# **Field Methods Mapping Project 1:** *Volcanic products and other materials in the Cima Volcanic Field, near Baker, CA*

**Overview:** This is your first mapping project for the field portion of this class. Although you have done some mapping using aerial photos and satellite images in previous courses such as Structural Geology, Petrology, and Geomorphology, many of you have not performed much field-based mapping and this project is a nice introduction as to how to do that. I have found through experience that one of the toughest tasks for young mappers to do is to draw a contact between two units on a map – once you get over that initial trepidation of drawing on your map, the process gets a lot easier. One way to get over that initial hurdle is to start mapping in an area where the contacts are 'obvious'. The Cima Volcanic Field affords us that opportunity. While learning to map, you will also be learning about volcanic products (not something we see much of in Erie!), Quaternary deposits, and metamorphic rocks.

For a background on the Cima Volcanic Field, see pages 468-473 of Lang et al. (2011), which is on the course Blackboard page. Chapters 7 and 10 as well as Appendix A10 (pg. 309) of your Coe textbook will also be helpful for this assignment.

**Learning objectives:** Your task is to create a geologic map of a portion of the Cima Volcanic Field over the next three days. Specifically, you are to create a map that identifies all geologic materials that appear in the Google Earth image that has the UTM grid overlain on it. Your map will cover ONLY the area covered in that image. When you finish creating your map, you will be able to:

1) Create a geologic map of geologic terrain through using fieldwork, topographic maps, and aerial images
2) Identify the different parts of a basaltic lava flow as well as identify a cinder cone
3) Use geologic principles to deduce a geologic history of a region

In addition, you will be able to:
1) Recognize and describe Quaternary alluvial deposits
2) Recognize and describe some metamorphic rocks

**Due and to turn in:** This assignment <u>is due by the end of breakfast on Monday, May 20</u>. You are to turn in:
a) a geologic map of the Cima Volcanic Field as seen in the Google Earth image and zoomed in topographic map (attached – these are both at the same scale).
b) a cartoonish geologic cross-section across some portion of the map area (you choose orientation and location)
c) a bulleted geologic history of the map area that includes a cartoonish stratigraphic section of te map area
d) answers to questions related to your mapping and which are listed below
e) your field map you created while working in the field

You may draw the map and cross-section on either a sheet of tracing paper OR overhead transparency. These are both located in the supplies box in the dining hall (near the door to the

back patio where we eat). I encourage you to place your map and cross-section on the same sheet. Colored pencils and sharpies are both located in the same supplies box. For your benefit, I have included a Google Earth image and zoomed in topographic map of the field area that DO NOT have the UTM grid overlain on them – it may be easier to view some parts of the field area without that grid.

An example of how a map and cross-section should be laid out when you turn it in is included in this packet (this is an example of a map my Geomorphology professor gave us as undergrads). Symbols you will want to use to denote units and features are provided in Appendix A10 (page 309) of your Coe textbook.

When you are turning in your assignment, have your assignment organized in the following manner:
a) Your map and cross-section on the first page
b) The base map you used for helping you map (Google Earth image or topo map); clean copies of the Google Earth images and zoomed in topo maps are available in the supplies box
c) The bulleted geologic history of the map area (written by hand on a sheet of paper you provide)
d) Answers to the questions outlined below. These are to be written by hand – you may write directly on the attached sheet with the questions, but if you use a sheet of notebook paper to write out answers, make sure to write out questions as well. You may use either pen or pencil to do this.
e) Your field map you made while out in the field

Turn this assignment into the file folder labeled, "Cima Project" that is next to our supplies box in the dining hall; please paper clip your work together and make sure your name is on each sheet. You are on the honor system to not look at and copy anyone else's work – though you are allowed to work together, you are to each do and turn in your own work.

**Grading:** The attached rubric outlines how you will be graded on this assignment. Please see me if you have any questions or concerns regarding this grading schema.

**Teams:** You are to work in the following teams of three for this assignment:

1) Joe, Sherry, Morgan
2) Nicole, Jacob, Marge
3) David, Renee, Michael

Remember that each of you are turning in your own assignment. Lizzie and I will turn you loose after an introduction to the field area and assignment and will then circle around to each group multiple times a day over the next three days. Be sure all of you are back at the van in the afternoon by the time I tell you at the start of the field day.

