Student Name: **Grade: _____**

Physical Geology 101 Laboratory #13

Structural Geology II – Drawing and Analyzing Folds and Faults

Introduction & Purpose: Structural geology is the study of how geologic rock units are initially arranged and later deformed. Changing spatial relations between geologic units and the stress and strain that occur during deformation events are key aspects in understanding geologic structures. The purpose of this lab is to both learn and apply the concepts of structural geology to reading and interpreting geologic structures, including tilted beds, folds, and faults. The terms and concepts of geologic structures, the application of structural geology to mountain building events, and the techniques used to interpret geologic structures will be presented and discussed. The three types of graphic representations of geologic structures: 1) geologic maps, 2) geologic cross sections, and 3) block diagrams will also be highlighted and discussed.

The purpose of this laboratory is to become successful at applying the principles of structural geology for both, interpreting surface and subsurface structural and geologic relations, stress and strain regimes, and solving structural problems, concerning geographic regions that expose a rock record of igneous, metamorphic, and sedimentary events, folding and faulting, and surface erosion.

Part I. PRELAB SECTION – To be completed before labs starts:

A. Review of the Rules for Interpreting Geologic Structures

There is a set of 12 simple rules for observing and interpreting geologic structures found in **Figure 10.11** in your lab manual. Carefully study and make use of these rules for completing Part II. The rules are listed below.

1) The strike of a rock formation is parallel to its adjacent contacts.
2) Tilted layers of rock dip perpendicular to the strike.
3) Tilted layers of rock dip downward in the direction towards where the youngest rock layers are exposed at the surface.
4) The older rocks are exposed in the center of eroded anticlines and domes.
5) The younger rocks are exposed in the center of eroded synclines and basins.
6) Plunging anticlines form "U" shaped outcrop belts that point in the same direction that the fold plunges.
7) Plunging synclines form "U" shaped outcrop belts that point in the opposite direction that the fold plunges.
8) The steeper the dip of the layer, the more narrow the width of its outcrop belt.
9) The strike of a fault is parallel to its exposed fault line.
10) In compressional faults, the hanging wall tends to move up relative to the foot wall (pushed together).
11) In tensional faults, the hanging wall tends to move down relative to the footwall (pulled apart).

II. IN-LAB SECTION:
Drawing and Interpreting Geologic Structures in Block Diagrams

A. Introduction: Three-dimensional geologic block diagrams are scaled-down, abstract, simple representations, or models of Earth's crustal rock structures, which include 1) formations, 2) unconformities, 3) faults, 4) folds, and 5) topography. Block diagrams are a 3-dimensional composite of both, a geologic map (horizontal map-view) and geologic cross-sections (vertical side-views). The key to successfully completing the block diagrams lies in *visualizing* the 2-D representations as 3-D structure.

B. REVIEW OF STRIKE AND DIP OF TILTED PLANAR FEATURES

1. Measure the strike and dip of the two planar objects the instructor has set up in the class:

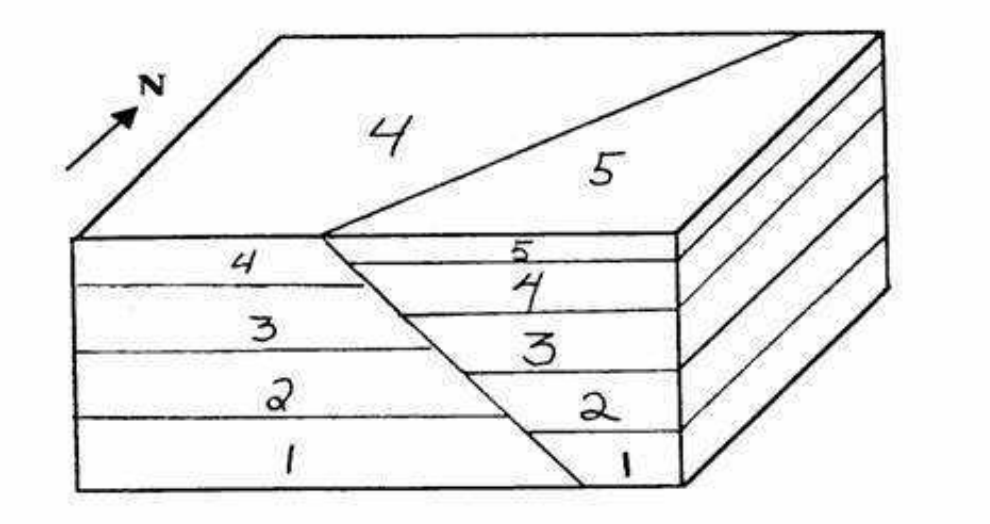
a) Planar Object "X"- Strike = _____ Dip = _____

