

Student Name:

Grade:

Physical Geology 101 Laboratory Interpreting Geology Maps I

Introduction & Purpose: The purpose of this laboratory exercise is to become acquainted with and 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. Review Taking Strike and Dip

Directions: Use the Compass and Inclinator, provided by your instructor, to determine the strike and dip of two inclined boards setup in the classroom. **Note:** Use the boards labeled “A”, and “B” for your measurements.

1. What is the strike and dip of the board labeled “A” strike: _____ dip: _____
2. What is the strike and dip of the board labeled “B”? strike: _____ dip: _____

Part II – 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) Verbal scale for this map? One inch of map is equal to _____ miles of real ground.
- 2) What is the contour interval? _____ ft. 3) This map covers _____ square miles.
- 4) What are the minimum and maximum elevations for this area? Min = _____ ft. Max = _____ ft
- 5) Is this area gentle, or rugged, in relief? _____
- 6) What topographic feature does Devil’s Fence correspond with? Valley? Mountain? Ridge? Plain?

7) Does the location and orientation of the Devil's Fence topographic feature (question 6) correspond to specific location and orientation of underlying geologic rock unit(s)? Hint: Underlying geology (nature of rock formations and structures like folds and faults) very commonly controls the overlying topography. Answer: _____

Geologic Questions

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

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

9) What's the total age range of the listed rock formations ? _____ to _____

10) Find the Colorado Formation unit on the map. What its age? _____Period

11) This rock formation forms the center of what general type of geologic structure, such as a fold or fault? Hint: notice the "V" shaped pattern of rocks) _____.

12) If you answered "fold", is it a syncline or an anticline? _____ Horizontal or plunging?

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

14) How could you tell whether it's a horizontal or plunging fold? _____

15) Find the Greyson Shale Fm on the map. What's its age? _____Period

16) This rock formation forms the center of what general type of deformational geologic structure? Hint: notice the upside down "V" shaped pattern of rocks) _____.

17) If you answered "fold", is it a syncline or an anticline? _____ Horizontal or plunging?

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

19) How could you tell whether it's a horizontal or plunging fold? _____

20) Determine the bearing of fold axes _____ Which direction are the folds plunging? _____

- 21) How many distinct folds are found in this geologic map? Hint: Way more than two!! _____
- 22) Which two compass directions did the deviatoric stresses come from to cause the folding? _____
- 23) What type of rock makes up the Sagebrush Park stock? _____
- 24) What's the age of the Sagebrush Park stock? _____ Period
- 25) Determine the timing of the regional folding event. **Note:** Folding must have occurred **after** the youngest folded rock unit BUT **before** the oldest non-folded rock unit). So to determine the age of the folding event, you will need to determine the following rock formation ages :

a) Name and age of youngest rock that is folded?

Formation name: _____ Age: _____ Period

b) Age of oldest rock that is NOT folded?

Formation name: _____ Age: _____ Period

c) Age of folding? Folding occurred between _____ Period and _____ Period

- 26) 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? **Note:** To confidently answer the above question, you will need to know the age of folding and the age of intrusion.

a) Age of folding event _____ Period

b) Age of Sagebrush Park intrusion? _____ Period

Based on the above ages, Did the intrusion occur **BEFORE, DURING, or AFTER** the folding?

c) Sagebrush Park intrusion intruded the sedimentary rock package _____ the folding.

- 27) 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?** _____

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

Answer: _____ **Why?** _____

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

Answer: _____ **Why?** _____

