Geologic Mapping Key - BirdSO Invitational

Written by: Aidan York (Giantpants)

March 7-14, 2021

Page:	3	4	5	6	7	8	9	10	11
Points:	8	8	5	$11\frac{1}{2}$	$9\frac{1}{2}$	14	9	13	12
Score:									

Page:	12	13	14	15	16	17	18		Total
Points:	5	9	$12\frac{1}{2}$	$5\frac{1}{2}$	6	7	8		143
Score:									

If you have questions or feedback about the test, feel free to contact me:

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Or fill out the feedback form at the end of test!

Directions and Introduction

- Hi! I'm Aidan York! I sometimes go by Giantpants on Discord or on scioly.org! If we've met, it's great to see you again, and if not, it's nice to meet you! I'm very happy to be serving as the event supervisor for Geologic Mapping for BirdSO!
- Please make sure you read ALL DIRECTIONS before starting the test!!
- Upon clicking to start the test, you'll have 50 minutes.
- For math and short answer questions, even if you have no clue what to put for an answer, at least come up with something so that I can potentially give you some partial credit.
- If you REALLY don't know what to write, feel free to write a funny answer, they always brighten my day while grading!
- For math, don't worry about significant figures, put as few or as many as you would like to. I'll be able to tell if you got the correct answer, and a few more or less decimal places shouldn't change that. If you put just the correct answer, you'll get full credit, but if you put just the wrong answer, then I can't give you any credit. So show work when you are able to/don't feel super confident about your answer!
- Once you start the test, please only use resources enclosed in your binders/virtual binders (which you can each have one of!). Obviously don't cheat by looking stuff up, I am placing immense trust in you all! I'm sure I'll be pleased with the results.
- Don't worry about the timer that tracks how much time you spend outside of your browser. I understand some teams may need to spend time looking at virtual notes, and there are some questions in which I'll invite you to look at an image in another tab. Again, do not worry about spending time outside of the test browser, whether to look at notes or at test materials. I will not count it against you at all!
- For short answer questions, please try to answer in as succinct and concise terms as possible. Please only answer in full sentences when I ask for an explanation. if a question is asking for a specific thing, or a math problem, giving a shorter answer will help me grade these quicker, and just be easier for me, since there are so many participating teams!
- Ties will be broken by specific questions, which are very clearly labeled as tiebreakers. Tiebreaker 1 will break the first ties, if both teams get that right, then tiebreaker 2, then if teams get that right, then 3, etc.
- That should be it for now. Enjoy the test!

1. (1 point) Before we begin, do you confirm that you and your team will follow all of BirdSO's rules and guidelines while taking this test? By selecting "I confirm," you are affirming your commitment to honesty and integrity in Science Olympiad!

   DO NOT SUBMIT UNTIL SELECTING "I confirm." (if you do, you're forfeiting a free point!)

   A. I confirm.

2. (1 point) You come across a fold labelled on your map as a synformal anticline. Which two choices describe this fold?

   A. Upward closing
   B. Downard closing
   C. Older in the center
   D. Younger in the center

3. (1 point) Which of the following rocks is most similar in composition to those you'd find making up oceanic crust?

   A. Rhyolite B. Granite C. Pumice **D. Gabbro**

4. (1 point) A basaltic intrusion solidifies and is eroded, eventually being covered by a layer of sandstone. Which type of unconformity is represented here?

   A. Disconformity
   B. Angular unconformity
   C. Paraunconformity
   D. Disnonconformity
   E. Nonconformity

5. (1 point) P-waves function as which kind of wave?

   A. Transverse **B. Longitudinal** C. Torisonal D. Mechanical

6. (1 point) Sediment deposited from a fluvial system that spreads out across the floodplain displays what trend in grain size as distance from the channel decreases?

   A. Grain size increases with distance from the channel.
   B. Grain size decreases with distance from the channel.
   C. There is no relationship between grain size and distance from the channel.

7. (1 point) Which two types of stress are present in a normal oblique-slip fault? (Choose two!)

   A. Compressional **B. Tensional** **C. Shear** D. Differential

8. (1 point) In which depositional environment do you think you'd be most likely to find micrite?

   A. Aeolian **B. Lagoon** C. Fluvial D. Glacial

9. (1 point) Some of the oldest oceanic crust on Earth is found in the Mediterranean Sea, dating back to 340 million years ago. Which ancient body of water was this oceanic crust likely part of?

   A. Pannonian Sea **B. Tethys Sea** C. Panthalassa D. Pacific Ocean

10. (1 point) A paleosol layer is evidence of what geologic structure?

    A. Syncline
    B. Anticline
    C. Unconformity
    D. Horst/Graben
    E. Basin

11. (1 point) If a topographic map has an elevation difference of 87 ft over a distance of 671 ft, what is the gradient of this segment of the map?

    A. 0.1297 B. 0.1302 C. 0.5841 D. 0.7126

12. (1 point) The oldest continental crust on Earth is approximately how many years old?