b) Planar Object "Z" - Strike = _____ Dip = _____

C. FAULT BLOCK EXERCISES

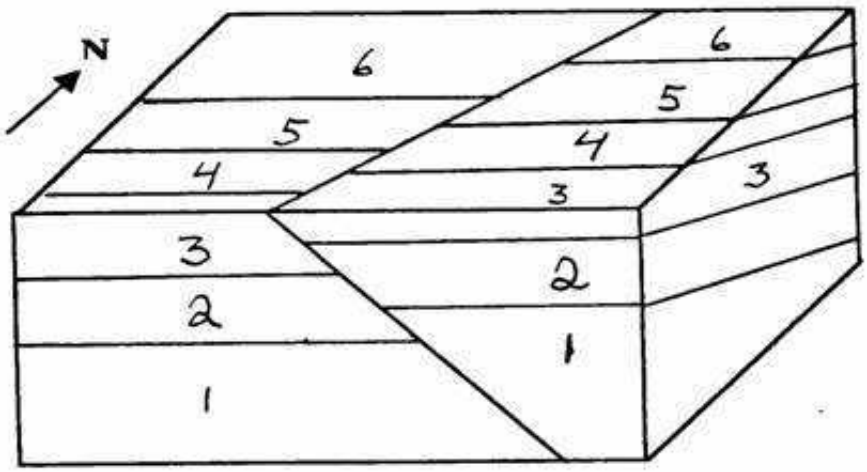
1. a) In map view (top of block), put strike and dip symbols on the beds and a fault dip symbol on fault. **b)** Also put appropriate displacement arrows on the fault in the **frontal cross-section**.

What type of fault is shown below? _____.

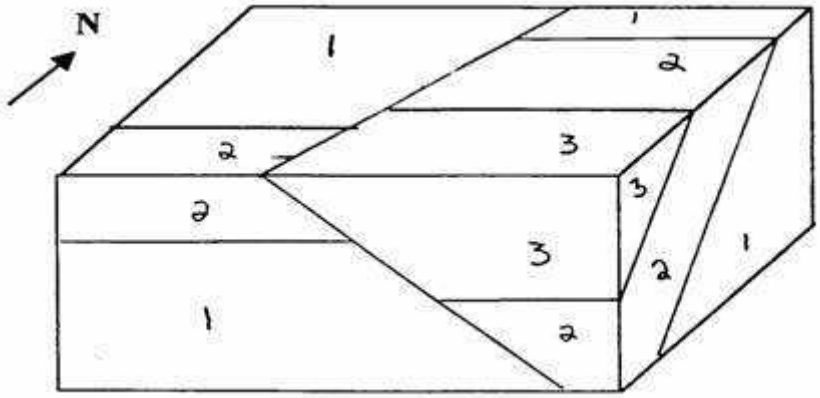


2. a) Put appropriate fault displacement arrows, fault dip symbol, and strike and dip of beds symbols in both the map view and cross-section. **What type of fault** is shown below if the slickensides are ***parallel to the dip***?

_____

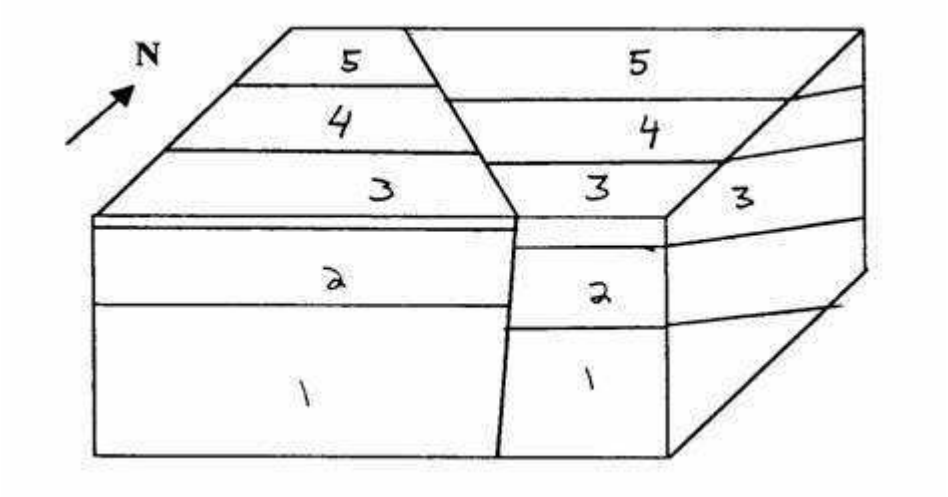


3. a) Put appropriate fault displacement arrows, fault dip symbol, and strike and dip of beds symbols in both the map view and cross-section. **What kind of fault** is shown below if slickensides are ***parallel to the dip***? _____



