Lab Exercise #3
Introduction to the Orientation of Structures in Space -
Geologic Map, Cross section, and Geologic History

Part A – Complete in lab. Will be graded before leaving.

Working in groups of 3-4 people, make a cross section of the Blue Diamond SE Quadrangle. Make sure to put all of your names on the cross section. This will be completed and submitted before the end of lab. (15 pts)

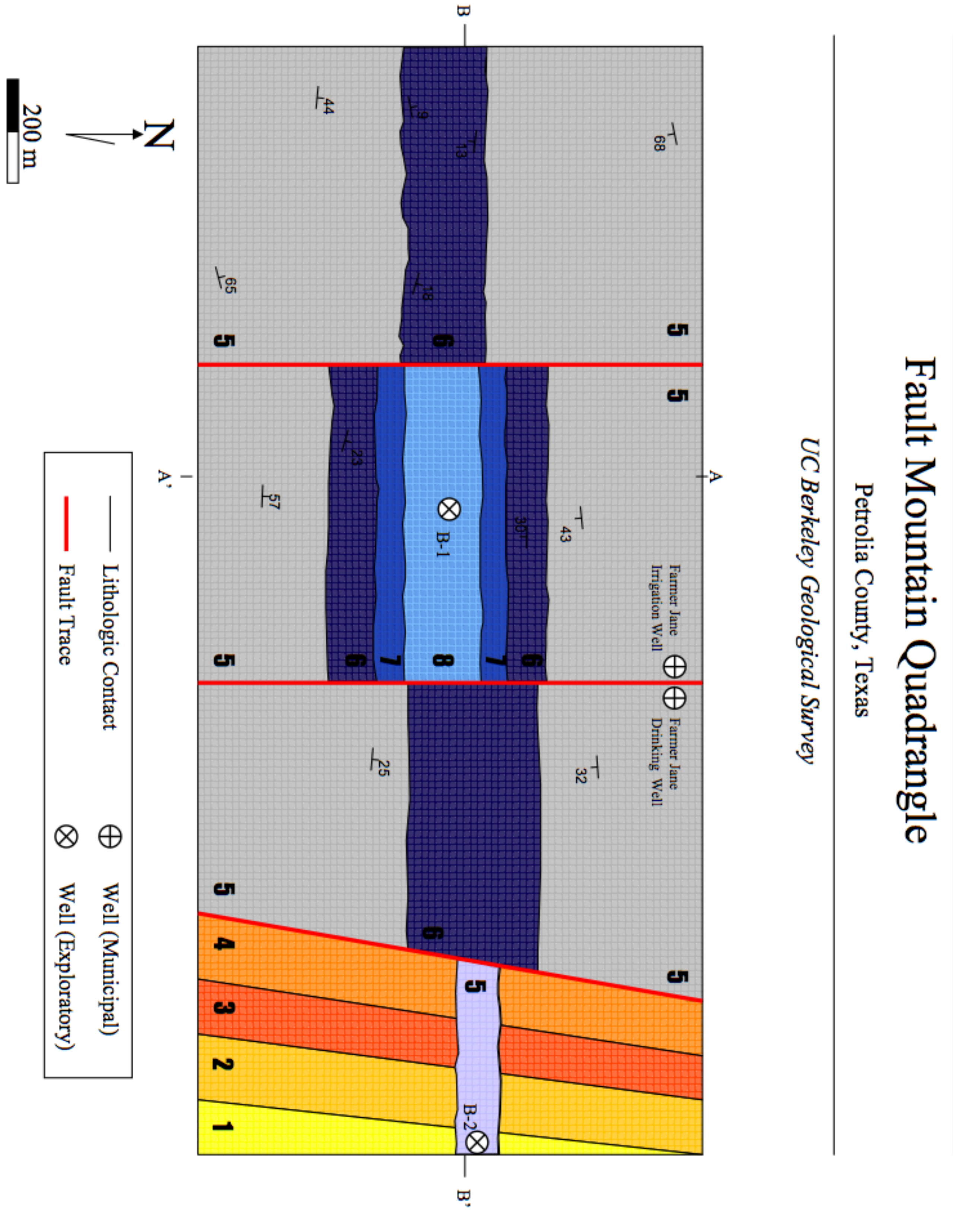
Part B – Complete by due date.

A lawyer has contacted the UC Berkeley Geological Survey and asked you to prepare a concise geologic report explaining the geologic history observed in the Fault Mountain Quadrangle (map provided on page 2). The workplan includes the following:

1. Give a brief geologic history of the region describing any deformation or age relationships that you can find. Include the order the lithologic units formed (youngest to oldest). (10 pts)
2. Using the map and the well data (page 3), construct cross section A-A'. (15 pts)
3. Using the map and the well data (page 3), construct cross section B-B' across all three faults. If you can, indicate the attitude (strike and dip) of each fault. (20 pts)
4. If you can, label each fault as a normal fault, reverse fault, or oblique fault. (10 pts)
5. Measure the total amount of relative offset along each fault. For faults whose attitudes are known, report the amount of movement along the fault plane. For faults whose attitudes are not known, report the amount of horizontal and vertical separation. (10 pts)
6. From the above information, determine the trend and plunge of slickenlines that you would expect to see along each of the faults. For faults whose attitude is not known, give the trend and plunge that connects two piercing points. (10 pts)

Hints:

