PRINT THIS AND BRING IT TO LAB. **Name**_____

By the end of this lab you will be able to:

1. *Read map legends and describe patterns in geological data on a global scale*
2. *Interpret geological data presented on a map*
3. *Examine the presence and patterns of geological data at plate boundaries*
4. *Construct profile view or cross-sectional view summary sketches of summarizing geological data*
5. *Identify different types of plate boundaries from interpreting patterns in geological data.*
6. *Use Google Earth Pro to (1) open and view data presented in a .kmz file and (2) view elevation profiles.*

Part 1: Discovering Plate Boundaries

The map attached to this lab shows the 12 major tectonic plates and their boundaries. The names of each plate are presented in capital letters (e.g., NAZCA PLATE). The plate boundaries are outlined in bold, black lines, and the names of individual plate boundaries are labeled in a smaller font (e.g., East Pacific Rise). These boundaries are categorized into three general types: divergent, convergent, and transform.

You can distinguish these three boundary types by examining patterns in the following data sets (see the maps at your table):

- Geography – Global Relief - Shows topography (elevation highs and lows of land above sea level), and bathymetry (elevation highs and lows on the sea floor)
- Seismology – Earthquake location and magnitude at different depth intervals within the Earth
- Volcanology – Location and type of Volcanoes, and explosivity of volcanic activity
- Geochronology – Age of the ocean crust

Spend time looking at the 4 data sets (presented on maps at your table) to make sure you understand what each map shows by reading the map legend and description. Understanding the legend is essential for describing the data presented in each map relative to the plate boundaries.

Answer the following questions about each map before you begin the analysis of plate boundary features:

Part 1 Map Orientation

1. **Geography (Relief) Map (**topography, and bathymetry highs and lows in elevation)
    a. What color represents topographic highlands? _____.
    b. What colors represent areas of the earth's surface with elevations between -100m and 100m? _____.

c. What color represents the deepest part of the ocean basins?

_____.

d. How deep are the deepest locations in the ocean (bathymetric lows) in meters?

_____.

2. **Seismology Map**

a. What does each dot represent regardless of color?

b. Red dots represent _____,

c. Yellow dots represent_____,

d. Green dots represent_____,

e. Blue dots represent _____.

f. Describe how large earthquakes (>7.0 magnitude) are indicated on this map?

3. **Volcanology Map**

a. What does each triangle represent regardless of color?

b. What type of volcanism is represented by a red line?

c. How is the magnitude of the explosivity of volcanic eruptions indicated on this map?

4. **Geochronology Map**

a. What color represents the most recently produced ocean crust?

_____

b. What color represents the oldest ocean crust? _____

Part 2: Describing map data by plate boundary type

In the following questions, your group will describe the map data associated with each type of plate boundary; the following questions may help you make descriptions of the map data.

A. Does the plate boundary in question have earthquakes? volcanoes?
B. Does sea floor age show a pattern around a plate boundary or does it lack a pattern?
C. What is the spatial distribution of earthquakes, subaerial (above water) volcanoes, and mountain belts (areas of high relief) relative to the location of the plate boundary?
D. Do earthquakes occurring near/on the plate boundary occur mostly at one depth or do they occur over a range of depths?
E. Does the plate boundary appear as a smooth line or is it stepped?

5. **Divergent-Type Boundaries** → Example locations: Mid-Atlantic Ridge and the East Pacific Rise. Describe the map data at these locations using as much detail as possible.

6. **Convergent-Type Boundary** → Example locations Aleutian Arc, the Andes, the Himalayas, and the Japanese Arc. Describe the map data at these locations using as much detail as possible.

7. Of the four examples of convergent plate boundaries listed in the previous question, which one has the least in common with the others? What makes it different? What do you think causes these differences?

8. **Transform Boundary** → Example locations: San Andreas Fault and the Motagua Fault. Describe the map data at these locations using as much detail as possible.

Part 3: Plate Boundaries Gallery Walk

In this section of the laboratory exercise, you will share your observations/descriptions from part 1 with the class. Your table group will add their observations to 3 posters, one for each type of plate boundary. You may contribute as many observations as you wish to each type of plate boundary by writing your observations on a post-it note and sticking it to the corresponding plate boundary poster, but your table must contribute three observations for each plate boundary type.