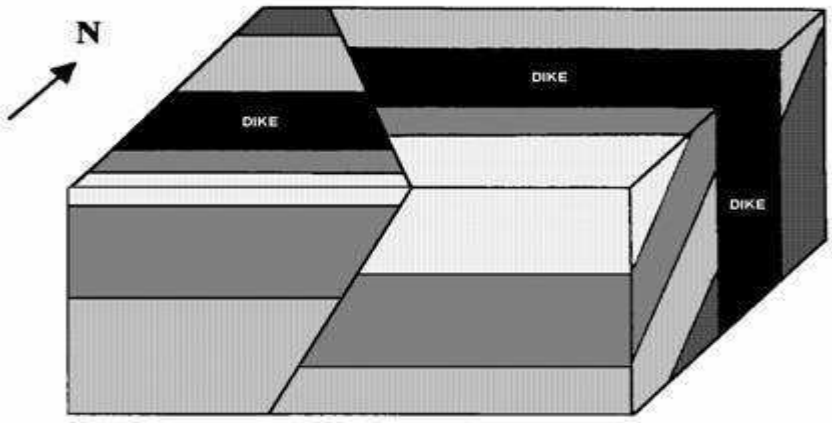
4. a) Draw the appropriate symbols for the fault in both the map view and cross-section. **b)** Draw strike and dip symbols for the beds. **What type of fault** is shown below if the slickensides are ***oriented horizontally***? _____

Estimate the strike and dip of the fault: _____ Estimate dip of beds. _____



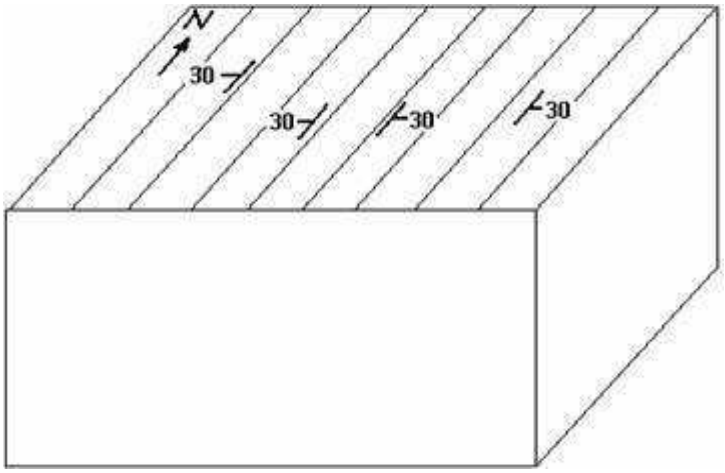
5. What type of fault is shown below if the slickensides are ***oriented horizontally***? _____

