# STRUCTURAL GEOLOGY LABORATORY

## INTRODUCTION

Geologists have named the structures found on the earth: flat-lying strata, anticlines, synclines, faults. These can be exposed by a vertical view into the earth, perhaps in an exposure of a road cut or stream channel. This activity will study the changes in flat-lying structures to form the various other structures. Compression (pushing together) makes the flat-lying strata shorter while tension (pulling apart) makes the strata longer.

## OBJECTIVES

To model a variety of geologic structures and to prepare diagrams to the scale of the models.

## MATERIALS REQUIRED

- Handouts with stratigraphic column and cross-sections
- clay or Play-Doh
  - set of 4 colors
- colored pencils or crayons to match clay
- plastic knife
- rulers
- wax paper - 4 sheets 5" x 10"
- rolling pins (I used short dowels)

## ACTIVITY (student directions)

Part I

1) Lay a piece of wax paper on the table
2) Select one color of Play-Doh or clay from your set and roll it out on the waxed paper to approximately 3" x 6", using about 2/3 of a can of Play-Doh.
   a) Repeat with the other 3 colors.
   b) Remove the wax paper and stack the clay slabs so they are even along the edges. The knife can be used to cut the edges so the edges are even. Imagine that this is a view of the earth from a road cut.
3) Using the Stratigraphic Column handout, color in appropriate squares with colors matching the clay in the order stacked. The bottom color will represent the oldest layer and the top color will represent the most recent or youngest layer of the four layers of strata exposed in the road cut.
4) Analysis

a) Why, in a depositional situation, would the top layer be the youngest?

Part II.

1) Using the "cross-section" block in the handout, make a cross-section to match the vertical appearance of the model.
2) Use a scale of 1:1.
3) Measure the length of your block and write it on the cross-section, labeling that number as the initial length.
4) On your cross-section, label the oldest layer of stratum.

Part III.

1) Push the ends of the model with your hands until the stack of clay slabs slides into a hill and a valley. You have formed an anticline (hill) and a syncline (valley) using compressive forces.
2) Make a cross-section to match the vertical appearance of the model as in Part II. Measure the length of the model and write it on the cross-section. Label the measurement as compressive length.
3) Analysis
   a) Is the compressed model shorter or longer than the unfolded model?
   b) Why?

Part IV.

1) Pull the clay layers back to their original position by tensile force. Using the knife, make a fault in the clay by cutting through a short width of the clay so that the cut slants through the vertical layers of clay. Do not make the angle of the cut too steep. Imagine while cutting that you are small enough to stand in the cut. Your feet would be on the "foot wall" and above you would be the "hanging wall". The length of the footwall block will be shorter along the top of the stratum and longer on the bottom.
2) Use some of the extra Play-Doh to form another layer to thicken the bottom layer on the foot wall so that the block stands a little higher. Push the two halves together so that they touch.
3) Draw a cross-section as in Part II. You have drawn a "normal fault". In a normal fault the hanging wall has moved down in relation to the foot wall.
4) Analysis
   a) Measure and record the length of the block. Label the length measurement as the “normal fault.” Is the clay model longer or shorter than before the model was faulted?
   b) What type of force could cause a normal fault?

Part V

1) Remove the clay that was added in Part IV and place it on the other piece of the faulted block, which is longer on the top than the bottom (hanging wall). Push the two halves together so that they touch.

2) Draw the cross-section as in Part II. You have drawn a "reverse fault." In a reverse fault the hanging wall has moved up in relation to the foot wall.
3) Analysis
   a) Measure and record the length of the whole block. Label the measurement as “reverse fault.” Is the model longer or shorter than before the model was faulted? What type of force could cause a reverse fault?

Part VI.

1) Remove the additional clay that was added in Part V Section 1. Use the knife or a pencil to scratch a lengthwise line on the top of the block. Imagine this is a road or stream. Move the two halves of the model along the fault line so that the ”stream” line is off-set a half-inch. You have created a "strike-slip" fault.
2) Place both hands over the fault with thumbs pointing along the fault line. If the far side has moved to the left, the strike-slip fault is "left-lateral." If the far side has moved to your right, then the fault is "right lateral."
3) Analysis
   a) Try the step of putting both hands over the fault with the thumbs pointing along the fault line. Were your results the same as the first time?
   b) Draw the cross-section as in Part II. Measure the length of the block. Is it longer or shorter than before the model was faulted? What type of force could cause a strike-slip fault?

# DRAW THE COLUMN AND DEFORMATIONS

## PART I Stratigraphic Column

**Youngest**

**Oldest**

## PART II Cross Section of clay slab plus measurement of length

## PART III Cross Section of compressed clay slab and measurement of length

## PART IV Cross Section of Normal Fault and length measurement

## PART V Cross Section of Reverse Fault and length measurement

## PART VI Cross Section of Strike-Slip Fault and length measurement

## SUMMARY OF EFFECTS OF TYPES OF DEFORMATION

| Deformation | Shape and length | Origin (Type of Force) |
|---|---|---|
| | | |
| II Deposition (initial) | | |
| | | |
| III Compression | | |
| | | |
| IV Normal Fault | | |
| | | |
| V Reverse Fault | | |
| | | |
| VI Strike/Slip Fault | | |
| | | |