Geology 350

LAB 5: LANDSLIDE RECOGNITION AND MAPPING

OBJECTIVES:

a. to learn to recognize and classify landslides on airphotos and topographic maps
b. to learn to recognize landslide topography on topographic maps
c. to analyze qualitatively factors leading to slope instability

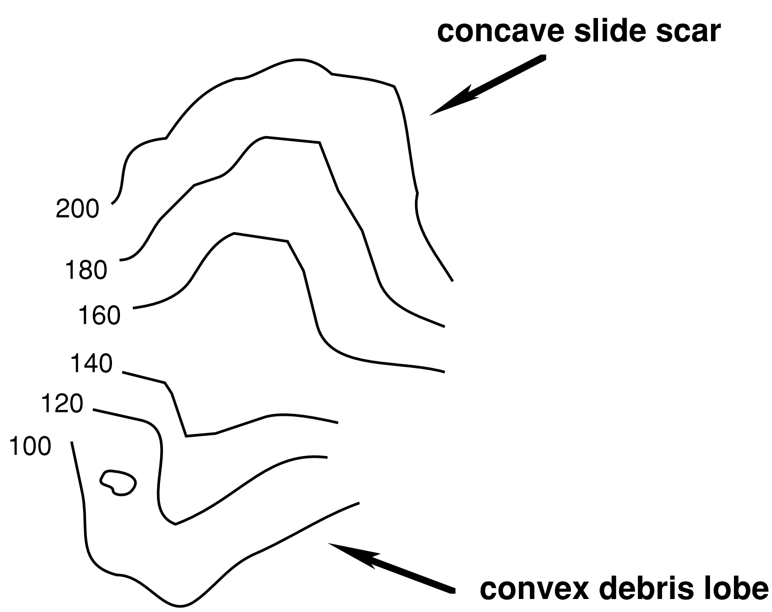
MATERIALS:

Malaga, WA 7.5' and 15' quads
Xerox reduction of the Malaga 15' quad
Chittenden, CA 7.5' quad
Xerox of Lomerias Muertas, Chittenden quad
airphotos of Lomerias Muertas
stereoscope
2H pencil
eraser
red sharpie pen for mapping
tracing-paper overlay

I. RECOGNITION OF SLUMP-EARTHFLOW TOPOGRAPHY ON TOPOGRAPHIC MAPS

MALAGA, WASHINGTON 7.5' AND 15' QUADS

Slumps and earthflows create a very distinctive hummocky, bumpy topography, marked by irregular contours, knobs, and closed depressions. (Solution and glacial deposition can also create irregular hummocky topography; but this is usually most prominent in valley bottoms, not on hillsides. It is typically on a large spatial scale.) Especially indicative.of sliding is a contour pattern like that illustrated below: concave contours upslope of convex contours.



The Malaga quadrangle in eastern Washington consists of sedimentary rocks of Tertiary age locally overlain by basalt flows. Along the Columbia River are terraces formed by the catastrophic floods released from Pleistocene Lake Missoula. Large slump-earthflows occur on many of the steeper slopes, and are clearly expressed in the topography. Hence this area is ideal for learning to recognize landslide topography.

Note: you will not have to turn the exercises on this page in. Check them against the posted answers.

a. **Recognition of landslides on the Malaga 7.5' quad**: Place a tracing-paper overlay over the quadrangle. Study the map carefully for evidence of landslides. Draw in the boundaries of any slides you recognize. Put hachures around the headscarp and draw an arrow in the slide body to indicate the direction of movement. I suggest you spend about an hour on this. You will not have to turn this map in.

b. **Recognition of landslides on the Malaga 15' quad:** On the xerox of the Malaga 15' quad, use a red sharpie to carefully outline the boundaries of any *areas* of mass movement that you can detect. *Do not* try to map individual slides; the slide areas are too complex to allow this on a map of this scale. Instead, you are to map *zones* of sliding. I suggest you spend no more than 20 min on this. You will not need to turn this map in.

c. **Criteria for distinguishing landslides:** List below the criteria (evidence) you used to distinguish the landslide areas.

d. **Rock types:** What rock type(s) probably underlie the slide areas? What is your reasoning?