Estimate the strike and dip of the fault: _____ Estimate the dip of beds. _____

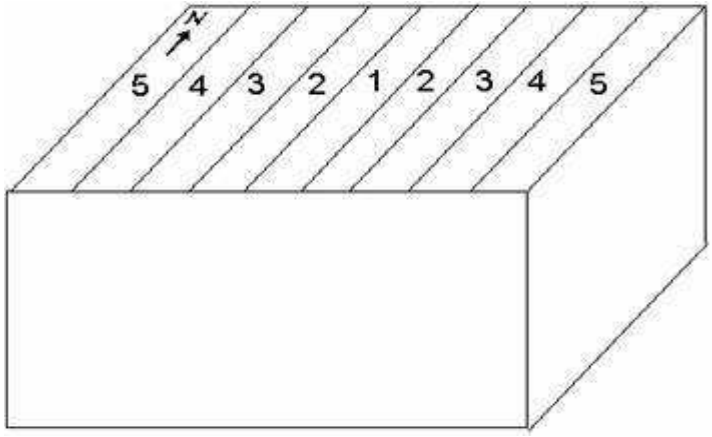


D. FOLD BLOCK EXERCISES

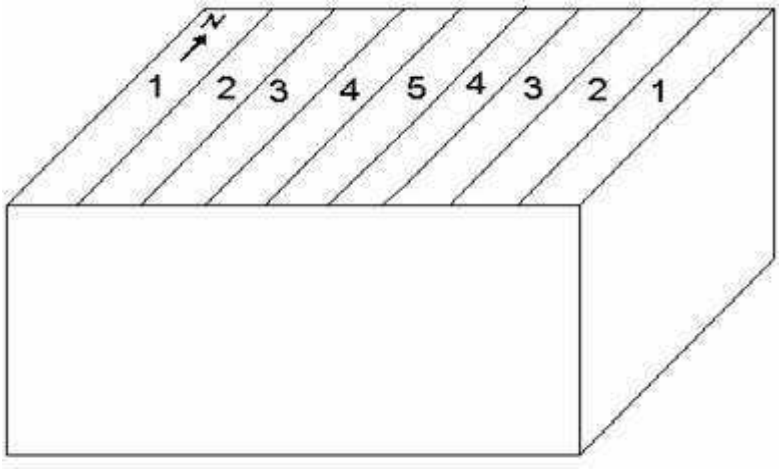
1. **a)** Complete the block (below). **b)** Number the beds from oldest to youngest (1 being oldest). **c)** Indicate the axial plane and fold axis with appropriate symbols in both the map view and cross section. **What is the name of this structure?** _____



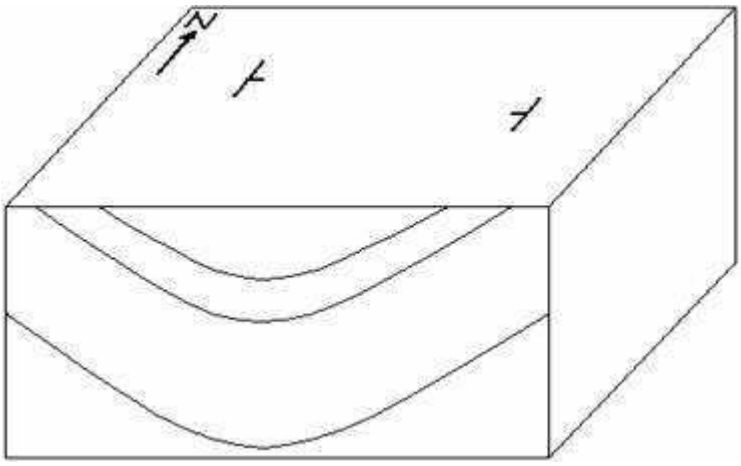
2. **a)** Complete the block diagram (below). **b)** Place strike and dip symbols on the map view (top of block) to indicate the structure. **c)** Label the axial planes and fold axes with the appropriate symbols. **What is the name of this structure?** _____



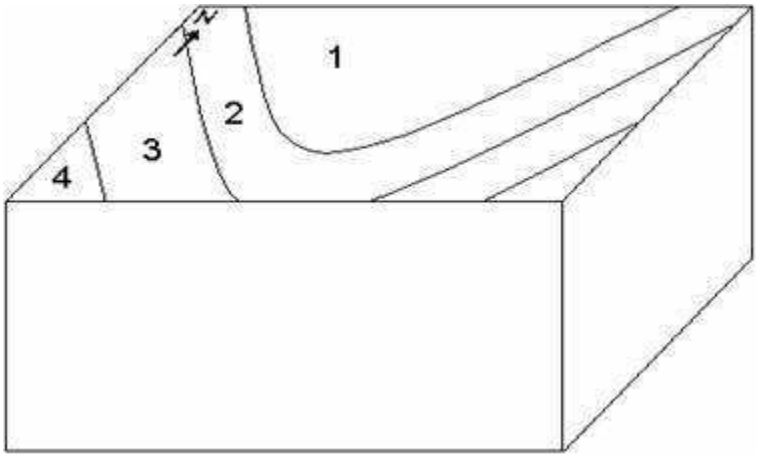
3. **a)** Complete the block (below). Dip amount is arbitrary, but dip direction is not. **b)** Number the beds from oldest to youngest (1 being oldest). **c)** Indicate the axial plane and fold axis with appropriate symbols in the map view and cross-section of the block. **d)** Place strike and dip symbols on top. **What is the name of this structure?** _____