    A. 180 million years old
    B. 350 million years old
    C. 1.2 billion years old
    D. 2.9 billion years old
    E. 4.4 billion years old
    F. 5 billion years old

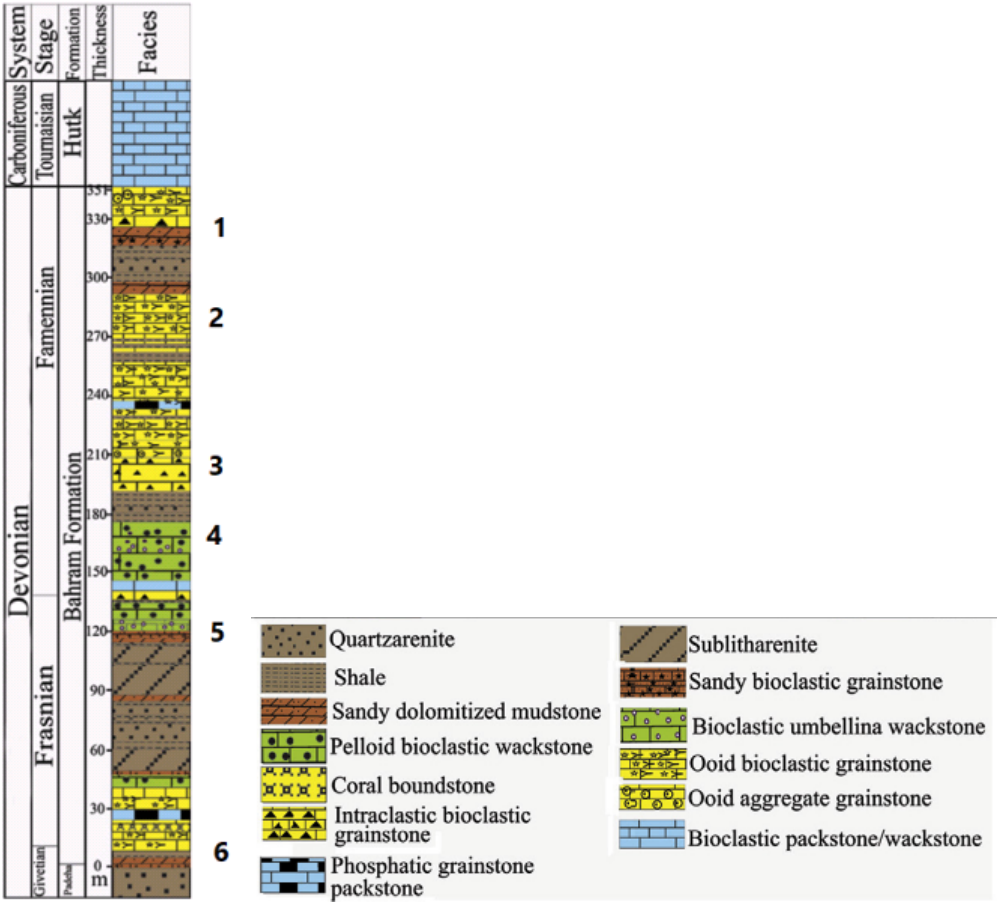
13. (2 points) Zoe notices that a ripple is asymmetrical. What can she assume about the fluid flow which produced it? (Tiebreaker #6!)

    A. The flow was constant in direction.
    B. The flow consistently alternated in direction.
    C. The flow pushed more heavily towards one side of the ripple.
    D. No conclusion can be drawn about the flow which produced the ripple.

14. (2 points) Hugo is examining a cross-bedded rock. He deduces that the current direction has what approximate relationship to the intersection between the truncated foreset beds and the overlying beds?

    A. The current direction is parallel.
    B. The current direction is at an angle between 0 and 90 degrees.
    C. The current direction is perpendicular.
    D. The current direction is at an angle between 90 and 180 degrees.
    E. The current direction is unrelated.

15. (2 points) Attached is an image depicting the sequence stratigraphy of the Hutk Section of the Bahram Formation in Iran, along with a legend for the rock units. Using the attached images, can you tell me at which numbers is there a trangressive systems tract? (Choose all that apply!)



A. 1 B. 2 **C. 3** D. 4 E. 5 F. 6

16. (2 points) Using the images from the previous question, which boundaries are lowstand systems tracts? (Choose all that apply!)

A. 1 B. 2 C. 3 D. 4 **E. 5** **F. 6**

17. (1 point) Internalites are deposites placed by internal waves in bodies of water. Along which of the following would you be most likely to find internalite deposits?

A. Thermocline
B. Halocline
C. Pycnocline
D. Bathyal boundary
E. Benthic boundary
F. Epipelagic boundary

18. (2 points) If Eric is looking to differentiate between internalites and storm-deposited sediments (tempestites), which of the following is a difference which would help him to distinguish the two? (Tiebreaker #7!)

A. Internalites are generally sediment more likely to be found in desert areas/aeolian environments.
B. Tempestites are usually interbedded with limestone.
C. Internalites are common across a variety of dip levels.
D. Internalites lack the coarse to fine gradation of storm deposited sediments.

19. (2 points) Allen is examining a sedimentary parasequence which he finds upon closer inspection is arranged into layers stacked vertically upon each other. Which class of sequence is Allen examining?

A. Progradational
B. Retrogradational
C. Aggradational
D. Degradational
E. Antigradational

20. ($1\frac{1}{2}$ points) In Allen's sedimentary sequence, how did the rate of sedimentation compare to the rate of sea level rise?

A. Sediment was deposited faster.
B. Sea level rose faster.
C. The rates were equal.

21. (2 points) In the sequence Allen is examining, which statement about the thickness of the layers is true?

A. Higher layers are thicker.
B. Lower layers are thicker.
C. The layers alternate in thickness.
D. There is no noticable difference between the thickness of the layers he is examining.

22. (2 points) Jay finds that a microfacies in a shallow marine depositional environment contains phosphite deposits. Which of the following phenomena explains this unusual abundance?

A. Ekman transport **B. Upwelling** C. Longshore currents D. Gyre formation

23. (2 points) In a pure shear model of a rift in continental crust, which changes does the center of the rift zone undergo? (Choose all that apply!)

