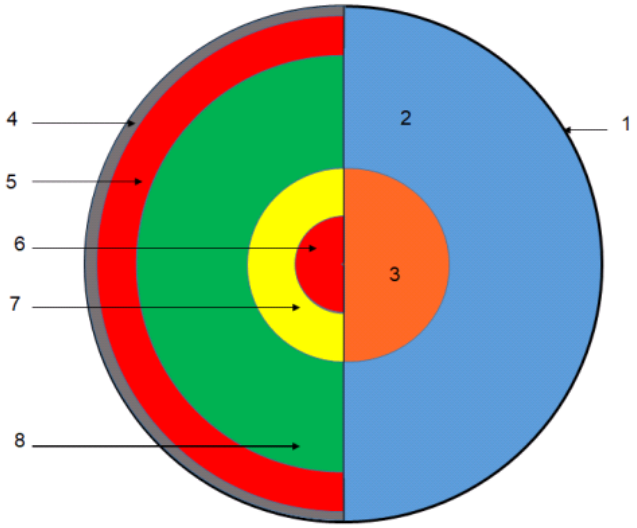
GeoLogic Mapping C - Geologic Mapping C - UT Invitational 2020 - Division C - 11-08-2020

1. You will have 50 minutes to take this test.
2. The Image Sheet is attached as a file.
3. All questions have their point value indicated. This test has a total of 169 points.
4. Give answers for bidirectional measurements (e.g. strike) in 180° azimuth form, clockwise from north. For numerical questions, answers within a reasonable range will earn full credit. For angular measurements, answer in degrees - other numerical units will be specified when asked for. You do not need to provide the unit, only the number. For questions that can be answered by one or more letter, write only the capital letters, separating multiple letters by only a comma if needed (e.g. "B" or "A,C").
5. The embedded images are of lower resolution than the original, therefore the full size versions of Images 3, 10, and 12 are attached for reference. Image 14 (attached) contains a standard USGS stratigraphic color key - use this to interpret the age of stratigraphic units where applicable.
6. Ties will be broken by comparing each question in order.

Section A

Image 1



1. (1.00 pts) For questions 1-8, answer according to the numbers marked on Image 1.

Crust

2. (1.00 pts)

Mantle

3. (1.00 pts)

Core

4. (1.00 pts)

Lithosphere

5. (1.00 pts)

Asthenosphere

6. (1.00 pts)

Inner Core

7. (1.00 pts)

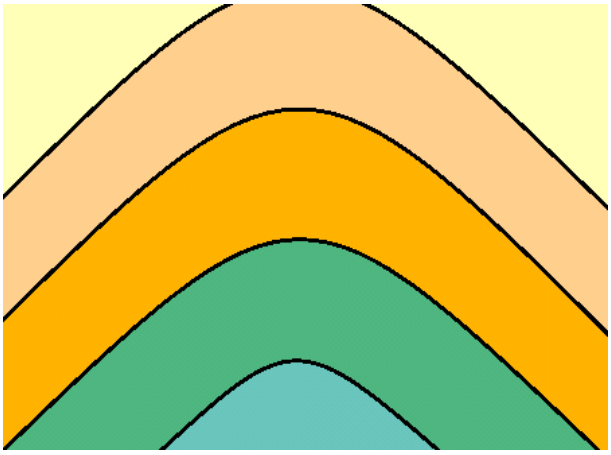
Outer Core

8. (1.00 pts)

Mesosphere

Section B

Image 2



9. (1.00 pts) Refer to Image 2 for Section B. What type of geologic structure is primarily shown in the image?

- A) Fault
- B) Fold
- C) Nonconformity
- D) Depositional bed

10. (1.00 pts) Are these layers overturned?

- A) Yes
- B) No

11. (1.00 pts) Which of these best describes the geologic structure in the image?

- A) Normal fault
- B) Monocline
- C) Syncline
- D) Anticline
- E) Reverse fault
- F) None of these

12. (5.00 pts) Which 5 geologic periods are represented in this image?

