

Student Name:

Grade:

Physical Geology 101 Laboratory #14 Interpreting a Geology Map

Introduction & Purpose: The purpose of this laboratory exercise is to become successful at applying the principles learned in the topographic and structural geology labs towards the analyses of geology maps. Students will learn to read a geology map for the purpose of understanding surface and subsurface structural relations and geologic history, that may include a record of igneous, metamorphic, and sedimentary rock forming events, mountain building deformation, and surface erosion.

Part I – Reading and Interpreting a Geologic Map

Introduction:

A geologic map is a greatly scaled-down, two-dimensional abstract representation of the surface geology, structure, and relief of a geographic region of Earth, or even another terrestrial planet. A geologic map typically includes most information found on a topographic map, but most importantly, includes color-coding regions and symbols that denote rock units, contacts, and other structural information. Additionally, all the geologic color-coding and symbols are explained in the legend on a geologic map, including topographic and cardinal information.

A. Reading and Interpreting a Geology Map

Directions: Do a general examination of the entire geologic map of the Devil's Fence Quadrangle. Carefully examine the various rock units represented by the colored regions and related map symbols on the map that portray the surface geology of this area in Montana. Note their shape, aerial extent, and the larger structural patterns formed by spatially- associated outcropping rock units. Use the explanation to the left of the map to decipher the rock units, in terms of formation name, age, and lithology, and structural. Also use the explanation to the left of the map to decipher the structural relations of the various formations, including strike and dip, folding, and faulting. Finally, answer the following questions, based on your analysis of the Devil's Fence Quadrangle.

Topographic Questions

- 1) Where in Montana is the Devil's Fence Quadrangle located? _____
- 2) What is the magnetic declination for this region? _____
- 3) What is the map and verbal scale for this map? _____
- 4) What is the contour interval of this map? _____
- 5) How many square miles does this map cover? _____
- 6) What are the minimum and maximum elevations for this area? Min = _____ Max = _____
- 7) What is the total vertical relief for this area? _____
- 8) Would you consider this area gentle, or rugged, in relief? _____
- 9) Does the topography (location and orientation of ridges and valleys) correspond to the location and orientation of geologic rock units _____ Describe an example _____
- 10) What topographic feature does Devil's Fence correspond with? _____

Geologic Questions

11) List the major types of rocks exposed in this area, such as sandstone, schist or granite. Include at least six rock types. Note: Include at least one rock type from each of the three major rock groups.

_____, _____, _____, _____, _____, and _____.

12) What is the total range in age for the various rock types found on the map? _____ years

13) Name the youngest rock unit exposed in this area? _____

14) Where is this youngest rock unit located on the map? _____

15) Name the oldest rock unit exposed in this area? _____

16) Where is this oldest rock unit located on the map? _____

17) This rock unit forms the center of what general type of deformational geologic structure, such as a fold or fault? (hint: notice the upside down "V" shaped pattern of rocks) _____.

18) If you wrote down "fold", is it a syncline or an anticline? _____

19) What information did you use to tell whether it was a syncline or an anticline? _____

20) If it is a fold, is it a horizontal or plunging fold? _____

21) If plunging, then which direction is the fold plunging? Determine the bearing of fold axis _____

22) Find the Colorado Formation. This rock unit forms the center of what general type of geologic structure, such as a fold or fault? (Hint: notice the upright "V" shaped pattern of rocks) _____.

23) If you wrote down "fold", is it a syncline or an anticline? _____

24) What information did you use to tell whether it was a syncline or an anticline? _____

25) If it is a fold, then is it horizontal or plunging fold? _____

26) If plunging, then which direction is the fold plunging? Determine the bearing of fold axis _____

27) How many distinct folds are found in this geologic map? _____

28) Which two compass directions did the deviatoric stresses come from to cause the folding? _____

29) What type of rock makes up the Sagebrush Park stock? _____

30) Determine the timing between the intrusion of the Sagebrush Park stock and the regional folding event. Did the intrusion occur before, during, or after the folding? **Answer:** _____

Note: To confidently answer the above question, you will need to determine the ages relations below:

a) Age of folding? (Folding must have occurred **after** the youngest folded rock unit BUT **before** the oldest non-folded rock unit) Folding occurred between _____ Million years and _____ Million years

b) Age of intrusion? (That is found in the explanation) _____ Million years;

c) Finally, explain exactly how you figured out the timing between the folding and the intrusion.

31) Based upon your study of the geology in the Devil's Fence region, which one of the three types of tectonic plate boundaries (divergent, convergent, or transform) was this region most likely a part of to create the folding and intrusions?

Answer: _____ **Why?** _____

32) If you picked convergence, was it subduction-related, or was it a continental collision scenario

Answer: _____ **Why?** _____

33) If you picked subduction, was it ocean-ocean subduction, or was it ocean-continental?

Answer: _____ **Why?** _____

Part II - Geologic Map Laboratory Reflection

Directions: Write a 120 word minimum reflection of the lab activity, explaining its purpose, the methods used, the results obtained, and a brief personal reflection of what you enjoyed and learned about doing this lab (3 points possible). Answer the following 3-point question reflection set on a separate sheet of paper:

1) *What was the purpose of this lab? What did you actually discover and learn during this lab?*

2) *What did you enjoy most about this lab? Also, what was challenging or thought-provoking?*

3) *What are your constructive comments about the design and execution of this lab? What's good? What's bad? Offer suggestions for making the lab better.*