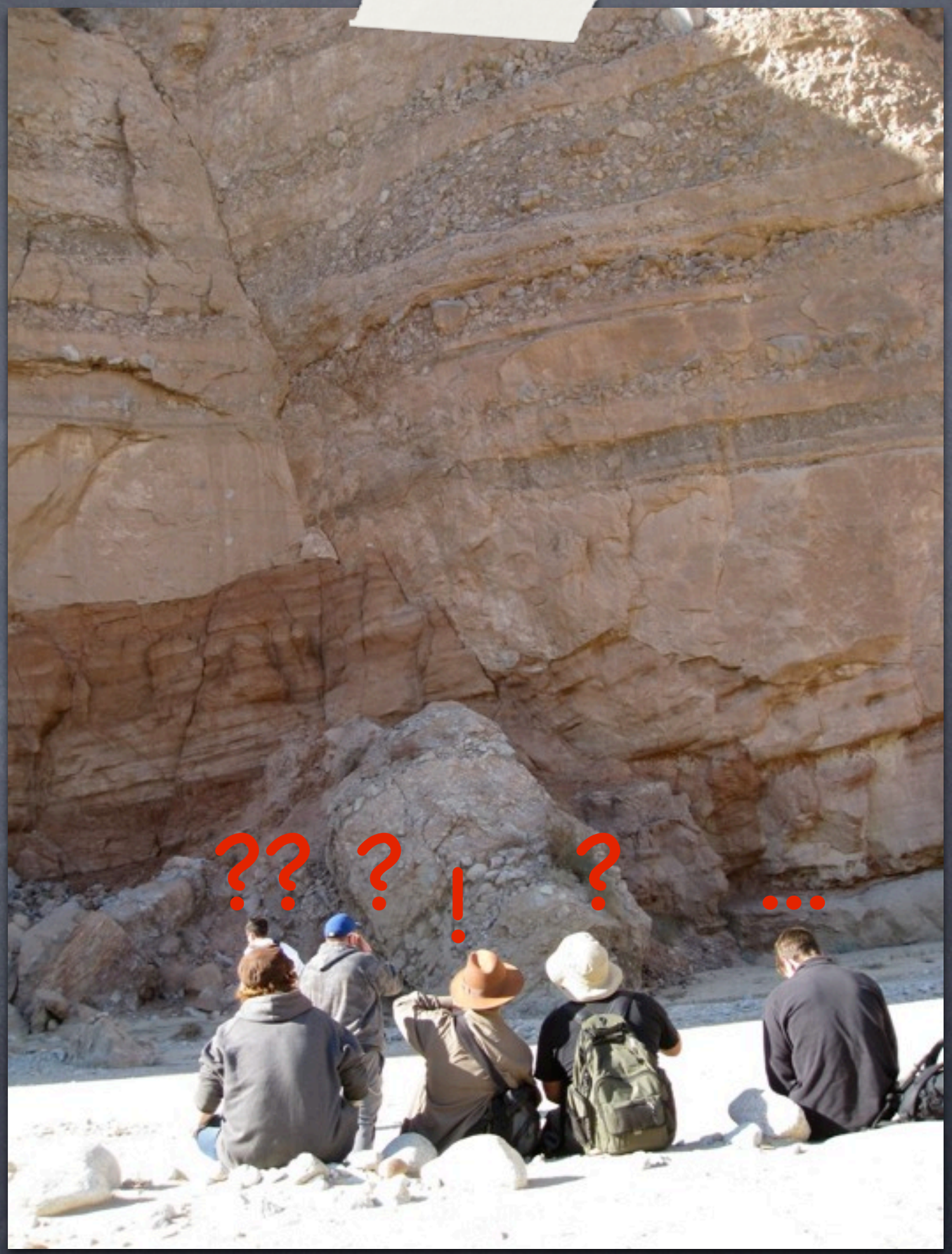
Fault-y Visualizations

An exploration of outcrop and map patterns of faulted rocks

The Problem...

