LAB 1: RECOGNIZING AND MAPPING TECTONIC LANDFORMS

OBJECTIVES:

- a. To develop your ability to recognize normal faults and volcanic centers on topographic maps
- b. To make a geologic map of the tectonic features in the area based on its topography
- c. To infer the sequence of events in the recent tectonic history of the area from a study of the topographic maps

MAPS AND MATERIALS:

Modoc Point, Oregon and Swan Lake, Oregon 15' quads Tracing paper to overlay both maps 2H pencils, eraser, drafting tape

BACKGROUND:

The Modoc Point and Swan Lake quadrangles cover an area of volcanism and faulting in a part of the Columbia River Plateau where it is merging into the Basin-and-Range province. The bedrock exposed in the area consists largely of basaltic lavas of Pliocene age which were erupted from fissures and from individual vents. The faults which cross the area are all normal faults.

PART I: PREPARATION (not to be turned in)

CRITERIA FOR RECOGNIZING FAULTS AND VOLCANIC CENTERS

You are going to be mapping normal faults and volcanic centers on a tracing paper overlay; thus you must decide what criteria you will use to distinguish them. I suggest that you start by visualizing what a fault scarp and a volcanic center (volcano, vent, or fissure eruption) look like; then visualize what the contour pattern on the feature would be. Looking at the maps should help you in doing this.

Fill in the table on the next page. For each of the four situations in the table (volcanic center, fault, faulted volcanic center, volcanic flow), list the criteria you would use to recognize the feature on a topographic map, and then sketch the contour pattern(s) that would indicate the feature. This table provides a reference you can refer to during your mapping. Now answer the questions below.

What *topographic* criteria would show you whether:

a. volcanism occurred before faulting

b. volcanism occurred *after* faulting

c. volcanism and faulting were in part contemporaneous

VOLCANIC CENTER (VOLCANO, VENT, OR FISSURE SOURCE OF FLOWS)	description of criteria	sketch of contour pattern(s)
FAULT	VOLCANIC CENTER (VOLCANO, VENT, OR FISSURE SOURCE OF FLOWS)	
FAULT		
	FA	
	ΓA	
VOLCANIC CENTER CUT BY A FAULT		
VOLCANIC FLOW (ESP. ON SIDE OF A VOLCANO)		

PART II: MAPPING AND INTERPRETATION (please turn in only this part of the lab)

1. (60) MAPPING THE FAULTS AND VOLCANIC CENTERS

Fold over the right edge of the Modoc Point map and carefully align it against the Swan Lake map; tape the two maps to each other at the top and bottom taking care not to disturb their alignment. Now carefully tape both maps to the light table. Place the tracing-paper overlay on the maps and tape it down at one side.

Mark the corners of the map area *carefully* on the overlay so that you can realign the overlay with the maps. DO NOT MARK ON THE TOPOGRAPHIC MAPS; WORK ONLY ON THE OVERLAY!

- a. On your overlay, carefully map *all* the faults you can recognize in the topography. Show faults by heavy black lines; dash line where the position of the fault is uncertain. Remember that the fault line is the intersection of the fault plane with the ground surface; **thus fault lines should be drawn at the** *base*, **not top of the fault scarp**.
- b. Show on your overlay all the volcanic centers you can detect by marking the eruptive center with a star (*). This should include both recognizable vents along fissures as well as isolated vents and volcanos.

- 2. (20) Based on your map and the criteria you developed in Part I, what *general* relations are there, if any, between volcanism and faulting in this area? Consider both space (position) and time (relative age) relations. Support your answer by citing specific examples from the map which exemplify the space/time relations.
 - a. Describe **spatial** relations between volcanism and faulting (please use list format). Be sure to mention any preferred orientations of faults or volcanos.

Examples to back up your statements. Group the examples by what they show. Please number each example and show its position boldly and clearly on your map.

b. Describe inferred **time** relations between volcanism and faulting. (This should be a generalization about whether volcanism mostly preceded, followed, or was contemporaneous with faulting. It should not be simply a listing of all possibilities.)

Examples to back up your statements. Group the examples by what they show. Please number each example and show its position boldly and clearly on your map.

3. (10) Sketch in the space below a crude geological cross section across the center of the map from W to E. This should be a cartoon or schematic diagram of the topography and the geologic structure sketch by simple inspection of the map. It need not be to scale.

4. (10) Suggest a plausible general *explanation* for the *overall space and time relations* between volcanism and faulting in this area. In particular, *why* did faulting and volcanism occur in the order and pattern they did? Your sketch above together with your answers in question 2 should suggest an answer. This should not be just a restatement of what you've said in question 2; rather you must speculate on the *causes*, in as reasonable and simple a way as possible. I am not interested in you doing outside research on this; I am chiefly interested in you speculating on the basis of your observations.