**To do:**
1) Working in the teams outlined above, use field work and the attached Google Earth and zoomed in topographic map to create a geologic map of this portion of the Cima Volcanic Field.

In addition, you each have the 1:24,000 scale USGS topographic map of this area to help think about your map area in a larger context; using Google Earth back at Zzyzx can also help here.

2) Using either the zoomed in topographic map or the Google Earth image, create your map of this area - you can draw directly on any of those items. That will constitute your field map. Use either a regular #2 pencil or colored pencil when writing on your field maps.

3) When you believe you have finished with your mapping in the field, start transferring that field map onto either a piece of tracing paper or overhead transparency back at Zzyzx as your final map. Then draw your cartoonish geologic cross-section on that same sheet (if you can fit it on there). Make your map and cross-section have titles and appropriate information (see attached example, but make sure you map has a title, legend, scale, and north arrow (if possible to determine orientation). Make sure your map and cross-section are colored in as well. Make these look as professional as you can. Attempt to show as much detail as you can. Use different colors for different units and various symbols for different structures. Your cross-section line can be oriented in any direction you like, but make sure to include as much geology in your cross-section as possible. Do not worry about a vertical exaggeration for your cross-section, but keep the exaggeration to as much of a minimum as possible.

4) On a separate sheet of paper, bullet point the geologic history of this area and draw a cartoonish stratigraphic section highlighting unit ages and any unconformities that exist here.

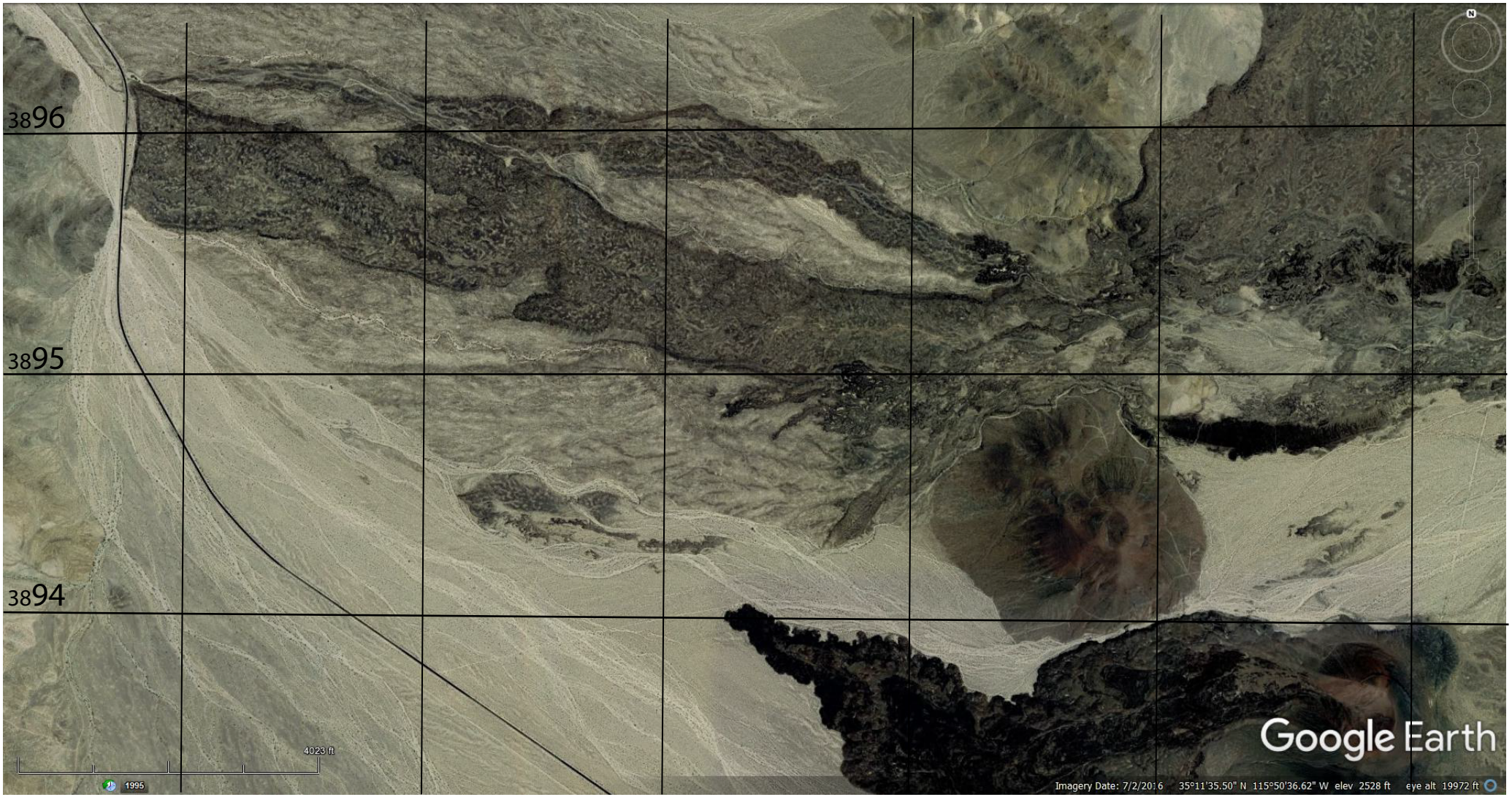
5) Answer the associated questions located at the very end of this packet.