A. Vertical extension
B. Vertical shortening
C. Horizontal extension
D. Horizontal shortening

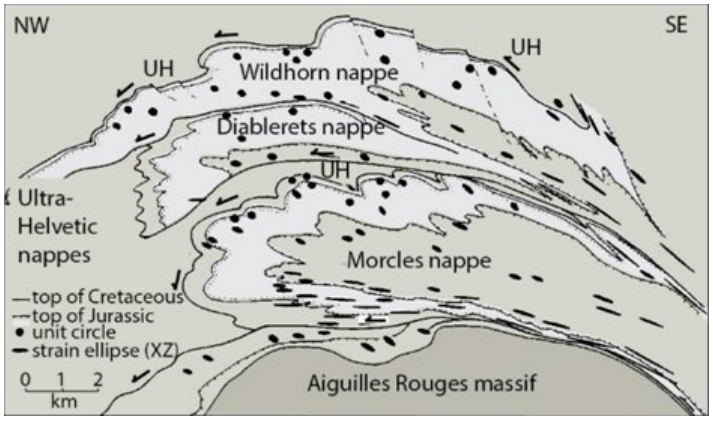
24. (2 points) By contrast, what is the fundamental difference between a pure shear model and a simple shear model?

A. In a simple shear model, no metamorphic fault rocks are produced due to lack of sufficient compression.
B. In a simple shear model, shear stress is applied in only one direction.
C. In a simple shear model, shear stress is combined with rifting to create an oblique slip rift.
D. In simple shear models, the crust disconnects at a deeper, separate shear zone.

25. (2 points) Flexural uplift resulting from rifting of the lithosphere creates erosion sites which have potential to develop into which structures? (Tiebreaker #5!)

A. Depocenters
B. Footwall overturning
C. Unconformities in sedimentary basins
D. Synthems

26. ($1\frac{1}{2}$ points) Attached is a cross section of the Helvetic Alps in Switzerland. Which faults are depicted in this cross section?



A. Normal **B. Reverse** C. Strike-slip

27. (2 points) Using the same map, is there a relationship between depth and degree of strain?

A. There is a relationship, but we cannot tell what it is.
B. There is a relationship, degree of strain increases with depth.
C. There is a relationship, degree of strain decreases with depth.
D. There is no relationship between depth and degree of strain.

28. (2 points) Again using the map, which direction does the X axis of the strain ellipse generally point?

A. Northwest B. Northeast C. Southwest D. Southeast

29. (2 points) Which fault is represented by the fault plane solution shown here?

A. Reverse **B. Strike Slip** C. Normal D. Olique-slip

30. (2 points) Beddings affected by fold-thrust interactions maintain constant thickness in all parts of the rock unit, except for one. Which segment's thickness varies? (Tiebreaker #3!)

A. Hinge B. Interlimb **C. Forelimb** D. Fold axis E. Backlimb

31. (2 points) Slip lineations can be useful for interpreting the direction of motion of a fault! Which of the following is true about slip lineations as indicators of fault movement?

A. Slip lineations can be formed by the crack-seal mechanism
B. Slip lineations can be erased by further fault movement.
C. All lineations going in the same direction is not sufficient evidence to determine the net slip direction of the vector.
D. Formation of newer sheets of fiber lineations helps emphasize the direction of motion.

32. (2 points) Paul is at his school's Amateur Radio Club trying to contact people in the surrounding area. He examines a radio coverage map, and when he does, he notices that a certain quantity is preserved. Which quantity is this, and what type of projection is he observing?

A. Shape, azimuthal
B. Scale, azimuthal
C. Direction, equidistant
D. Shape, conformal
E. Scale, azimuthal
F. Direction, conformal

33. (2 points) Knowing this, which of the following maps could Paul have been examining? (Tiebreaker #11!)

A. Mollweide B. Gnomonic C. Werner **D. Mercator**

34. (2 points) You find a country to have an angular distance of 9.8 degrees across, and a maximum radius of 27.4 degrees. Which type of projection is suitable for the best representation of this country?

A. Azimuthal B. Cylindrical C. Conformal D. Conic

35. (2 points) The classification of a fold vergence is given by the orientation of what part of a fold?

A. Dip axis B. Hinge axis C. Forelimb **D. Fold axis** E. Hinge line

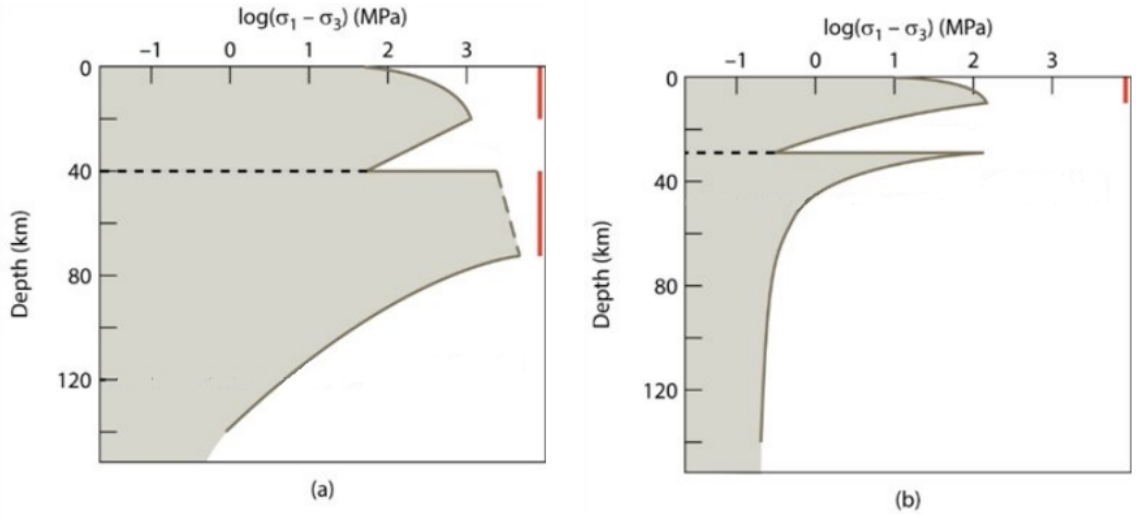
36. (2 points) Which of the following is another qualifying characteristic of fold vergences?