Part 4: Profile View Summary Sketches of Geological Data at Plate Boundaries

Before you begin this section of the laboratory exercise, your laboratory instructor will demonstrate the procedure for summarizing map data in a profile view sketch - different from map view or birds eye view. Profile view allows you to show earthquake distribution and/or concentration with depth, the location of the volcanoes relative to topography/bathymetry and the location of the plate boundary.

By convention a profile begins at point A and end at A', and is written as A-A'.

Draw your concept sketch in this order:

I. Draw the elevation profile graph (Showing Topography/Bathymetry from Google Earth Pro) - Add ocean to your sketch if relevant at the appropriate elevation.
II. Find and then Label the location of the plate boundary. Plate boundaries are included in the .kmz file for each location.
III. If present, illustrate earthquake concentration around plate boundary and depth distribution of those earthquakes.
IV. If present or relevant, label sea floor age data from youngest to oldest
V. If present, location of volcanism relative to the plate boundary and elevation profile.

You will use Google Earth Pro to find the bathymetric/topographic profile across a plate boundary. Use the following step-by-step directions:

A. Open Google Earth Pro
B. Select File<Open<Plate Tectonics Map data and profiles.kmz – This will load the .kmz data file into your temporary places menu. (The .kmz file for this exercise can be downloaded in the plate tectonics module.
C. Click on the right pointing grey arrow next to the GSci 121_plate boundaries_data_profiles folder – this will open the folder and allow you to navigate the prepared content.
D. Highlight the profile of interest (A-A', B-B', or C-C')
E. Go to the Google Earth Pro menu and select Edit<Show Elevation Profile – This will take you to the map location of the profile that you highlighted and will generate a graph of elevation relative to sea level versus map distance along the profile line drawn in white between two yellow push pins – this graph is the elevation profile or topographic/bathymetric profile).
F. If you move your cursor along the elevation profile, a red arrow appears on the map indicating the map location corresponding to the elevation along the profile.
G. Copy the elevation profile graph in the space provided in this lab exercise leaving space below the profile so that you have space to include earthquake locations by depth. **While you will not be able to draw this relationship to scale, you should devise a way to illustrate the depth-spatial relationships of earthquakes along a profile if relevant for the plate boundary type.**
H. Locate the plate boundary along the profile - the plate boundary is a solid bold line color coded by plate boundary type. Label the location of the plate boundary along your elevation profile.
I. Check boxes next to menu options for viewing Holocene Volcanoes (only shows volcanoes that erupted above sea level), USGS Earthquakes from 1985-2015 by depth and magnitude (color coding slightly different from physical maps, but legend given in file), and seafloor age. Add relevant information to your profile.
J. To Zoom in-out use the (+)/(-) scaling buttons located on the right side of your Google Earth Pro window.

Group Example:

9. **A-A' through Kathmandu, Nepal.** Draw a cross-section (profile view) through a continent-continent convergent plate boundary. Copy the graph of elevation versus distance. Then label the location of the plate boundary (dark blue line), the location of volcanoes – if any exist, and the location and depth of earthquakes for the elevation profile line.

Now Try it on your own:

10. B-B' through the Andes Mountains (South America)

Highlight the menu item B-B' and select "Show Elevation Profile" located in the edit menu. Draw a cross-section (profile view) through an ocean-continent convergent plate boundary. Copy the graph of elevation versus distance. Then label the location of the plate boundary (Cyan line), the location of volcanoes – if any exist, and the location and depth of earthquakes for the elevation profile line.

11. C-C' through the Mid-Atlantic Ridge (from Chesapeake Bay, U.S.A. to Nouakchott, Mauritania

Highlight the menu item C-C' and select "Show Elevation Profile" located in the edit menu. Draw a cross-section (profile view) through an ocean-ocean divergent plate boundary. Copy the graph of elevation versus distance. Then label the location of the plate boundary (Red line), the location of volcanoes – if any exist, and the location and depth of earthquakes for the elevation profile line.

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