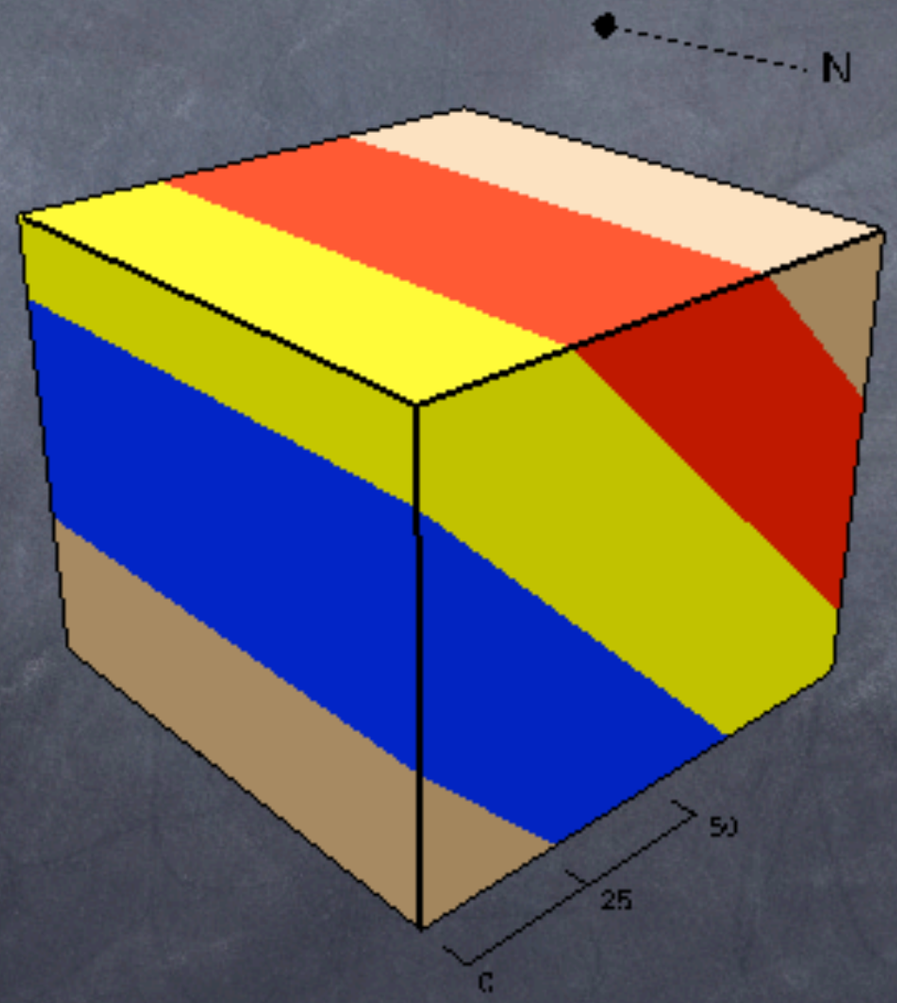


Student goals

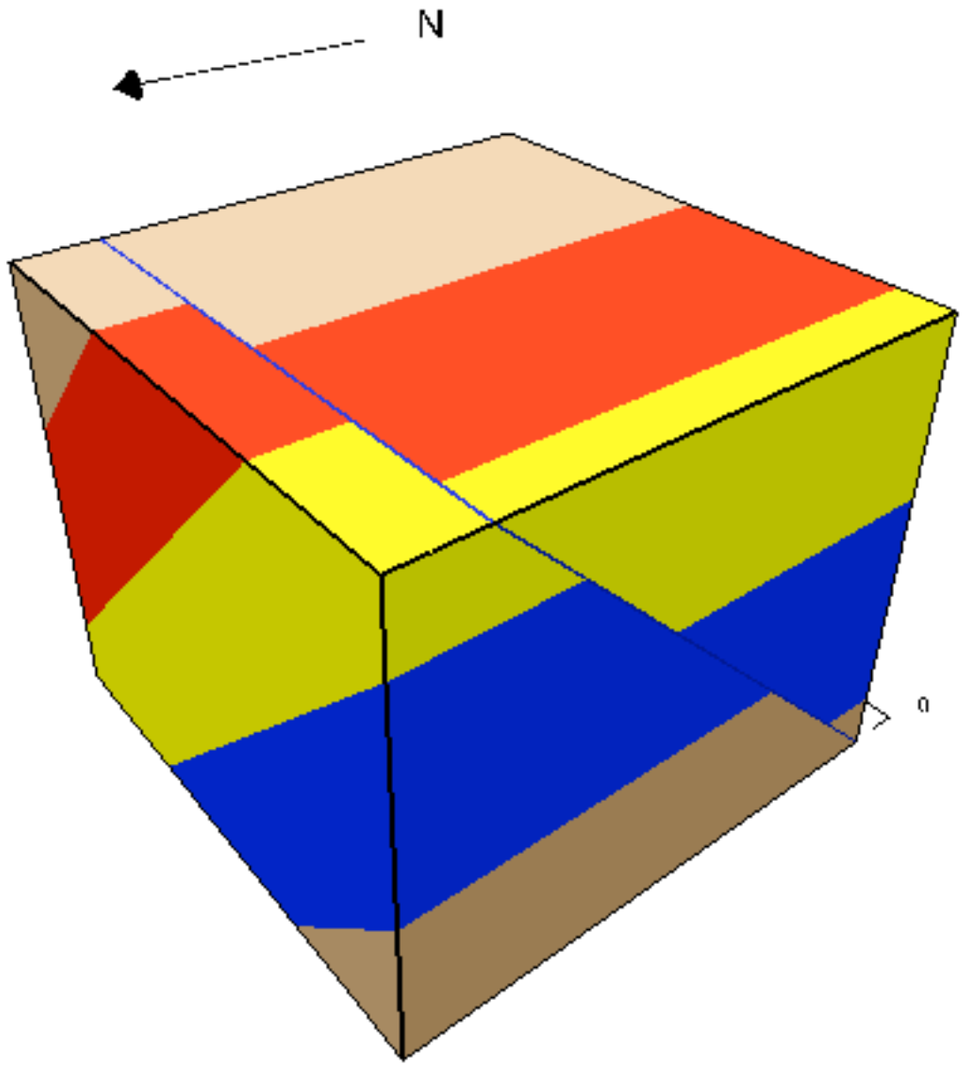
- realize that 2-D views of faulted layers show APPARENT offset
- be able to reconstruct faulted block diagrams using Visible Geology to...
- visualize map and X-section patterns
- be able to formulate several testable working hypotheses about fault offset from outcrop patterns or map patterns