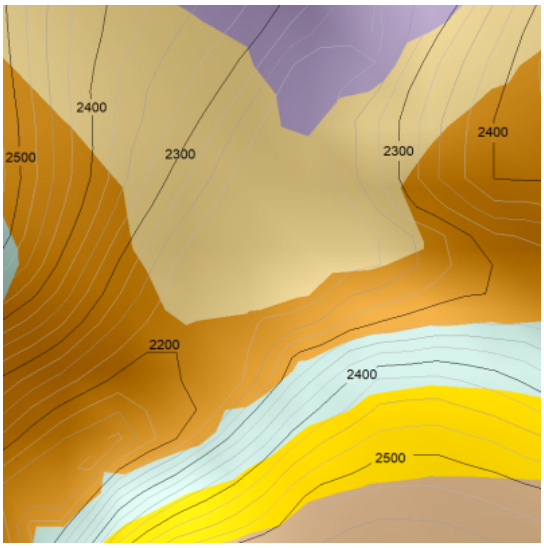
Expected Answer: Triassic, Jurassic, Paleogene, Neogene, Quaternary (1 pt each)

13. (4.00 pts)
Unconformities are not marked on this image - however, based on the layers shown, is there an unconformity among these strata? If so, which geologic period(s) are missing in this image?

Expected Answer: Yes (2) Cretaceous (2)

Section C

Image 3



14. (2.00 pts) Refer to Image 3 for the questions in Section C. Are the strata in this image tilted?

- (●) A) Yes
- ( ) B) No

15. (5.00 pts) This map is 1 km on each side, and the altitude is measured in meters. What is the strike and dip of the strata in this image?

Expected Answer: 76-84 deg strike (2 pts), 26-34 deg dip (3 pts)

16. (4.00 pts) All of the strata in this image are the same thickness. What is this thickness, in meters?

Expected Answer: 90 to 110 meters

Section D

17. (3.00 pts)
You're examining a rock layer outcropping on a canyon cliff face. The cliff is dipping at a 75 degree angle, in the same direction as the outcrop, which you observe to have an apparent thickness of 3.4 cm. You ascend to the flat ground on the top of the canyon and find another outcrop of the same layer, 560 meters above the first outcrop and 900 meters directly opposite the dip direction. What is the dip angle of this rock layer?

Expected Answer: 31.8 to 32.0 deg

18. (3.00 pts) What is the angle of incidence between the lower outcrop and the cliff face?

Expected Answer: 43.0 to 43.2 deg

19. (3.00 pts) What is the true thickness of the rock layer in centimeters?

Expected Answer: 2.30 to 2.34 cm

Section E

Image 4

Image 5

20. (1.00 pts) Refer to Image 4 for the questions in Section E. What type of structure is this?

- A) Moraine
- B) River Delta
- C) Subduction basin
- D) Alluvial Fan

21. (2.00 pts) What type of depositional environment is this?

- A) Fluvial
- B) Glacial
- C) Alluvial
- D) Marine

22. (2.00 pts)
Consider Image 5. Which of the locations marked on this map could be plausible locations where you could find the depositional environment from the previous questions.

E G

Section F

23. (1.00 pts) Which of these projections is conformal?

- A) Gnomonic
- B) Mercator
- C) Albers
- D) Stereographic

24. (1.00 pts) Which type of projection is area-preserving?

- A) Gnomonic
- B) Mercator
- C) Albers
- D) Stereographic

25. (3.00 pts) Which two of these useful properties of map projections cannot coexist in the same projection?

(Mark **ALL** correct answers)

- [x] A) Preservation of area
- [ ] B) Preservation of local distance
- [ ] C) Preservation of local direction
- [x] D) Preservation of geometry

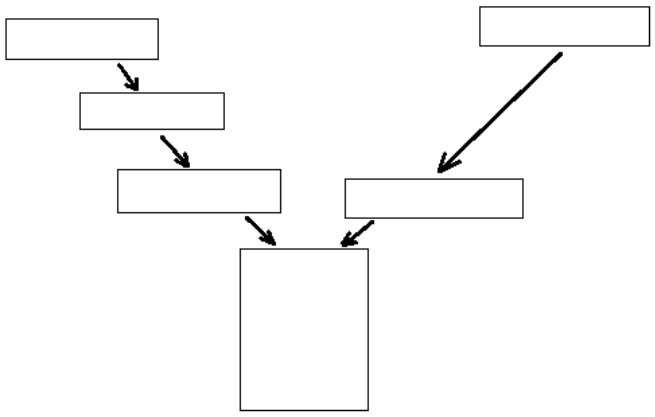
Section G

26. (8.00 pts)
Fluvial and alluvial deposition are related but generally distinct. How do these two depositional environments differ in terms of their location, size, and composition/structure?

