School Name:_____ Team #_____

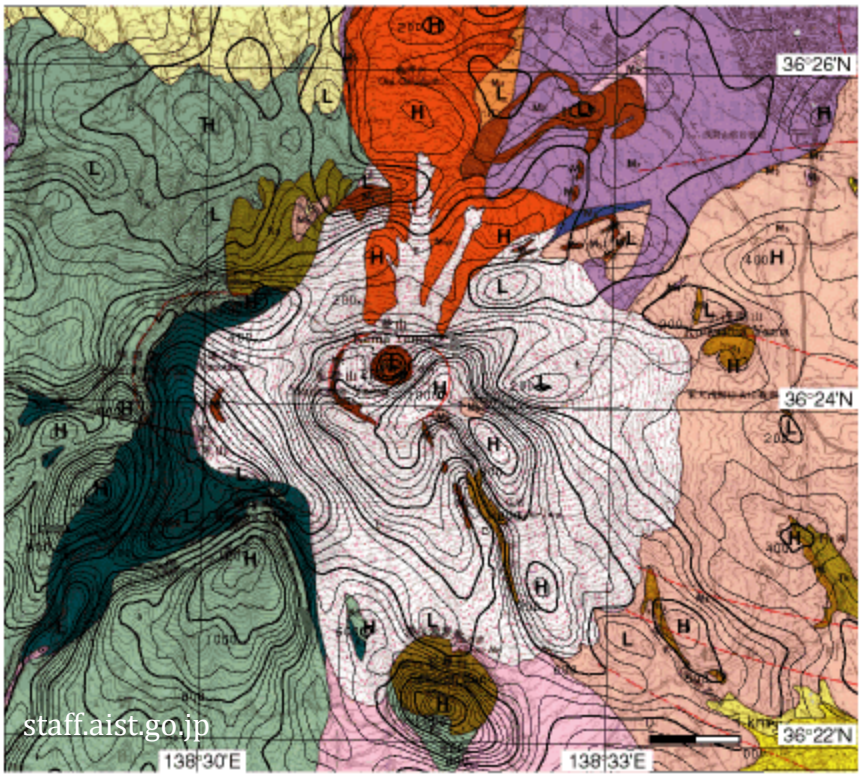
Student Name: 1) _____ 2) _____

GeoLogic Mapping

National Science Olympiad Tournament

UNL - May 16, 2015

Event supervisor: Enrica Quartini



- *All answers must be reported **clearly** on the **answer sheet***
- *You can detach the pages of the test and answer sheet but MUST return them stapled back together in the **right order***
- *Tiebreakers (in order of evaluation):*
  38, 21, 68, 31, 48, 29, 53, 54, 59, 60, 16, 7, 5, 3, 19

DO NOT OPEN
until instructed to do so

ALASKA MAP

Main Map:

1) (0.5) What does the white unit represent?
2) (0.5) What is the scale of this map?
3) (0.5) Which of the following scales would give better detail resolution than the one of this map? (choose the best option)
   a) 1 : 63360
   b) 1 : 63365
   c) 1 : 63355
   d) 1 : 63345
   e) 1: 63375
4) (0.5) What is the contour interval in meters?
5) (0.5) What is the magnetic declination in this region?
6) (0.5) In the map, all elevations are measured with respect to what?
7) (0.5) How many minutes of latitude does this map span?
8) (0.5) Which region of the map is at the highest elevations?
   a) N
   b) S
   c) W
   d) E
   e) Center
9) (0.5) a) What are the latitude and longitude coordinates of the center of the blue star in the map?
   (0.5) b) Report the coordinates you found in question a) in decimal degrees
10) (1) What type of unconformity exists between formation Tif and Qt? (1pt) T##
11) (0.5) a) Name one formation that hosts mineral deposits
    (1) b) What *type* of rock is that?
12) (0.5) Name one formation that shows to "pinch out"?

Columnar Section:

13) (1) Put intervals A, B, C, and D in order from coarsest to finest
14) (1) Look at intervals E, F, G, and H. Which interval represents a
    a) upward fining succession
    b) upward coarsening succession
15) (1) a) What are the two most fossiliferous formations?
    (1) b) What *type* of rocks are those?
    (2) c) In which paleo-depositional environment did each of those two formations form? (Choose between: reef, deep marine, coastal plain)
16) (2) The interval between ~7000 ft and ~ 10500 ft represents:
    a) a progressive deepening of the basin
    b) a progressive shallowing up of the basin
    c) cyclic alternations of marine and terrestrial environments