the template

http://app.visiblegeology.com/profile.html



The exercise



fault 1: apparent dextral offset on normal fault Visible Geology image

Structural Geology, GEOL 330 Name: _____
Fault-y Visualizations (HW 9) Spring 2012

Fault offset patterns are tricky business and a lot of information (heave, throw, dip-separation, strike-separation) needs to be known to fully reconstruct the net slip on a fault. Often it may not be possible to directly measure all the necessary information, so it is important to have a visual fluency in recognizing fault offset patterns and linking what you see to the motion on a fault. The following exercises are designed to help you become familiar with map patterns produced by faulting tilted layers.

Open Visible Geology and make an initial block diagram with three layers following these specifications

1. Dark blue layer, 30 units thick
2. Bright yellow layer, 30 units thick
3. Brilliant red layer, 30 units thick

Next, tilt these layers along a strike of 000° and a dip of 45°E.

Now you're ready to add some faults! After you create each fault, answer the following questions, then delete the previous faulting event and create the next one.

Questions for each fault:

1. Sketch the map-view outcrop pattern.
2. Sketch the cross section view parallel to the dip of the fault plane.
3. Measure and record on your sketches the *throw, heave,* and *strike-separation*. (Note that because the fault scarp is not exposed we cannot measure the dip separation.)
    a. For extra credit, use a stereonet and orthographic projection to find the net slip on the fault.
4. What is the apparent motion seen in map view along the fault? (I.e., if all you saw was a map-view of the offset, what type of fault would you call this?)
5. What type of motion actually occurred along the fault? Reverse, normal, sinistral, dextral? (Hint, look at the rake value…that's the rake of the slip direction on the fault surface…)
6. Explain how you could have predicted the type of movement if you knew the rake value ahead of time. (This will help you understand what the rake value controls with respect to fault block motion for the program).

