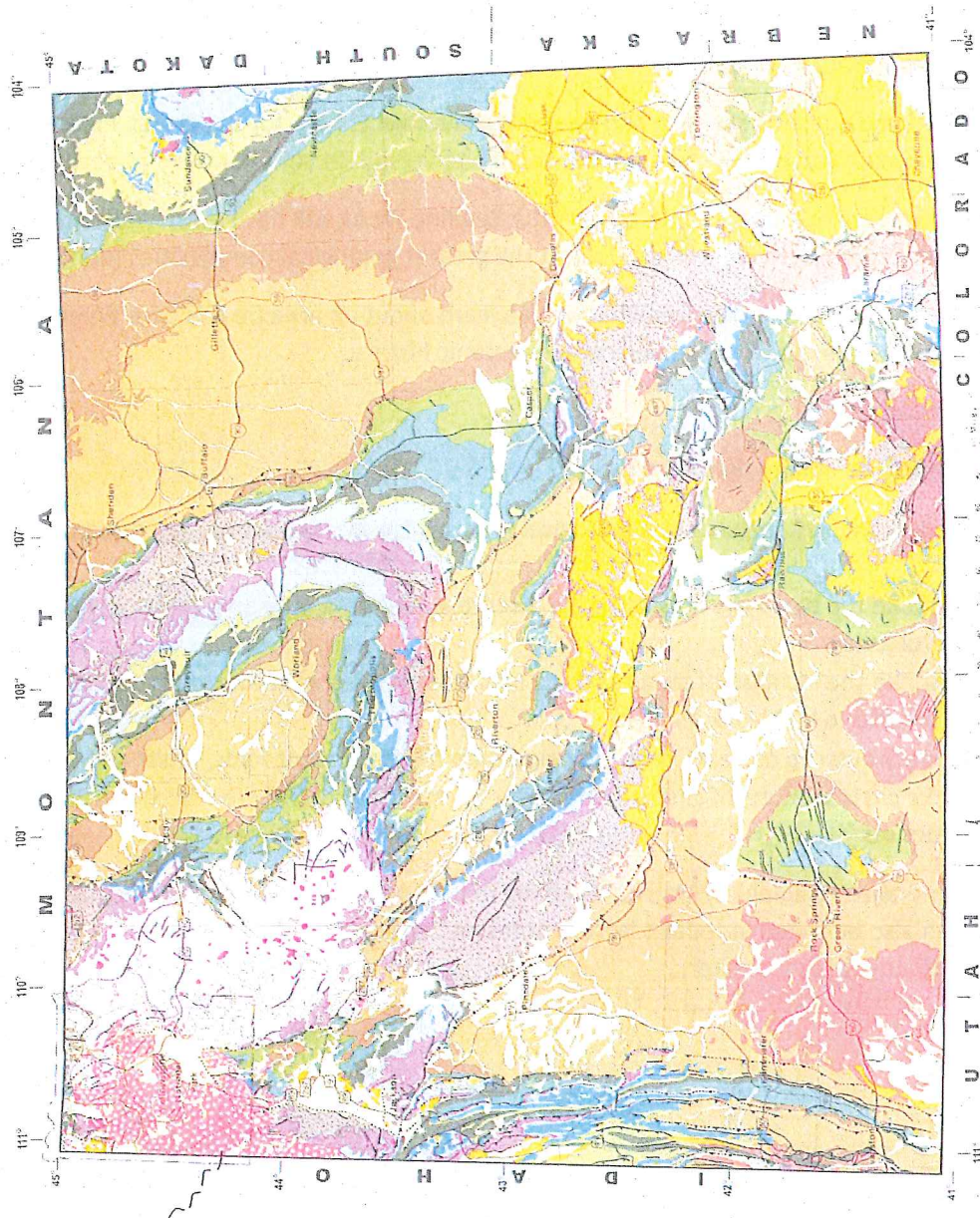
Students should be able to do the following:

