Hands-On Applications

If geologists are to understand a dynamic Earth, they must understand the nature of the stresses within the Earth. One way to learn about stress is to study the strain, or deformation, that it has produced. This type of study is based on descriptive and interpretive analysis of folds, faults, and other deformational features. Using drawings and three-dimensional models, this lab focuses mainly on the geometric aspects of deformed rocks. You will learn how observations and measurements made at the surface are used to predict the structure of rocks in the subsurface.

Objectives

If you are assigned all the problems, you should be able to:

1. Distinguish between elastic and plastic strain, and list the conditions that might favor one over the other.
2. Recognize structures formed by compression, tension, and shear.
3. Identify conformable and unconformable depositional contacts, intrusive contacts, and fault contacts on a geologic map, cross section, or block diagram.
4. Define dip and strike, plot them on a map, and determine their general orientation on a geologic map or top surface of a block diagram.
5. Define, sketch, and recognize—on a geologic map or a block diagram—a dome or basin and plunging and non-plunging anticlines and synclines.
6. Determine the direction of plunge of plunging anticlines and synclines on a geologic map or block diagram.
7. Define, sketch, and recognize—on a cross section or block diagram—normal, reverse, thrust, and strike-slip faults.
8. Distinguish the hanging wall and footwall of a normal, reverse, and thrust fault on a cross section, geologic map, or block diagram.

Problems

1. To demonstrate how the same material can respond to stress (deform) differently under different conditions, try the following with Silly Putty™. First, roll it into a ball and see if it bounces. Next, roll it into a thick cigar shape and slowly stretch it out. Finally, roll it into a thick cigar shape again and pull it apart as fast as you can. In each case, the Silly Putty™ behaves differently.

   a. Name the type of behavior exhibited in the three cases, using the terminology given in the introduction to this lab.

   b. How did the conditions under which deformation occurred differ in the three cases?

Your instructor may want you to do either Problem 2 (cut-out blocks) or Problems 3 and 4 (perspective drawings).

2. The following problems use the cut-out block diagrams A, B, and C, which are found at the end of the lab manual. The blocks should be cut out before beginning the problem in which they are used. When constructing the box, be very careful to make the folds exactly along the lines, or the problems may not work out as they should. It will be easier to draw on the boxes if you do not tape the sides together until after you have completed the problem. Even then, it is recommended that you use removable tape.

   a. Refer to Block A with Side 1 up. When Side 1 is up, Block A is similar to Figure 14.9A, and the top surface represents the Earth's surface.

      (1) Fill in the blank faces on the sides of the block.

      (2) Measure the dip with a protractor at several places on the front surface (note that the dip changes below the surface and that the angle you should measure is right at the top surface) and put strike and dip symbols at the places indicated with dots on the top (map) surface.