

LAB 3: MAPPING GEOLOGIC STRUCTURE FROM TOPOGRAPHY

OBJECTIVES:

- a. to improve your ability to determine structure from topography, especially in recognizing the topographic expression of folds
- b. to improve your visualization of geologic structures and their intersection with, and influence on, the land surface
- c. to make a detailed geologic map of an area of folded rocks based chiefly on topography

MATERIALS:

soft dark (2H) pencil
eraser
colored pencils (red, blue, green, yellow)

MAP:

Millheim, PA 15' quad

MAPPING INSTRUCTIONS:

This area lies in the Valley-and-Ridge province of the folded Appalachians. The ridges and cliffs are held up by rocks resistant to weathering and/or erosion (commonly quartzite); the valleys are underlain by rocks that are easily weathered or eroded in a humid temperate climate (e.g., limestone and shale.)

Using a tracing-paper overlay, you are to prepare a geologic map of this quadrangle, based solely upon the topographic map. On the basis of their resistance to erosion, you will be able to distinguish four units, which we will label A, B, C, and D in order from oldest to youngest. Unit A (the oldest) is a valley-former. Units B and C each consist of a ridge/cliff forming member overlain by a valley-former (i.e., a resistant member overlain by a weak member; see diagram below.) Unit D is a complex valley-former which contains some more resistant members. You are to draw contacts at the **base** of the resistant (cliff-forming/ridge-forming) members of B and C, and at the base of unit D. (Unit D is found only in two areas in the SE part of the map. It contains complications of structure and topography which you would be wise to ignore.)

Carefully trace the formational contacts, keeping in mind the "rule of V's" where dipping beds and contacts cross a stream or ravine. (The contact makes a "V" which points in the direction the bed dips.) Be sure that your contacts follow the base of the cliff-forming units, not their top.

In determining where anticlines and synclines are located, remember that where a cliff-forming member is nearly horizontal (as is usually the case along an anticlinal or synclinal axis), it will be bordered by cliffs along the rock outcrop. These will rise abruptly above the older rocks beneath. The sketches of anticlinal and synclinal mountains in your structure-and-topography handout should help you in interpreting the map.

Label the formations A, B, C, and D in order of decreasing ages (i.e., A is oldest, D youngest) and color in each unit **lightly** with the colors indicated below. Show all anticlinal and synclinal axes with heavy lines, using the appropriate symbols to distinguish them and to show their direction of plunge. Some of the fold axes may bifurcate or peter out. In at least two cases, the folds are doubly-plunging. There may be a fault or two you will discover, but they are small. Don't waste time hunting for faults.

D	complex valley-former	<i>yellow</i>
C	valley-former cliff/ridge-former	<i>green</i>
B	valley-former cliff/ridge-former	<i>red</i>
A	valley-former	<i>blue</i>

It will be easiest if you start in the northern half of the map and work south, since the structure is more complex in the south. Also, you already worked some of this northern structure in the previous lab. It will help you if you label the units and show the fold axes as you go.

Be sure to mark the quadrangle corners on your overlay.

In summary:

- mark quad corners on overlay
- map boundaries between the four cliff-and-valley-forming units A, B, C, and D, where A is the oldest. All the units except A consist of a cliff-forming layer overlain by a valley-forming member. Unit D is complex and appears to have a valley-forming unit at its base also. Remember V's where contacts cross valleys or ravines.
- lightly* color each unit as indicated below.
- show all anticlinal and synclinal axes and directions of plunge

This exercise is worth 200 points.