    A. Two crests of the fold are pushed together, giving the fold an apex crest.
    B. The fold gains a dip direction in a third dimension.
    C. There is a conjunction of two folds at the hinge point.
    D. The orientation of the enveloping surface remains unaltered.

37. (4 points) Jasp is examining a Flinn diagram, a very useful tool for categorizing strain ellipsoids based on the style of strain and their ellipsoidicity, but she admittedly doesn't really know what it all means. Can you help Jasp by describing the different regions of the diagram, the kinds of strain that fall in each region, and how they relate to the different kinds of tectonites?

Solution: On the Flinn diagram, the line y=x (K = 1) is characterized by plane strain, or strain which does not affect the second perpendicular axis. Also, this describes L-S tectonites. As K appraoches infinity, the strain becomes more and more constrictional, resembling L tectonites. Lastly, as K approaches 0, the strain becomes more and more flattening and like the S tectonites.

38. (3 points) Attached here are two strength curves of different regions of the Earth. What is a defining quality of the region that allows you to tell the curves apart? Can you give an example of each one? (1.5 for kinds of regions, 1.5 for examples)



Solution: The first curve represents an area with a low geothermal gradient, such as a shield of continental crust, or an area that would have relatively low temperature variation throughout. The second graph represents an area with (you guessed it) high geothermal gradient! For example, an area of crustal extension can be an example of this. If people just give examples, give 1.5 points, and if they just give the geothermal gradient definitions, give 1.5 points only. Each one is worth 0.75!

39. (2 points) What do you think the dotted line represents? What might the massive change in the curve's shape tell us about this location?

Solution: It represents the Moho, or the boundary between the crust and the mantle. Obviously the graph changes drastically at this point, indicating that this is the only place on the graph where there is a change in composition.

40. (2 points) What do you think the red lines on the right side of the graph represent?

Solution: These red lines represent areas where seismic activity can occur along the strength curve.

41. (2 points) Using these strength curves, can you explain why plastic flow starts to occur at a certain depth in the earth's crust?

Solution: This question is actually just reading the graph! The decrease in strength as depth increases provides evidence for this, though students should also mention increased temperature at lower depths. This, therefore, allows for greater ductility in the material of greater depths, and therefore plastic flow. Anything relating temperature and depth to strength giving a good explanation of plastic flow is sufficient for credit though.

42. (4 points) Sophia is trying to determine the sequence of deposition in a sedimentary basin she finds near a strike slip fault. Is this strike slip basin a good place to try to determine the order of deposition of beddings? Why or why not? Support your answer using evidence and proper reasoning! Even if you choose the wrong option (Yes/No), you may still be able to get some points if your evidence is sufficient! (Tiebreaker #4!)

Solution: Sophia should not be using strike slip basins to develop a sedimentary timeline in an area. Strike slip basins are relatively unreliable due to their abrupt vertical and lateral facies changes, abundant deformation, and rapid subsidence in initial basin formation.

43. (3 points) Inspired by her friend Sophia's research, Bhavna decides to begin studying the Dead Sea, interested by its history as a strike slip basin. The basin is rather unusual in that it is longer than the slip of the Dead Sea Fault. Can you help Bhavna come up with an explanation which explains this phenomenon?

Solution: An explanation is that the Dead Sea Basin is actually subdivided into numerous sub-basins known as sequential basins, each divided by a fault which gradually extends and deepens the basin overtime. The explanation doesn't need to be this specific, but if it gives the general idea, then it's good!

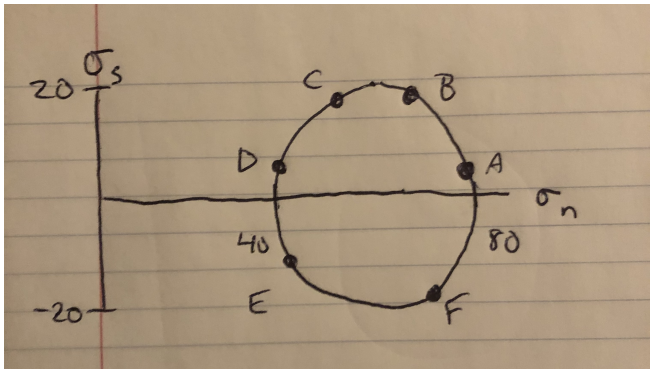
44. (7 points) Jason is running BirdSO with his friends, but it's a lot of work, and he is kind of stressed. Wanting to step away for a minute, he goes out into the wonderful world of geology! However, Jason cannot escape the stress, and so he begins to wonder about how the rocks he is observing respond to stress.

    Jason comes across a cliff with an exposed rockface. He notices in the vertical rock face there is a fault which has a dip of 31 degrees to the east. Since Jason assumes that the fault is buried under about 3 km of rock, it probably has about 81 MPa of stress acting on it vertically. He guesses that the horizontal stress acting on the rock is about 39 MPa. Can you tell Jason what the resultant net traction acting on a central point on the fault is (3 points), as well as the magnitudes of the component shear and normal stresses (2 points each)? Assume a perfectly two-dimensional system for simplification!