6) Turn this in at the appointed location by the appointed time.

**Some notes about the field area:**
Your map should have a minimum of four units divided out. There are Proterozoic metamorphic rocks (lump all of these together as one unit), there are Quaternary-aged basaltic lava flows, Quaternary-aged cinder cones, and Quaternary-aged alluvial deposits. The Mesozoic-aged Teutonia Batholith may or may not be exposed in your map area; if it is, then there would be an additional fifth unit – it is up to you to determine if it is exposed in your particular area. Again, look at Lang et al. (2011) for more detail on the units exposed here.

You may or may not want to subdivide your lava flow units and your alluvium units into multiple sub-units. Subdivide as far as you are comfortable, but I would encourage you to show as much detail on your map as you can without going beyond the limits of your data (this would include flow direction arrows for your lava flows).

Each box in the grid on your Google Earth image represents a distance of 1000 m or 1 km. Use that as your scale. That grid is a UTM grid of zone 11S in WGS 84.

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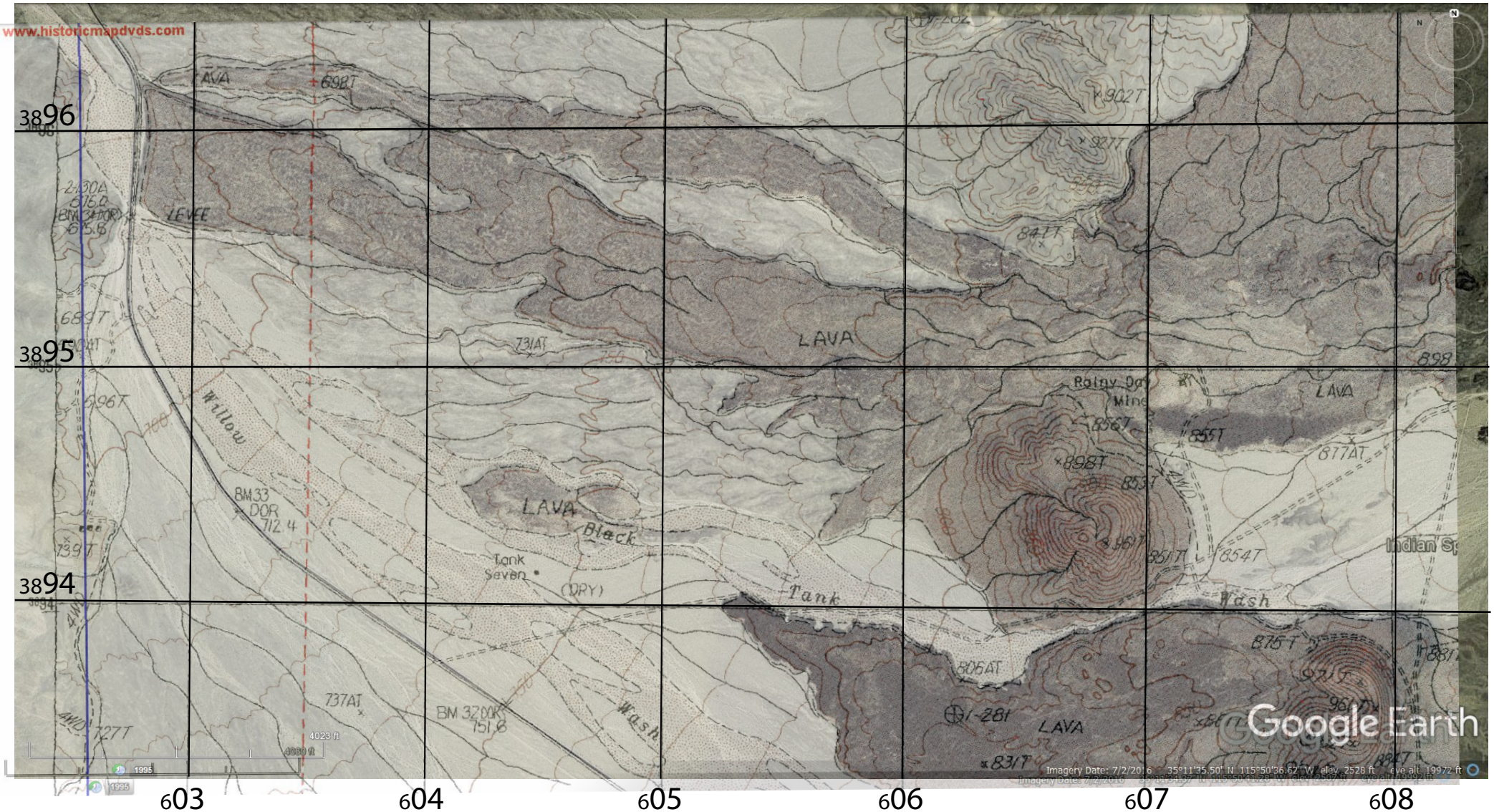


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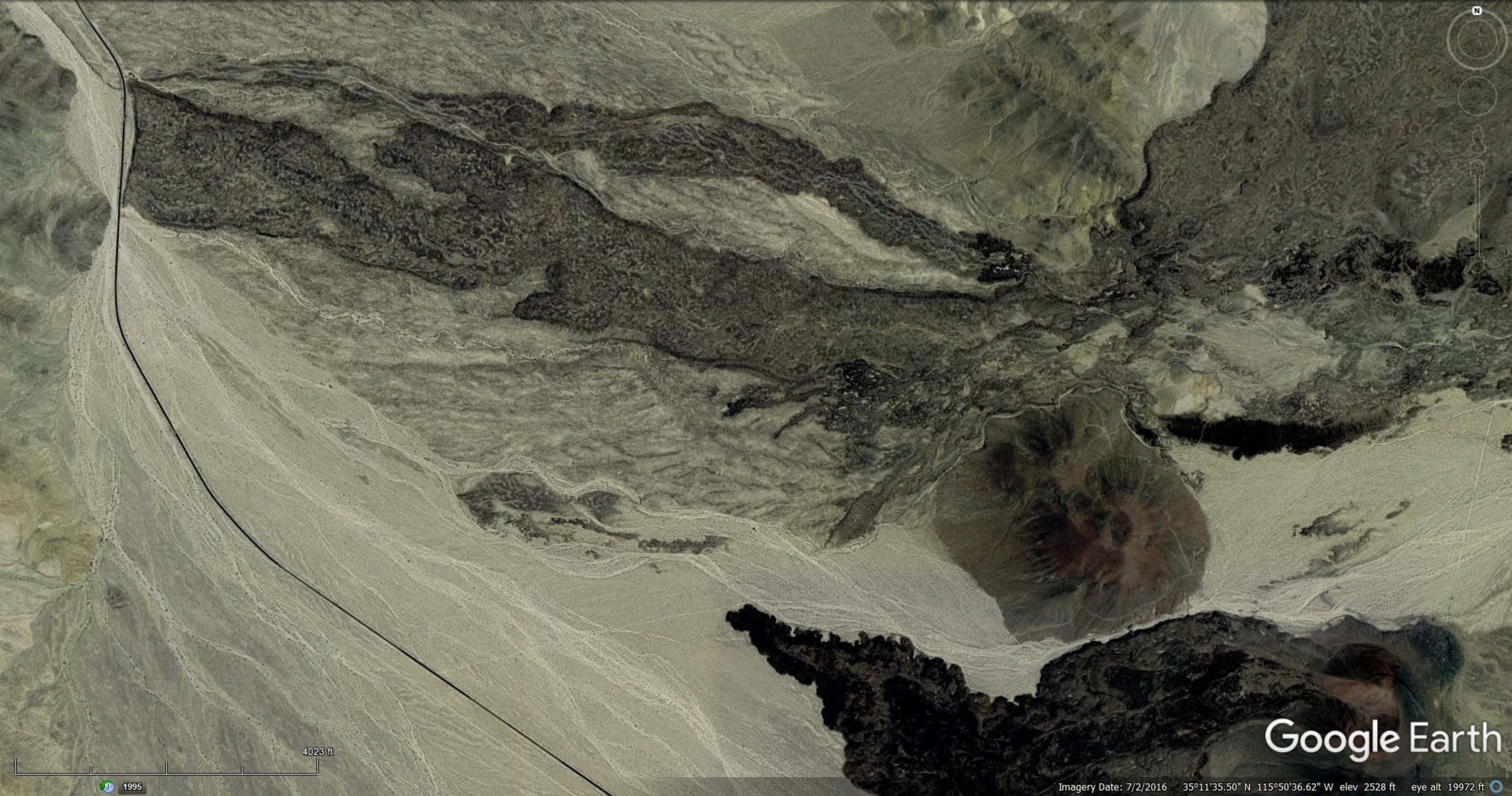
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Google Earth
Imagery Date: 7/2/2016 35°11'35.50" N 115°50'36.62" W elev 2528 ft eye alt 19972 ft