17) (2) Name:
   a) one deposit that resulted from explosive volcanic activity in the region
   b) one deposit that resulted from effusive volcanic activity in the region
   c) one example of intrusive igneous rock
   d) one example of extrusive igneous rock

Cross Sections:

18) (1) Along profile D-D', which formations have no dip?
19) (1) Along profile C-C', what type of unconformity exists between Km and $T_R$ng?
20) (1) Along profile C-C', what geologic structure affects Station Creek formation?
21) (4) Look at profile C-C' and put the following processes/events in the correct order (NOTE: some repeat):
   a) deposition of the Cretaceous units
   b) erosion (x2)
   c) extension
   d) deposition of the Tertiary and Quaternary units
   e) compression (x2)
   f) deposition of the Permian through Jurassic units

FIGURES 1 - 3

22) (1) This map shows different degrees of risk associated different areas around Mount Vesuvius' volcanic center: red is proximal, yellow is distal, and blue is distal and low topography. Which of the following represents the main hazard in each area (red, yellow, and blue) ?
   a) lava flow, pyroclastic flow, and pyroclastic surge
   b) pyroclastic fall
   c) pyroclastic fall and laars
23) (0.5) The risk associated with the more distal areas depends upon:
   a) wind direction in the stratosphere
   b) grain size of the tephra
   c) intensity of the eruption
   d) topography of the area
   e) all of the above
24) Figure 1 is a map of the *risk* associated with Mount Vesuvius.
   (1) a) Define *risk* and *hazard*
   (1) b) Based on your answer to a), explain why is Figure 1 a map of *risk* (instead of hazard)
25) (1) Put the following in order from the lowest to highest in kinetic energy content:
   a) pyroclastic surge
   b) lava flow
   c) pyroclastic flow
26) (0.5) Look at Figure 2 and link each one of the following *processes* to the *deposits* they emplace, shown in panels A-C:
   a) pyroclastic surge
   b) pyroclastic fall
   c) pyroclastic flow
27) (0.5) Figure 3 shows what remained of the town of Saint Pierre, situated about 6.4 kilometers south of the summit of volcano Mount Pelée, after the famous volcanic eruption of May 1902.

Based on your answers to previous questions, can you infer which of the following *processes* was responsible for the destruction of the town?

a) pyroclastic flow
b) pyroclastic surge
c) pyroclastic fall
d) lava flow

28) (0.5) In Figure 3, look at the way the walls of the buildings are preferentially destroyed in one direction over the other. This observation can definitely be used as a proxy for what information about the process that destroyed the town?

a) density
b) speed
c) direction
d) temperature

29) (3) Historically, the volcano Mt. Vesuvius has shown the following precursor signs before an eruption. For each precursor, list one instrument you would install on the ground to monitor the volcano's status of activity:

a) seismicity
b) fumarole activity
c) ground deformation

30) (2) What type of indirect geophysical method would you adopt to image the underground mass of magma?

FIGURE 4: GEOLOGIC COMPASS

31) (2) Link each panel of Figure 4 to the correct type of field measurement from the ones listed below:

a) dip of a plane
b) dip of a line
c) azimuth
d) strike of a line
e) strike of a plane
f) plunge of a line
g) plunge of a plane
h) trend of a line
i) trend of a plane

32) (0.5) Which features represent lines? [select all that apply]

a) foliations
b) acicular crystal and fossils
c) hinge of a fold
d) cleavage

33) (1) When measuring the true bearing to go from your location A to destination B using a compass and a geologic map, which one of the following is the very first step you would have to take?

a) rotate the compass dial to align with the true north
b) align the edge of the compass to connect your current location with the destination
c) adjust the compass by the amount of magnetic declination shown on the map
d) read the degree indicator and follow your azimuth

34) (2) Put the steps required to take the measurement of a line, in the correct order:

a) orient the compass vertically
b) align the edge or the sight of the compass with the line
c) read the value on the clinometer scale to get the plunge
d) hold the compass over the line
e) tilt the compass to match the plunge of the line
f) check the Bulls eye level to keep the compass horizontally leveled
g) read the north arrow to measure the trend
h) adjust the clinometer level

FIGURE 5

35) (0.5) How many upward coarsening sequences can you count in this outcrop?
36) (3) Draw a stratigraphic column (also called columnar section) of this outcrop (for scale, the hammer is ~ 40 cm)
37) (1) In the field, you would accompany the columnar section of the outcrop with a detailed description of all its sequences and components. Name three types of measurements you would perform at this specific outcrop.

MAP 1: CROSS SECTION

38) (15) Draw a cross section with topographic profile along A-A' (15 pt)
39) (2) What is the true thickness (in meters) of unit Oc?
40) (0.5) What units does the A-A' profile cross?