    (Remember to show all your work so I can give you partial credit if your work warrants it! No partial credit can be given for just a wrong answer!) (Tiebreaker #1!)

    Solution: Resultant traction = 72.28 MPa, Normal = 69.86 MPa, Shear = 18.54 MPa, The explanation for this is rather complex and long, so I will not be including it here! Instead, I'll be including a link to a Google Drive picture of my full work for the solution! The attachment can be found at this link.

45. (3 points) Jason is interested in plotting his results on a Mohr Circle! He makes a quick sketch in his field notebook. Which of the following points could possibly be the location of the values for the normal and shear stress which Jason is studying?



    A. Point A B. Point B C. Point C D. Point D E. Point E **F. Point F**

46. (2 points) Intrigued by Jason's findings, his friend Andrew decides to create a graph relating shear stress, shear force, and the dip angle of a plane. He finds that maximum shear stress is applied to a plane with what dip angle?

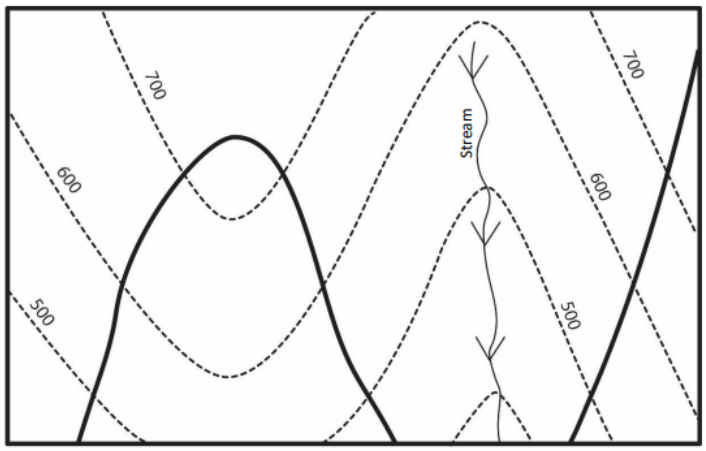
    (Hint! Think about the formula you used to get the answer in the last question, and apply it in a general sense!)

    Solution: 45 degrees is the dip angle at which applies the maximum shear stress is applied to a plane.

47. (3 points) Andrew relays his findings to his friend Vincent, who is eager to verify Andrew's results in the field by examining some reverse faults. He expects that the dip angle for most faults will match up with the angle at which maximum shear stress is achieved. Vincent is, however, disappointed to find that the vast majority of the faults do not have the dip angle predicted by the calculations. Approximately what dip angle do most of these faults have, and, assuming Andrew did the math right, why did his theoretical results differ from the results Vincent found?

Solution: Most reverse faults will roughly have a 30 degree dip angle (but a decently close answer is sufficient for points!). Andrew's results differ from the actual values because although shear stress is maximized, failure (and faulting) occurs when shear stress overcomes normal stress. Normal stress decreases rapidly after shear stress hits a maximum, while shear stress decreases relatively slowly. So if you plotted them on a graph, you'd notice distance rapidly decrease and shear stress overcome it approximately when the dip angle equals 30. Of course, a sufficient explanation of this needn't be this detailed, but as long as they explain the steep drop off in normal stress compared to the not so steep one in shear stress, it should be good.

48. (1 point) What is the approximate dip and strike/dip direction of this bedding? (within 5 degrees for the strike and 10 degrees for the dip are acceptable!)



Solution: Dip direction: 180 (strike is 90, and dip direction is perpendicular to strike) The dip here is 12 degrees, but in order to find that, you'd need a scale, which I forgot to provide. As such, I am throwing out this part of the question, and making the question worth only one point for the dip direction. Apologies for any confusion this may have caused!

49. (1 point) At a quick glance, it may look like there are actually two acceptable values for the strike! However, there is really only one. How can we differentiate between the two values?

Solution: It may look like the strike could be either 90 or 270 degrees. However, according to the right hand rule of geology, the strike has to be 90 since the bed dips 90 degrees to the right of the strike! (Any similar explanations of the right hand rule of geology will suffice too!)

50. (2 points) Using your answer to the previous question, is there a relationship between the dip of a bedding and the shape it produces on a topographic map? (0.5 points) If so, what is this relationship? (1.5 points!)

Solution: There certainly is a relationship! Think of a bedding as starting at 90 degrees, meaning it is vertical and therefore it appears as a straight line. As the dip decreases from 90, the Vs produced by the bedding become sharper and more defined as moving with the topography, until eventually, when dip=0 degrees, the bedding appears parallel to contour lines. Therefore if you see very well defined dips in a bedding (like in the last question) you know that the dip must be relatively low!

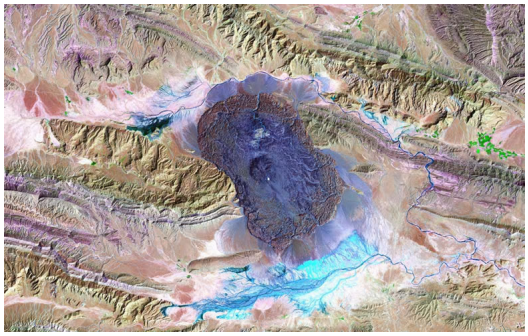
51. (2 points) With these in mind, what would you need to plot the strike of a bedding?