Expected Answer: Fluvial - near rivers (1), larger (1), well-sorted (2). Alluvial - slopes/mountains (1), smaller (1), poorly sorted (2).

Section H

Image 6



27. (1.00 pts) Refer to Image 6 for the questions in Section H. What is the name of the diagram shown in this image?

- [ ] A) Wilson Cycle
- [x] B) Bowen's Reaction Series
- [ ] C) Phillips relationship

28. (1.00 pts) What type of elements are usually placed on this diagram?

- [x] A) Minerals
- [ ] B) Rock types
- [ ] C) Depositional environments
- [ ] D) Geologic structures

29. (6.00 pts) What are the names of the two sides of this diagram? What is the primary difference between them?

Expected Answer: Continuous (1) and Discontinuous (1). The continuous branch is felsic (2) while the discontinuous branch is mafic (2).

30. (3.00 pts) Can the two sides of this diagram manifest at the same time? Why or why not?

Expected Answer: Yes (1) because the division is not related to the primary purpose of the chart (2).

31. (3.00 pts) This diagram primary classifies its elements vertically according to what property?

Expected Answer: Temperature at which the mineral crystallizes from magma.

Section I

Image 7

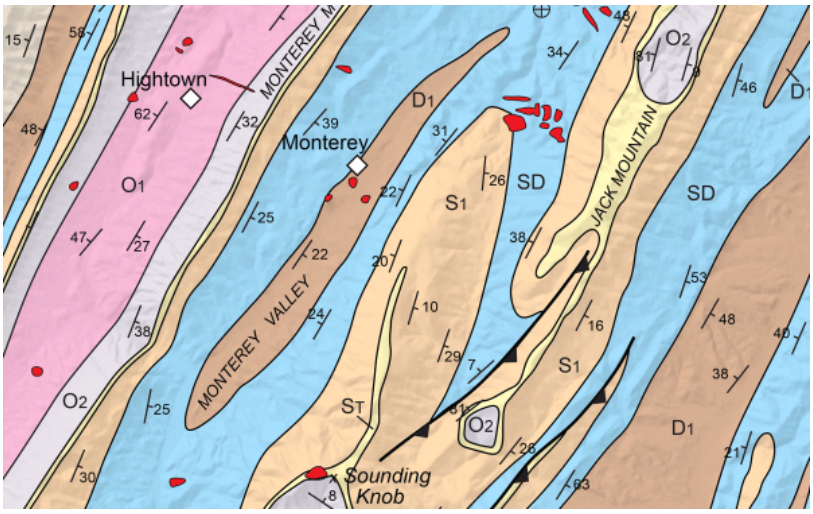
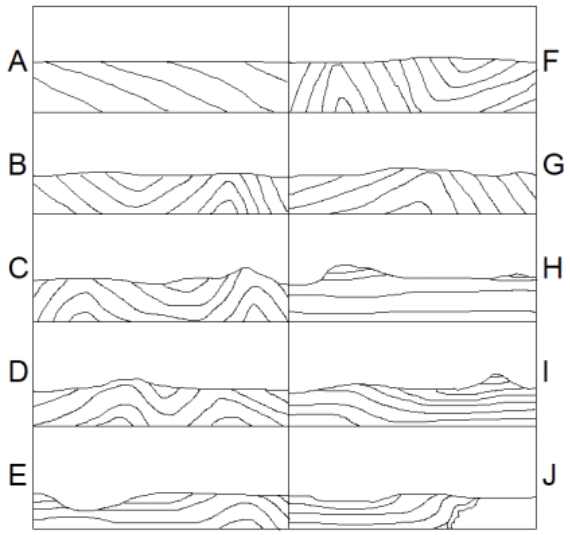


Image 8



32. (1.00 pts) Refer to Image 7 for the questions in Section I. What geologic structure is shown in this image?

Fold

33. (1.00 pts) What is the approximate axial strike angle of this structure? Round to the nearest 10 degrees

30

34. (2.00 pts) How many limbs, full or partial, are visible in this image?

5

35. (2.00 pts) What geologic era are the strata in this image from?

Paleozoic

36. (2.00 pts) What do the numbers next to the markers on this map indicate?

Expected Answer: Dip angle

37. (4.00 pts) Order the units in this map from oldest to youngest. Label the red-colored unit as "m".

Expected Answer: O1 O2 ST S1 SD D1 m (1/2 pt each pairing, +1 pt all correct)

38. (1.00 pts) What type of faulting is shown in this image?