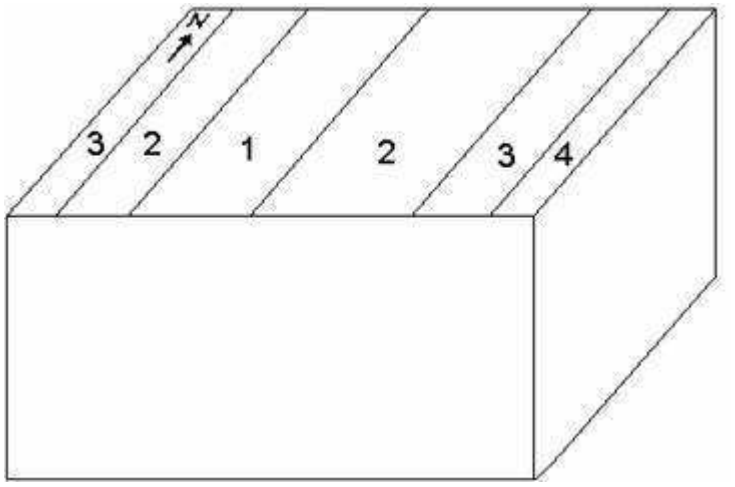
4. a) Complete the block (below). **b)** Number the beds from oldest to youngest (1 being oldest).
c) Indicate axial plane and fold axis with appropriate symbols in the map view and cross-section.
What is the dip angle? _____. What is the name of this structure? _____



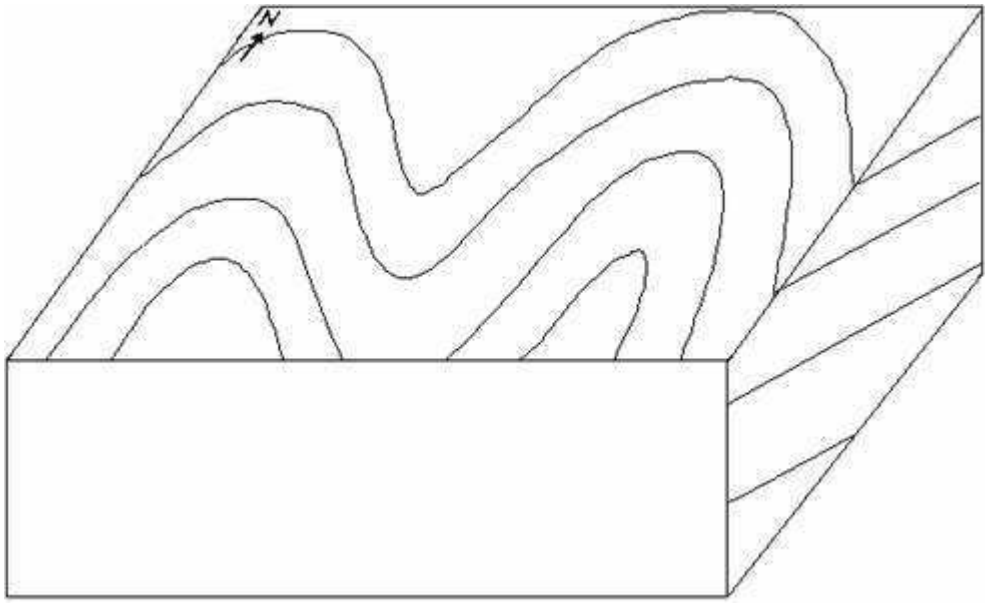
5. a) Complete the block (below). **b)** Number the beds from oldest to youngest (1 being oldest).
c) Indicate the axial plane and fold axis with appropriate symbols in the map view and cross-section face of the block. **d)** Draw strike and symbols on the map view.
What is the fold plunge angle? _____. What is the name of this structure? _____



6. a) Complete the block (below). **b)** Number the beds from oldest to youngest (1 being oldest).
c) Indicate the axial plane and fold axis with appropriate symbols in the map view and cross-section face of the block. **d)** Draw strike and symbols on the map view. Note bed width for #2.
What is the bed dip angle? _____. What is the name of this structure? _____



7. **a)** Complete the block (below). **b)** Number the beds from oldest to youngest (1 being oldest). **c)** Indicate the axial plane and fold axis with appropriate symbols in the map view and cross-section face of the block. **d)** Draw strike and symbols on the map view.
What is the bed dip angle? _____. What is the name of this structure? _____



Part III – Structural Geology Laboratory Reflection

Directions: Write a 120 word minimum reflection of the lab activity, explaining its purpose, the methods used, the results obtained, and a brief personal reflection of what you enjoyed and learned about doing this lab (*3 points possible*). Answer the following 3-point question reflection set on a separate sheet of paper:

1) *What was the purpose of this lab? What did you actually discover and learn during this lab?*

2) *What did you enjoy most about this lab? Also, what was challenging or thought-provoking?*

3) *What are your constructive comments about the design and execution of this lab? What's good? What's bad? Offer suggestions for making the lab better.*