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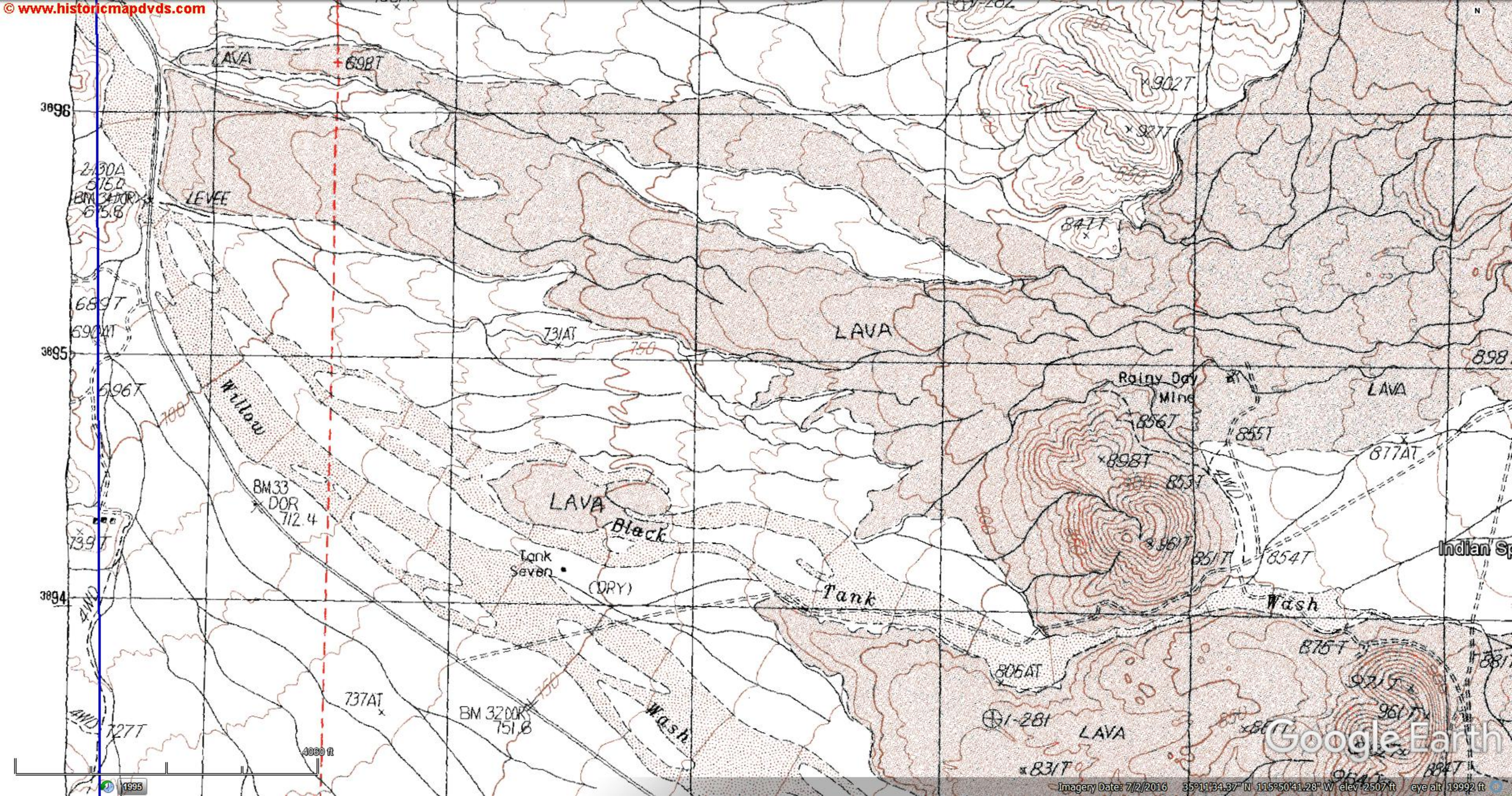