II. Analysis of Landslides on Maps and Airphotos

CHITTENDEN, CA 7.5' QUAD AND AERIAL PHOTOS

NOTE: these exercises are to be turned in

Lomerias Muertas in the SE quadrant of the Chittenden map is an area of classic landslide topography. The aerial photos GS-WL 13-61 through 13-63 and 13-86 through 13-89 cover this area. I have posted xeroxes of three oblique photos of the area on the north side of Lomerias Muertas.

Scans of the aerial photos and the topographic map are available from the Geology 350 website:

http://www.humboldt.edu/~geodept/geology350/350_maps_airphotos.html

a. (20) **Distinguishing landslide age or activity:** Study the aerial photos. Slides of different ages and/or degrees of activity are evident on both the north-facing and south-facing slopes. In the table below, list the criteria you can devise to differentiate between old and young (or inactive and active) slides. I have indicated some items to compare.

	active/young	inactive/old
scarp definition		
dissection/ drainage development		
vegetation type and density		
other topographic features		
photo tone		

b. (10) **Transferring airphoto mapping to topographic map:** Carefully compare the airphotos with the xerox map of the Lomerias Muertas area. Try to see how the landslides are reflected in the contour pattern. Carefully *draw on the map* the boundaries of 1) the most active slide on the N-facing slope and 2) the most active slide on the S-facing slope. You will have to locate the slide boundaries by comparing the topography to the air photos.

c. (10) **Slide type, size, and frequency:** As you examine the north-facing and south-facing slopes of Lomerias Muertas, look for contrasts in slide type, size/shape, and frequency. Then fill in the table below:

	north-facing slopes	south-facing slopes
slide type (give reasons)		
slide size/shape (qualitative)		
relative *number* of slides per unit area		

d. (15) **Inferring rock type from topography and/or landslide type:** Study the airphotos and map, and then do your best to infer what rock type lies close to the surface under each of the three areas listed below. Use slope steepness, presence or absence of obvious resistant beds, presence or absence of slides and other erosional features, landslide types, and general topographic appearance in making your decisions. Give your reasons/observations for making each inference. Please put your answers in the table provided.

The areas:
1) Hill 1131 just south of the "o" in "Lomerias Muertas"
2) about 1500 feet south of the top of Hill 1131
3) about 2200 feet north of the top of Hill 1131

area	inferred rock type(s)	reasoning
Hill 1131		
1500 ft S of Hill 1131		
2200 ft N of Hill 1131		

e. (7) On the Santa Cruz sheet of the State Geologic Map find the Lomerias Muertas area. From it, determine the geology of the N and S-facing slopes of Lomerias Muertas. How well does the geology on the map fit with your inferences in part d above? Explain.

f. (8) **Determining strike and dip of bedding:** Determine the approximate strike and dip of the bedding exposed in the southern part of Lomerias Muertas. I suggest you determine it just south of the lake in the canyon lying about S20°W of "Sargent" triangulation station (VABM 1184). Explain your method and show calculations.

Strike: ____________ Dip: ____________

g. (30) Briefly analyze the factors that seem to control landslide type and occurrence on Lomerias Muertas. Consider: 1) slope, 2) rock type, 3) geologic structure, 4) aspect (direction slope faces), and 5) slope length. Based on *your observations*,which of these factors seem most important in determining amount of sliding? Which factors are least important? (I suggest that you rank the factors from 1 to 5, with 1 = most important and 5 = least important. Ties are possible.) Are some so closely connected that their separate effects can't be distinguished?

Please answer using the table below. Include in your answer why each factor should or shouldn't be important.

factor	importance	reasons
slope angle		
rock type		
geologic structure		
aspect		
slope length		