- A) Normal
- B) Reverse
- C) Strike-Slip

39. (1.00 pts) What type of forces are primarily acting on the region shown in this map?

- A) Tension
- B) Shear
- C) Compression
- D) None of these

40. (1.00 pts) What type of geologic structures make up the red-colored unit?

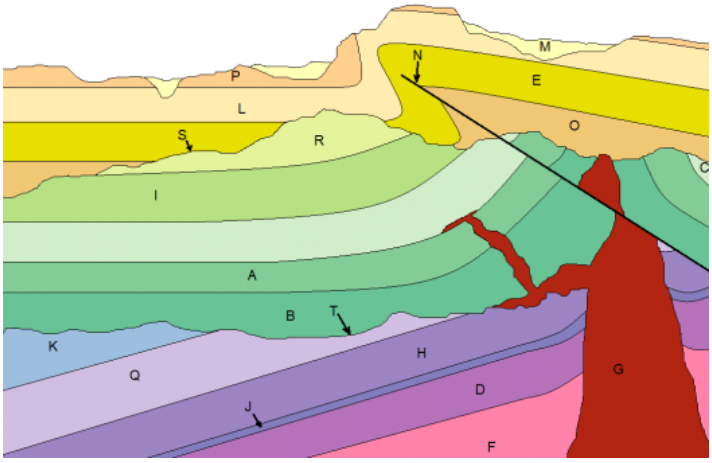
Expected Answer: Dikes

41. (5.00 pts) Refer to Image 8. Which of these best represents what an east-west cross section of this region would look like?

C

Section J

Image 9



42. (11.00 pts)
Refer to Image 9 for the questions in this section. Order these stratigraphic units from oldest to youngest. Use the letter U to represent the folding event in the purple and pink units.

Expected Answer: Oldest - F D J H Q K (T U) B A G C I R S O E L P (M N) - Youngest (1/2 pt each pair, +1 pt all correct)

43. (3.00 pts) Which geologic period(s) of the Phanerozoic, if any, are not represented in this cross section?

Expected Answer: Cambrian, Permian and Triassic (1 pt each)

44. (2.00 pts) What type of fault is shown in this cross-section? (be specific)

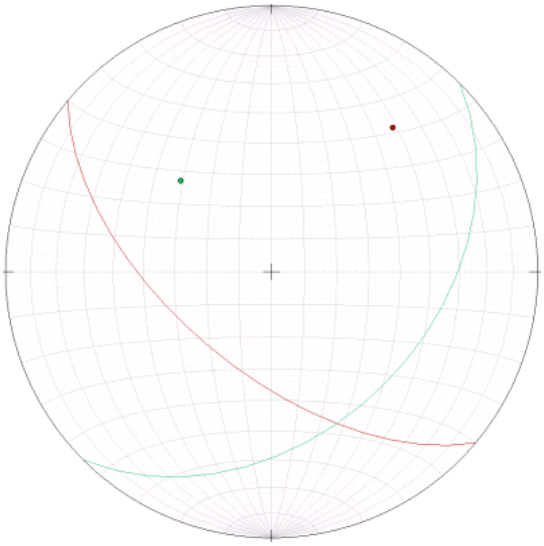
Expected Answer: Blind (1) thrust fault (1)

45. (2.00 pts) The fault from the previous question has produced what type of folding?

Expected Answer: Monoclinal

Section K

Image 10



46. (1.00 pts) Refer to Image 10 for the questions in this section. What type of diagram is shown in this image?

- A) H-R diagram
- B) Stereonet
- C) Cross section
- D) Drill core

47. (4.00 pts) For this type of diagram in general, what do dots represent? What do curves represent?

Expected Answer: Linear (2) and planar (2) elements respectively

48. (3.00 pts) In this specific diagram, what do the dots represent?

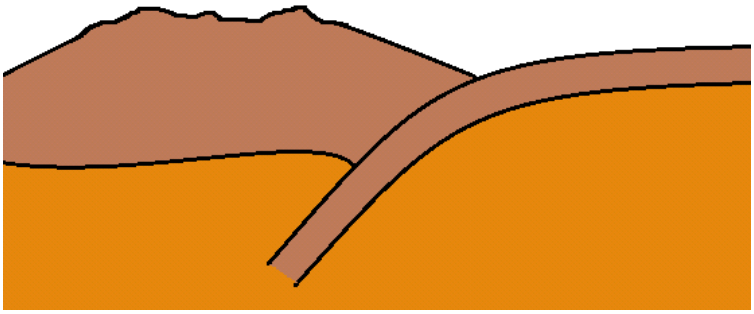
Expected Answer: Axes of the planar elements

49. (8.00 pts) What is the strike and dip of each of the two geologic structures shown here? Refer to the structures as "green" and "red".