Geol 455 Field Methods in Geology Grading Rubric

| Objective | Score of 5 | Score of 4 | Score of 3 | Score of 2 | Score of 1 | Score of 0 | Scored: |
|---|---|---|---|---|---|---|---|
| **Distinguish between different geologic units and features (e.g., Qal, basalt, seds, volcano, strike and dip, etc…)** | All geologic units identified with their boundaries clearly identified. | Most geologic units identified correctly and correctly labeled. Boundaries are mostly clearly identified. | | Some geologic units correctly identified and labeled. Boundaries are fuzzy or not clearly defined. | Not correctly identified or labeled. | Not attempted | |
| **Identify and determine the extent of the boundaries between geologic units** | All contacts between geologic units are correctly identified and traced out on the map. | A majority of the contacts between geologic units are correctly identified and traced out on the map. | | Only some contacts between geologic units are correctly identified and traced out on the map. | Not correctly identified or labeled. | Not attempted | |
| **Associated questions answered** | All questions are correctly and appropriately answered | | | | Only a minimal attempt was made to answer the associated questions | Not attempted | |
| **Neatness/ presentation of the map** | Map is clear and easy to read; all necessary aspects are included such as scale, north arrow, legend, units correctly identified | Map is mostly clear and easy to read and most critical map elements are included | | Map is legible, but only some critical map elements are shown such as scale, north arrow, and/or legend | Map is sloppy and difficult to read; most of the critical map elements are missing such as scale, north arrow, and legend | Not attempted | |
| **Geologic cross-section** | Cross-section includes a majority, if not all, of the geologic units and exhibits the proper contact relations between units and easy to read | Cross-section includes a large percentage of geologic units and proper contact relations between units are mostly correct and easy to read | | Cross-section includes only some of the present geologic units and contact relations between geologic units is only partially correct | Cross-section only includes a minimal number of present geologic units and/or displayed relation between geologic units is mostly, if not entirely, incorrect | Not attempted | |
| **Write a geologic history** | Geologic history is entirely correct – no units or events are out of order. | A majority of the geologic history is correct – the timing of a few units or events may be out of order. | | Geologic history only partially correct. | Geologic history entirely incorrect. | Not attempted | |
| | | | | | | **Total:** | **/30** |

[suggested format for photogeologic map]

Geologic Map of a portion of
Rockbridge County, Virginia
25 November 1963 R. J. Carson
(photos from p.444 of U.S.G.S. Prof. Paper 373)

CENOZOIC
Quaternary

Qal alluvium: loose sediments

MESOZOIC

Pss Resistant bedrock: sandstone?