MAP 2

41) (0.5) a) What does the red line represent?
(0.5) b) What geological structure does it identify?
42) (2) Of the units affected by the geological structure you identified in question 41), name:
a) the oldest unit and which period it belongs to
b) the youngest unit and which period it belongs to
43) (0.5) What other major geological structure affects the area? [be specific]

MAP 3

44) (0.5) Count the number of:
a) anticlines
b) synclines
c) reverse faults
d) normal faults

45) (0.5) What unit hosts iron minerals?
46) (1) What does it mean when the symbol for normal fault is
a) dashed
b) dotted
47) (1) The contact between units is marked with a solid black line. Note that between some units the line is *dashed* instead. What does that indicate:
a) a fault contact
b) a potential fault contact
c) unconformity
d) a shear zone

48) (3) Put the formations in order from the youngest to the oldest.
49) (1) What period does the oldest formation belong to?
50) (1) What era does the youngest formation belong to?
51)(2) Complete the following sentences using the words listed below (a-h):
1)_____ are the result of a process called 2)_____, which induces 3)_____ 4) _____ in the 5)_____, which is the 6) _____ shell of the Earth. This definition is based on the 7)_____

properties of the rocks that constitute the shell, as opposed to the term 8) _____, which is a definition based on the rock composition.

a) compressional and extensional
b) plate tectonics
c) crust
d) stresses
e) rigid and outmost
f) lithosphere
g) faults and folds
h) mechanical

MAP 4

52) (0.5) Is this a ridge or a valley?
53) (2) Which direction is unit Ol dipping?

MAP 5

54) (3) Draw the location of the major drainage divide that passes through this map
(NOTE: draw your answer on map that is in the *answer sheet*!!!)

MAP 6

55) (0.5) What is the major aquifer of Nebraska?
56) (0.5) What aquifers are mostly unconfined along the A-A' cross section?
57) (0.5) What aquifers are mostly confined along the A-A' cross section?
58) (0.5) a) If you were asked to drill a well that would not need the use of pumps to get water, which aquifer/s would you drill?
(0.5) b) What is the minimum depth (in metes) you would have to drill?
59)(0.5) Which of the following lithologies would make the best aquitard?

a) well-sorted sand
b) fractured crystalline rock
c) karstic limestone
d) clayey silt
e) gravel

60) (2) Look at the cross section. If it rains at the Colorado-Kansas boarder, water would percolate into the ground and flow in different preferential directions and speeds through the rocks and sediments. Through which unit/s is water flow going to be mostly

a) horizontal
b) vertical
c) fast
d) slow

61) (0.5) What *type* of projection is the one used in this map?
62) (0.5) What does this type of projection conserve?
63) (0.5) Where is distortion minimal in this map?

MAP 7

64)(2) Based on the information shown in MAP 7, what can you speculate about the Dune Sand region of Nebraska (shown in MAP 6)? [select all that apply, -0.5pt for each wrong answer]

a) This is an important recharging area of the High Plain aquifer
b) Wells can and should be exploited more in this area to allow wells downstream to recharge
c) Water demand in this area needs to be limited to assure recharge of aquifers downstream
d) Ground-level decline could still occur if the Dune Sand are simply slow to react to extreme droughts and the rise recoded here is the result of extremely wet years from the past
e) All the above

65) (0.5) Based on the information shown in MAP 7, the highest concentration of wells is likely to correlate with areas of groundwater level _____ (complete the sentence)

66) (1) The Ogalla Aquifer, which constitutes the major part of the High Plains Aquifer System, is in a state of overdraft. What are some of the effects to expect in case of aquifer depletion? [select all that apply, -0.5 pt for each wrong answer]

a) drying up of wells
b) deterioration of water quality
c) increased pumping costs
d) increased water in streams and lakes
e) land subsidence

67)(0.5) Recharge of aquifers varies based on

a) amount of precipitation
b) soil type
c) vegetation cover
d) all of the above
e) a) and b)

STEREONET

68) (4) Draw the following planes: 080/35, 280/55SE

69) (0.5) The intersection between two planes identifies a line. How are lines reported?

a) trend/plunge
b) plunge/trend
c) trend/dip
d) dip/strike
e) strike/dip

70) (0.5) Report the line that the two planes of question 68) identify

71) (2) In order to report your plane as 080/35, what assumption do you necessarily have to make in order to know in which direction is the plane dipping?

72) (1) In the notation 280/55SE what does SE indicate?

73) (0.5) How would you report plane N50E/35 according to the azimuth notation?