- Identify the key features of a geological map: title, scale, legend or map explanation (stratigraphy and rock ages), grid references or coordinates.
- Describe the two ways in which scale is represented on a map and determine which is most useful today
- Describe the location of features using coordinates (here latitude and longitude, but equally applicable to UTM coordinates)
- Identify outcrop patterns on a geological map that represent folds, faults and unconformities
- Make cross sections of geological features on the map to show reveal subsurface geology and structure

Use the Generalized Geological Map of Wyoming to help you answer the following questions. A pdf of the map can also be found in today's lecture notes on Connect and may be useful if you need to zoom in to see any features/labels better.

GENERALIZED GEOLOGIC MAP OF WYOMING

- Approximate age in millions of years before present
- MAP EXPLANATION**
- CENOZOIC IGNEOUS ROCKS**
 Quaternary, Pliocene, and Miocene
 rhyolite and basalt; some intrusives
 Upper Tertiary to Cretaceous(?)
 intrusive rocks; some extrusives
 Eocene Albaracka Volcanic Supergroup
- SEDIMENTS AND SEDIMENTARY ROCKS**
 Cenozoic
 Quaternary unconsolidated sediments
 Lower Quaternary, Pliocene, and Miocene
 Oligocene
 Middle Eocene; some Upper Eocene
 Lower Eocene
 Paleocene
 Mesozoic
 Upper Cretaceous
 Upper and Lower Cretaceous
 Lower Cretaceous; some Jurassic
 Jurassic; some Lower Cretaceous
 Triassic
 Paleozoic
 Permian and Pennsylvanian;
 some Mississippian and Triassic
 Carboniferous, Devonian,
 and Mississippian
 Precambrian
- IGNEOUS AND METAMORPHIC ROCKS**
 Major
 unconformity
 Middle Proterozoic intrusive rocks
 Early Proterozoic igneous and
 metamorphic rocks
 Archean igneous and metamorphic rocks
- MAJOR FAULTS**
 Fault (dotted where concealed)
 Thrust fault; teeth on upper plate
 (dotted where concealed)



Wyoming State Geological Survey
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Modified and adapted from Roberts, S., 1989,
 Wyoming Geomaps: Wyoming State Geological
 Survey Educational Series 1, 41 p.



Question 1

- a) What are the two ways in which scale is represented on the map?

numerical $1'' = 42 \text{ miles}$ or $1 : 2667000$ or rule-like scale

- b) Which is the most useful and why?

The second one is more useful because it will keep accuracy if we change the size of the map.

Question 2

- a) Using the Map Explanation (Key or Legend), what are the oldest rocks on the map?

Archean igneous and metamorphic rocks.

- b) What are the youngest rocks on the map?

Quaternary unconsolidated sediments

- c) What age and rock type are represented by the bright blue areas on the map?

Triassic.

Question 3

The coordinates on this map are in latitude and longitude given as degrees north (numbers along the sides of the map increasing from the bottom upwards, e.g. 42°) and degrees west (numbers along the top and bottom increasing from the east to the west (right to left), e.g. 108°). All locations on the map can therefore be expressed as coordinates in the form: $YY^\circ N XXX^\circ W$.

- a) What is the name of the town found at $44.3^\circ N 106.7^\circ W$?

Buffalo.

- b) What is the age and type of rock found at $43.0^\circ N 109.6^\circ W$?

more than 2500 years million of years old
Archean igneous and metamorphic rocks.

- c) Find the town of Riverton – what are its coordinates?

$43.0^\circ N 108.3^\circ W$

- d) Find the outcrops of the Quaternary rhyolites, what geological feature is this and what are its approximate coordinates?