Psh Erodible bedrock: shale?

anticline

syncline

strike & dip

horizontal beds

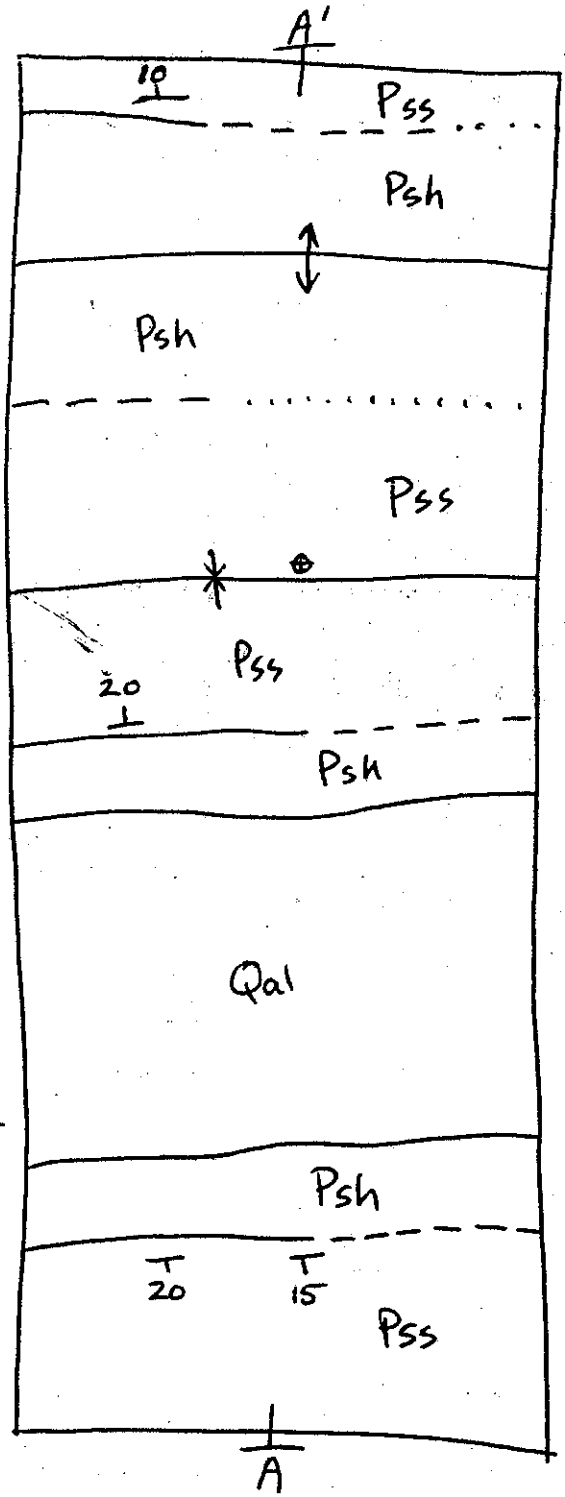
known contact

Approximate contact

Concealed contact

½ mile ?
SCALE

N?



**<u>Questions to answer:</u>** Hand write the answers to these questions. You may write directly on this paper, but make sure your writing is legible.

1) Sketch a hypothetical cross-section through a basaltic lava flow and highlight the various parts of that flow (e.g., columnar jointing, where vesicles are located, etc…).

2) Consider all of your map units. How much total time is represented in this map area?

3) What appears to be the timing between the emplacement of the lava flows and formation of the cinder cones? How about between the Quaternary alluvium and the basalt flows? Explain – how can you tell the age relations?

4) Is there anything filling in the tops of the lava flows? What is it and how did it get there?

5) What seems to potentially have controlled the lengths of the lava flows here and the directions they traveled? In your answer, consider the possible role of lava tubes and channelized lava flows.

6) Were the Old Dad Mountains, on the west side of the map area, present when these flows were emplaced? If so, did the mountains serve as a barrier to flow movement?

7) What is the volume of material erupted from the lava flows and cinder cones in your map area (consider ONLY the volcanics you have mapped)? You can estimate this, but show your work. Comment on the factors that can add to the complexity of this calculation.