Expected Answer: Green: 41 to 49 deg strike (2), 36 to 44 deg dip (2) Red: 126 to 134 deg strike (2), 56 to 64 deg dip (2)

Section L

Image 11



50. (1.00 pts) Refer to Image 11 for the questions in this section. What type of plate boundary is shown in this image?

- (●) A) Convergent
- ( ) B) Divergent
- ( ) C) Transform
- ( ) D) None of these

51. (2.00 pts) The left plate is (continental/oceanic) and the right plate is (continental/oceanic).

continental | oceanic

52. (1.00 pts) Which process is depicted in this image?

- ( ) A) Obduction
- ( ) B) Ridge push
- ( ) C) Inversion
- (●) D) Subduction

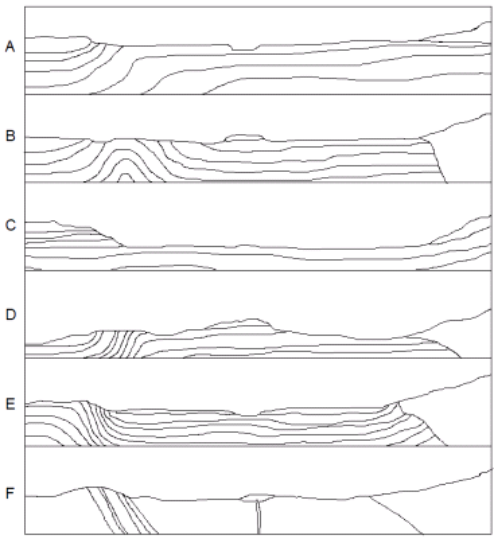
53. (4.00 pts) What physical properties cause the right plate to sink beneath the left plate? How does the chemistry of the plates affect this?

Expected Answer: Higher (1) density (1). The right plate is mafic (1) while the left plate is felsic (1).

Section M

Image 12

Image 13



54. (2.00 pts)
Refer to Images 12 and 13 for the following set of questions. Suppose that the portion of the map in Image 12 is 33.1 cm horizontally. What is this length in real life, in kilometers?

Expected Answer: 20.2 to 21.1 km

55. (2.00 pts) What is the scale factor of this map? Give only the larger number, excluding the "1:".

62500

56. (4.00 pts) Most of the rocks towards the west and east date from which two geologic periods, respectively?

Expected Answer: Permian on the west (2) and Cretaceous on the east (2)

57. (2.00 pts) What type of geologic structure dominates the region shown in this map?

Expected Answer: Monocline

58. (3.00 pts) The structure from the previous question was created by what subsurface structure?

Expected Answer: Thrust fault

59. (4.00 pts) What type of depositional environment is at Letter A? What type of depositional environment is at Letter B?

Expected Answer: Alluvial (2) Fluvial (2)

60. (1.00 pts) The streams and rivers in this area primarily flow in which cardinal direction? (answer with one of the 8 primary and secondary cardinal directions)

South

61. (1.00 pts) Consider the mountain towards the northeast of this map. What geological forces created this mountain?

Expected Answer: Volcanic/anything like that

62. (1.00 pts) Which of these best describes the overall geographic structure of this map?

- A) Continental margin
- B) Valley
- C) Mountain
- D) Floodplain

63. (4.00 pts) Consider the presence of the unit Kmf towards the northeast of this map. Why is this unit outcropping in this area?

Expected Answer: Uplifting (2) from the adjacent igneous intrusion (2)

64. (1.00 pts) What is the contour interval of this map, in feet?

80

65. (2.00 pts) What is the magnetic declination of this map, to the nearest 0.1 degrees?

13.5

66. (3.00 pts) The magnetic declination reading for this map was produced in 1985. Where is the region in this map most likely located?

- A) Georgia
- B) Wisconsin
- C) Oregon
- D) Pennsylvania
- E) Utah
- F) Texas

67. (6.00 pts) Consider Image 13. Which letter best represents the cross section of this map as taken across the southwest-northeast line on the map?

E

The End