$43.7^\circ N - 45.0^\circ N 110.5^\circ W - 111.1^\circ W$.
volcano, very young

Question 4

Find the town of Worland (hint it is on the 108°W grid line). Consider the rocks outcropping between Worland and Buffalo (to the NE of Worland).

a) Consider the ages of the rocks – the oldest is Archean igneous ^{and metamorphic rocks} in age and is closest to the town of Buffalo; the youngest is Lower Cretaceous in age and is closest to the town of Worland.

b) What does the distribution of the rocks tell you about their tilt or dip direction?
anticline south

c) More or less the same rock types outcrop to the south west of Worland, what does their outcrop pattern tell you about the tilt or dip direction in this area?

anticline syncline

d) Now consider the continuity of the outcrop pattern around Worland. Follow the Upper and Lower Cretaceous rocks from the SW, to the S and finally to the E. How would you classify the geological structure around Worland?

plugging fold

Question 5

Compare the sequence of rocks between Worland and Buffalo to the units listed in the Map Explanation.

a) Are all the rock units represented in this sequence? If not, which age rocks are missing?

No
missing Triassic
Middle Proterozoic intrusive rocks
and early Proterozoic igneous and metamorphic rocks.

b) Why would any of the periods of geological time (represented by the rock units of different ages) be missing from the sequence? Because of erosion

c) The town of Worland itself is built on Quaternary sediments. Look at the map as a whole, how would you describe the outcrop patterns of the Quaternary sediments?

Syncline

d) Why are they the shape that they are? (Hint: the Quaternary Period is from 1.6 Ma to the present day) Because from 1.6 Ma to the present days

e) What geological term could you use to describe the contact between the base of the Quaternary sediments and the older underlying rocks?

Unconformity

Question 6

Approximately 60 miles east of Riverton there is a dotted black line with teeth on it on the map.

- a) What is this feature (Hint: look in the Map Explanation)?

It is Trust fault.

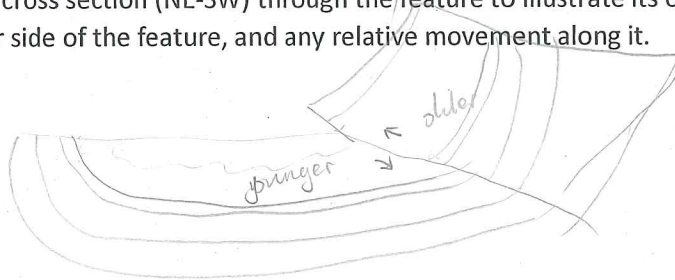
- b) Why is the line dotted?

Because this place is concealed by the trust fault.
the line of

- c) What are the ages of the rocks on either side of the feature?

Between 70 Ma to 49 Ma.

- d) Draw a simple cross section (NE-SW) through the feature to illustrate its orientation, the ages of rocks on either side of the feature, and any relative movement along it.



- e) Follow the dotted line to the northwest, where it becomes a solid black line with teeth, what does this represent?

It was not be faulted.

- f) Now look 70 miles to the west of Riverton, you will find another dotted line with teeth on it. Compare this to the one to the east of Riverton. Do they have the same age rocks on either side? Do these features have similar orientations and direction of movement, and amount of movement along the features (i.e. a lot of movement, or not very much movement)?

No, they don't have exactly same age rocks on either side.
No, the first one does have that much movement.

- g) Now look to the very west of the map where you can see a series of these dotted lines with teeth. What can you say about the orientation of these features and the direction of movement along them? Is it the same or different to the previous ones you have investigated?



It is the same to the previous one.

Question 7

- a) Based on your answers to the above questions, what are the main structural features of Wyoming?

Main structural features of Wyoming might be thrust fault.
Syncline & anticline

- b) What do these features tell you about the structural history of the area?

This area ~~ex~~ has experienced a couple of faults in the history.

- c) What was the general direction of the main tectonic forces involved in the structural deformation of this large area? (i.e. were they north-south, etc.) What evidence have you used to make your interpretations? They were west-east.

Thrust faults ~~is~~ were always east to west.

THE END