Solution: You would need two outcrops of equal elevation to plot the strike of a bedding.

52. (2 points) What elements of a plane do you need to find its dip?

Solution: You need three points, at least one of which has to be on a different elevation than the other two!

53. (2 points) Jasmine is cruising along on Google Earth one day and notices this. Not being able to identify the black object, she turns to the BirdSO Geologic Mappers to help. Can you help her out by identifying what this black object is, and how it reached the surface?



Solution: This is a salt glacier, formed when salt protrudes from an anticline in a salt diapir. It reaches the surface due to gradually rising due to density differences, and salt being incompressible.

54. (1 point) Kayla is doing what all good geologic mappers do and examining landforms to get a better sense of the geologic history, since she loves geology so much. She notices some desications on top of a facies, so she starts to wonder, are the desications on top of a regressive or transgressive sequence?

A. Regressive B. Transgressive

55. (4 points) Kayla continues analyzing the region, when she comes across a drowned carbonate platform, in a completely separate stratigraphic sequence (so don't let your answer be influenced by the answer to the last question!). What does it mean for a carbonate platform to be drowned? (1 point)

    Additionally, as Kayla tries to piece together the geologic history of the area, she comes across a problem when thinking about the mechanism behind the carbonate platform's drowning. What problem might Kayla have come across? (3 points) (Tiebreaker #9!)

    Solution: A carbonate bank is drowned when the rate of sea level rise exceeds the rate of accumulation on a carbonate platform. This is pretty clear just by the idea of a drowned bank, so yeah. The challenging part of this question is thinking about what potential problems arise from trying to find a mechanism to the drowning, since studies estimate that the growth of carbonate platforms was able to occur at about 1000 micrometers per year, which is much faster than any possible rates of long term sea level rise. So, the problem is that it doesn't make sense to have the drowning explained by slow gradual sea level rise, since that would never be fast enough!

56. (4 points) Continuing to think about Kayla's problem, what is a possible solution or explanation to her problem that you can come up with? These don't need to necessarily be proven as fact, just ensure that your answer makes sense in the context of the question!

    Solution: There are plenty of sensible explanations! They include rapid surges of sea level rise, lowering of carbonate deposition based off of environmental shifts. The former may be supported by latitude shifts/regional tectonic activity or submarine volcanism, while the latter can be thought about due to massive shifts in oceanic climates that occurred, or even potentially extraterrestrial impacts!

57. (3 points) Kayla calls in her friend Tim to help her analyze the broader history of the region. As Tim arrives, he notices that the sequences are almost exclusively shallowing upwards. Can you explain what this means?

    Additionally, what can Tim infer about the size of sediment throughout the sequence? (Tiebreaker #10!)

    Solution: Shallowing upwards means that the sequence contains rocks that would be more common in shallower bodies of water as it goes upwards. Additionally, the sequence will have coarser grained sediment on top of finer sediment, so coarsening upwards. These are all properties of a regressive sequence!

58. ($1\frac{1}{2}$ points) For the grand finale, is Tim and Kayla's region an example of a transgressive region or a regressive region?

    A. Transgressive **B. Regressive**

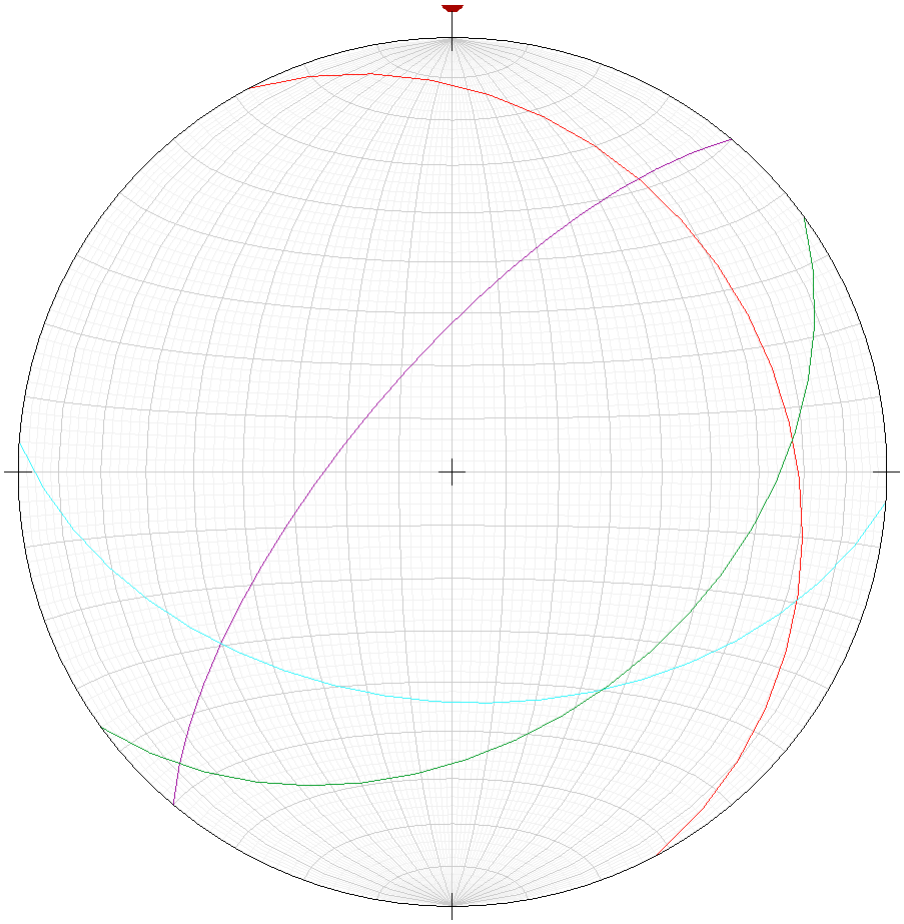
59. ($3\frac{1}{2}$ points) Vivek is a skilled geologist. He is the field examining a bed which has a dip of 39.1 degrees, an outcrop width of 61.8 meters from the upper to lower contact, and a true thickness of 25.4 meters. While measuring, Vivek drops his geologic compass down the hill, and it rolls away. Frustrated, he decides to find the slope of the hill on which he is standing. What is the slope of the hill, and in which direction relative to the bedding is it sloped?