- Your cross sections are part of the final result and are not merely sketches. A carefully crafted cross-section should prevent you from having to use any trigonometry. (5 pts each for the professional look and quality of your cross section)
- You cannot determine the precise strike and dip of all faults with the information available. In at least one case, you can constrain the dip of a fault to a certain range of dips and rule out all other possible dips.
- You cannot determine the total amount of slip accommodated by at least one of the faults. You can, however, give a minimum amount of slip.
- Make sure you identify the true-dip and not the dip found on an oblique cross-section.
- Be sure to show any mathematical formulas you use to make any calculations.
- **This assignment is much more time consuming than the last exercise, so start early. And do not forget Problem 7 on the last page.**


Fault Mountain Quadrangle
Petrolia County, Texas
UC Berkeley Geological Survey
Farmer Jane Irrigation Well
Farmer Jane Drinking Well
B-1
B-2
A
A'
B
B'
N
200 m
Lithologic Contact
Fault Trace
Well (Municipal)
Well (Exploratory)
68
44
9
13
65
18
23
57
30
43
25
32
1
2
3
4
5
6
7
8

Subsurface Data

Knowing that faults can often be good traps for petroleum, the petroleum geologists at Texaco have drilled two exploratory wells in the Fault Mountain Quadrangle. They have been kind enough to give the Berkeley Geological Survey copies of their well logs. Note, BoB indicates the Bottom of Boring, or the end of the hole.

Exploratory Wells

Texaco B-1	
Depth	*Lithologic Unit*
0 - 22m	8
22 - 60 m	7
60 - 121m	6
121-BoB	5
376m	Fault
450m	BoB

Texaco B-2 **	
Depth	*Lithologic Unit*
0 - 19m	5
19 - 38	1
38 - 290m	2
290 - 583m	3
583 - 599m	4
599m	BoB

** No fault encountered, but the eastern-most fault in the Fault Mountain Quadrangle is believed to be a bedding fault -- meaning that the fault plane formed along the bedding-plane boundary of two lithologic units.

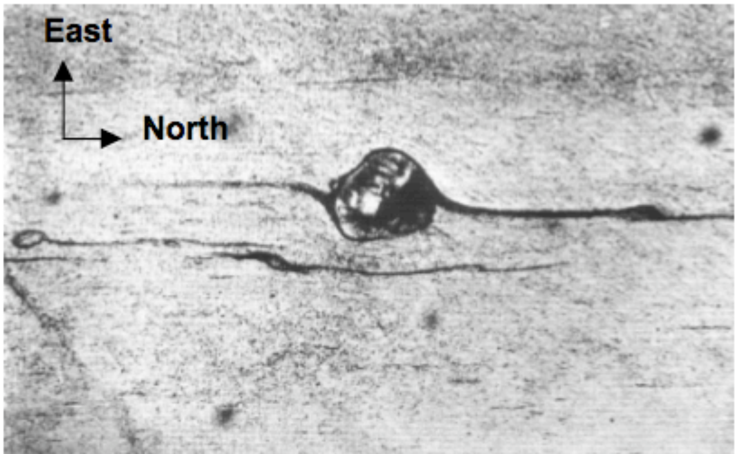
Municipal Wells

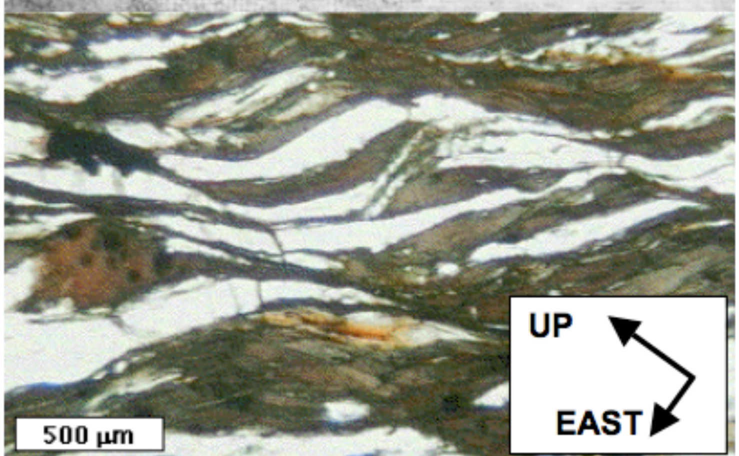
Farmer Jane noticed that the fault on her property was the source of a natural spring. She drilled two wells near the fault: Her drinking well is 2m due east of the fault and her irrigation well is 2m due west of the fault. Neither well encountered the fault, but she has had plenty of water since she installed the wells two years ago.

Farmer Jane Drinking Well	
Depth	*Lithologic Unit*
0 - 1.5m	Soil
1.5 - 25 m	5
25m	BoB

Farmer Jane Irrigation Well	
Depth	*Lithologic Unit*
0 - 1.0m	Soil
1.0 - 39 m	5
39m	BoB

7. You recently trained your field assistants to take oriented field samples (see Prior et al., 1987). Your assistants collected oriented samples at surface exposures of the three faults. They cut vertical and horizontal slices from each of the oriented samples. There's only one problem -- the thin sections got mixed up with someone else's and none of them have sample labels! Using only the sense of shear as an indicator, can you figure out if these thin sections came from the Fault Mountain Quadrangle? If so, which faults are they from? (10 pts)

1)


2)


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