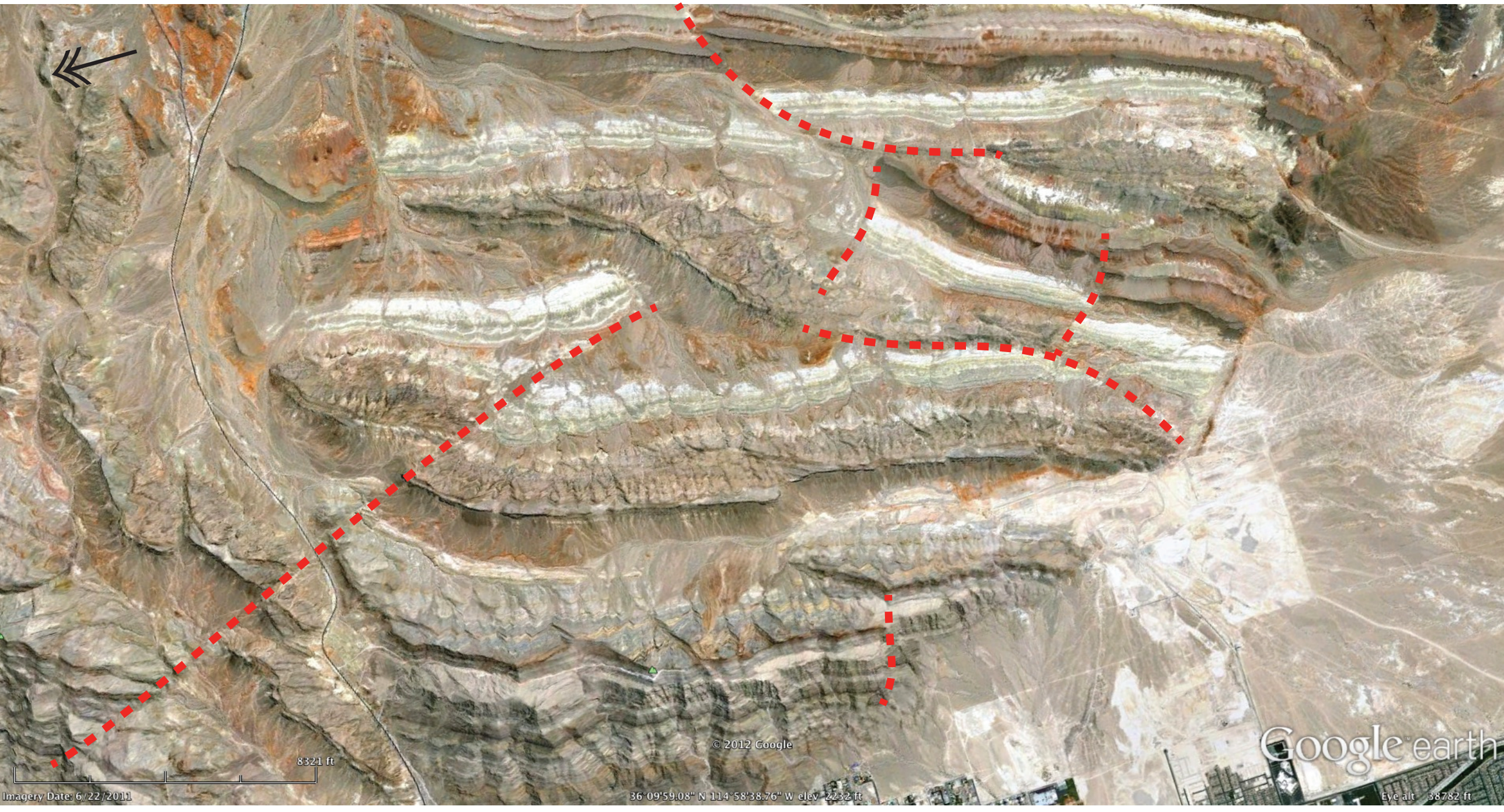
Here are the three faults you will be creating, one at a time:

	Fault 1	Fault 2	Fault 3
Strike	090	090	090
Dip	45	45	90
Rake	090	270	000
Slip	25	25	25

For added challenge for your optic nerve, use the "Fault scarp, GEOL 330" topography model to make a fault that parallels the dipping topographic surface so you can see the strike-, and dip-separation, heave, and throw along the fault scarp for tilted layers. (Hint, here you have to tilt the layers to the north or south to see the offset along the scarp.)

Once you are comfortable with using Visible Geology to model and visualize faulted layers, answer the questions on the following page pertaining to faulted sedimentary layers near Las Vegas Bay in Nevada.

Faulted sedimentary layers near Las Vegas Bay, NV. Double pronged arrow points north. Dashed red lines delineate fault traces.



Explore two faults from this area using Google Earth.

1) For each fault, use what you just learned to propose how the map pattern could be produced by 1) strike-slip faulting; 2) normal faulting; and 3) reverse faulting. For each option you will need to state the approximate attitude of the beds AND of the fault plane. (2-5 sentences each)

2) For each fault, choose the MOST APPROPRIATE fault type from #1 and create a Visible Geology model that reproduces the map pattern viewed above using that fault motion. Please print your Visible Geology model and record on the printed image the strike, dip, rake, and slip of the fault.

3) Finally, label this diagram to indicate which faults you investigated and also put those labels on the Visible Geology print-outs.

Questions & Discussion