Solution: 14.832 degrees, slope is in the same direction as the dip!
$\frac{t}{s} = sin(dip + slope)$ where t=thickness and s=outcrop width

$\frac{25.4}{61.8} = sin(39.1 + x)$
$0.4110 = sin(24.268)$
$24.268 = 39.1 + x$
$x = -14.832$ degrees

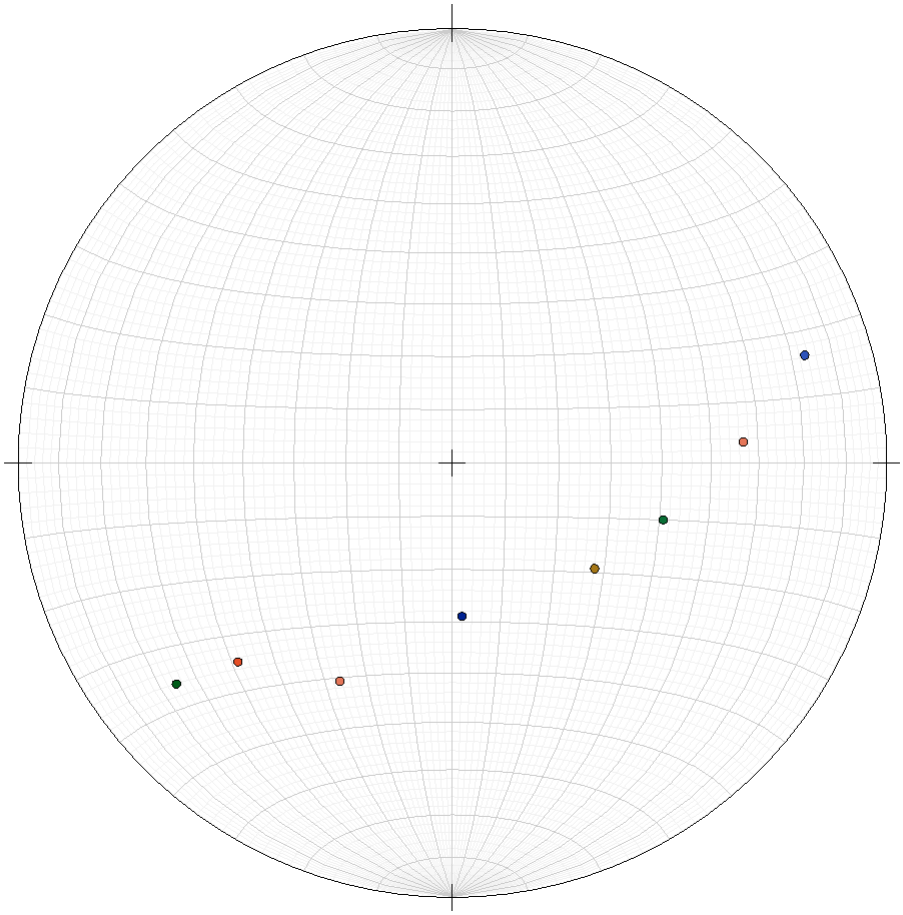
60. (2 points) Attached is a stereonet! Don't worry, we won't be spending too much time with these haha.

After retrieving his compass, Vivek is plotting his data on a stereonet. Can you tell me which of these planes on the stereonet is the plane Vivek measured the dip and thickness of?



A. Cyan plane **B. Green plane** C. Purple plane D. Red plane E. None of the above

61. (3 points) Arman, after a long day of playing Valorant, is folding his laundry. Inspired by the intricacies of laundry folding, he decides to do some research into geologic folds. Arman was able to plot a number of poles of beddings of a fold on the stereonet below, but he isn't actually sure of what to do next. Can you help Arman find the trend and plunge of the fold axis of this fold? (I'll accept within 10 degrees for the trend, within 5 for the plunge!) (Tiebreaker #2!)



Solution: Trend: 333 (Accept 323-343) and Plunge: 30 (Accept 25-35)! This is found by plotting a great circle of best fit for the fold data, then the pole of that plane is the fold axis!

62. (3 points) Using the same fold data, can you tell Arman what the strike and dip of his axial fold is? (I'll accept within 10 degrees for the strike and 5 degrees for the dip!)

Solution: Strike: 153 (accept 143-163) and Dip: 90 (accept 85-95). We can find this by finding the great circle along which both the axial plane and the midpoint of the fold data lie. This happens to be the central line in Arman's fold data!

63. (2 points) Robert is analyzing an asymmetrical fold while writing one of his many tests for BirdSO. What can we learn about the direction of shear strain simply by knowing that a folded layer is asymmetrical?

