Amherst College
Department of Geology

INTRODUCTION TO GEOLOGIC MAPS

A geologic map represents the distribution of rocks across the surface of the map area by drawing lines ("contacts") between different rock units (commonly called "formations") and by representing each rock unit with a different color. Typically colors and contacts of a geologic map are superimposed on a topographic base map so that the contours of the surface of the earth and the rocks underlying those contours can be studied together. (For this reason, colors used are muted so that topo lines and other information are not obscured.)

A geologic map also includes a variety of geologic information regarding the attitude of the rock units (their strike and dip) and the location of folds or faults that affect the rocks.

A little familiarity with the conventions used in a geologic map will allow you to use any available geologic map to get to know the geology of any new or interesting area. Your objective this week is to work with a large color copy of a geologic map of an area in Montana to become more knowledgeable about how to read geologic maps in general. For the purposes of this exercise, you may write directly on the map copy.

LEARNING YOUR WAY AROUND A GEOLOGIC MAP

All geologic maps include basic elements that aid the reader in using the map. These include the following important components.

1) A title that indicates the area of the map. Find the title and label it ①.
What area does this geologic map cover? Where is it located?

2) A bar scale (in km in newer maps and miles in older ones) that allows you to determine distances on the map. Find the bar scale and label it ②.

3) A "North arrow" (an arrow pointing to geographic north) so that you can determine the orientation of the map and of rock units and structures represented on the map. Find the north arrow and label it ③.

4) A "Key" or "Explanation" that names each rock unit on the map and shows the color that represents the rock unit. The rock units are arranged in order of age, with the oldest on the bottom and the youngest on the top (as they would be in a sequence of sedimentary rocks). The age of each unit, in so far as it is known, is indicated. The Key also explains every symbol used on the map. Scan through the Explanation that accompanies this map.

What color is the Pilgrim dolomite represented with on the map?

What is the oldest unit on the map?

Draw the symbol for horizontal beds.

READING GEOLOGY FROM A GEOLOGIC MAP

Exploring the distribution of rock units on a geologic map will allow you to extrapolate their extent in three dimensions (underground). It also allows you to interpret their relative ages.

5) Are the sedimentary units - say, the Park shale - tabular, parallel sided (of constant thickness) and laterally continuous? If so, how is this expressed on the map? (Remember that this real geologic map comes from an area with substantial topography, unlike the flat-topped box diagrams you worked with last week. This will introduce some variation in the outcrop width of rock units.)

6) Find the large anticline with a north-trending axis that underlies the center of the map area. Check to see that the oldest units are in the center and the youngest on the flanks of this fold. Check to see that the units dip away from the center of the fold. Circle the evidence on the map that allowed you to check this point. Label your circle or circles with a ⑥.

What is the oldest unit that you can observe to be folded by this anticline?

What is the youngest?

7) Find a fault. Label it with a ⑦.
What is the effect of the fault on the map pattern?

8) Find an intrusive rock. Label it with an ⑧ .
What is the shape of the intrusive body?

What is the relationship of the intrusive to the contacts of the surrounding units?

9) Is there an extrusive rock unit in the map? If so, label it with a ⑨.
What is the age and composition of the extrusive rock?

10) Explore whether or not there seems to be a correlation between the geology and the topography of the map area.
Which unit underlies the highest peak? Does generally high topography follow this unit (making a ridge)?

What rock type is this?

What role, if any, does the generally arid climate of Montana play in making this rock type resistant to erosion?