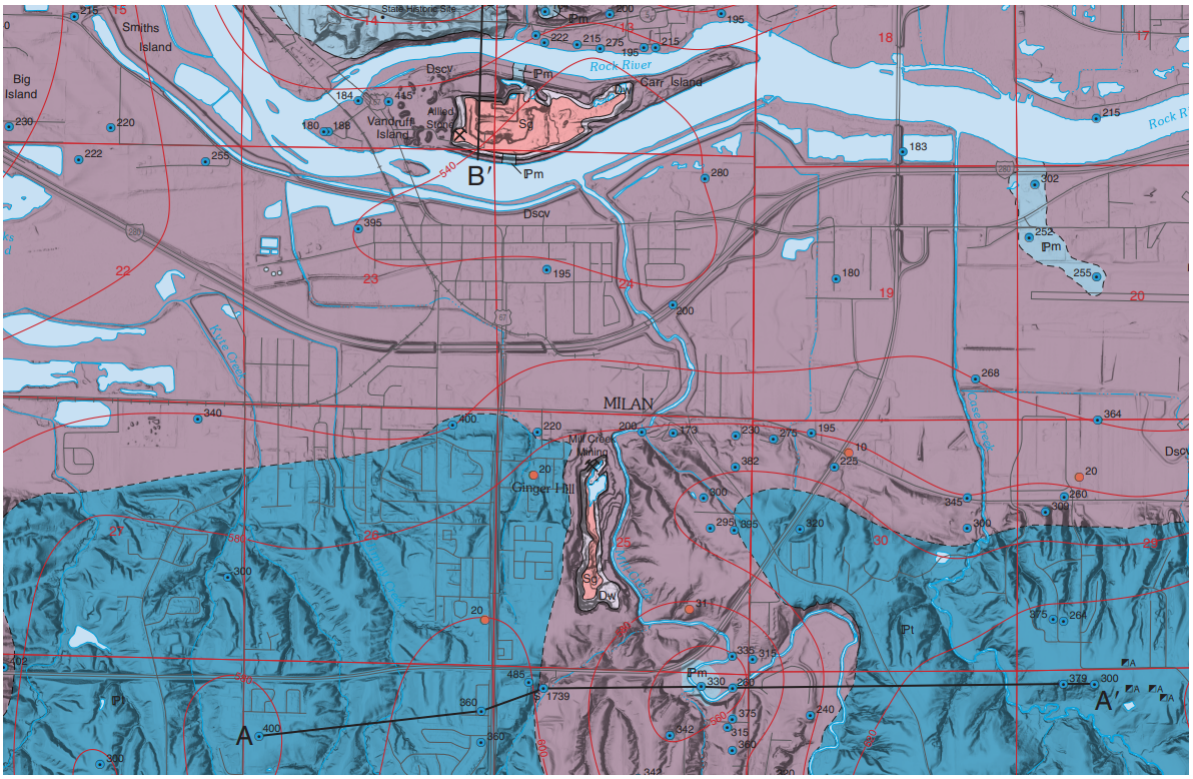
Solution: The shear strain is parallel to the folded layer in an asymmetrical fold!

64. (3 points) Since Robert loves statistics and distributions, he decides to plot and find the distributions of wavelengths and thicknesses of the fold. What properties of the fold can be estimated using this distribution?

Solution: You can estimate the ratio viscosity of the stiff layer to its matrix and degree of non-linearity in the flow given these distributions.

65. (2 points) I am attaching to this question a part of a geologic map you can use to answer the next questions! The map is from Davenport, IL, and depicts the bedrock formation of the area. (The full version of the map will be in the folder you found this test in!)

Please turn your attention to the bottom of the image to line A-A'. The line has multiple dots within blue circles. What do these dots represent? Why are the features these dots represent located in this particular region?



Solution: These are wells! They are good here because they pierce down into carbonate systems which have low concentrations of dissolved solids, and they have substantial water output.

66. (3 points) Can you place the rock layers on the map in order from oldest to youngest?

Solution: Sg, Dw, Dscv, Pm, Pt! Found based off of lettering and formations on the geologic map itself.

67. (2 points) In which bedding would you be likely to find fossils? Why did you choose this bedding?

Solution: Fossils are common within the Cedar Valley Formation, which is a limestone layer. Think about the layer which surrounds most of the mines, which are the primary sites of fossil research!

68. (1 point) Which map projection is this geologic data plotted on? (Tiebreaker #8!)

A. Robinson Projection
B. Mollweide Projection
C. Transverse Mercator Projection
D. Sierra-Cliff Projection
E. Robinson Projection
F. Arlo Projection

69. (2 points) There is one geologic structure omitted from the map. All deposits unique to this region's depositional environment are included in the omission. Using what you know about the map's location, as well as the history of the region, what depositional environment do you think deposited these sediments? Can you name some possible kinds of sediments deposited?

Solution: Glacial depositional environment! Some kinds of sediments include loess, till, outwash.

70. (0 points) This is the final question on our test, worth zero points. It is the ultimate question science still cannot answer. What is the name of the event you are currently doing?

A. Geologic Mapping B. GeoLogic Mapping C. Geological Mapping

Conclusion

- Thanks for taking my Geologic Mapping test! I hope you enjoyed it.
- If you have any concerns about the test, you can feel free to message me on Discord (preferred, Giantpants#6460) or on scioly.org (Giantpants) or email me (ayork@haverford.edu)! I'll be happy to do my best to help with any questions you have about the test.
- If you are interested in leaving feedback, you are welcome to do so at this Google Form. (anonymous if you so choose!) I would really love to know what you think of the exam! (If you don't have time to fill it out now, I've also linked the form on my scioly.org Userpage, which is accessible at anytime by simply googling "Giantpants scioly.")

Thanks again!!
Aidan

(P.S. it's Geologic, not GeoLogic!!)