

Challenge Worksheet



Earth Sci. Computer Applications GEOL 5303

Lab 3: Plate Tectonics using Google Earth

Your Mission: To become familiar with the major plate boundaries through exploration of plate tectonic features using Google Earth.

Your Supplies:

- (1) A computer with internet access and the Google Earth program installed.

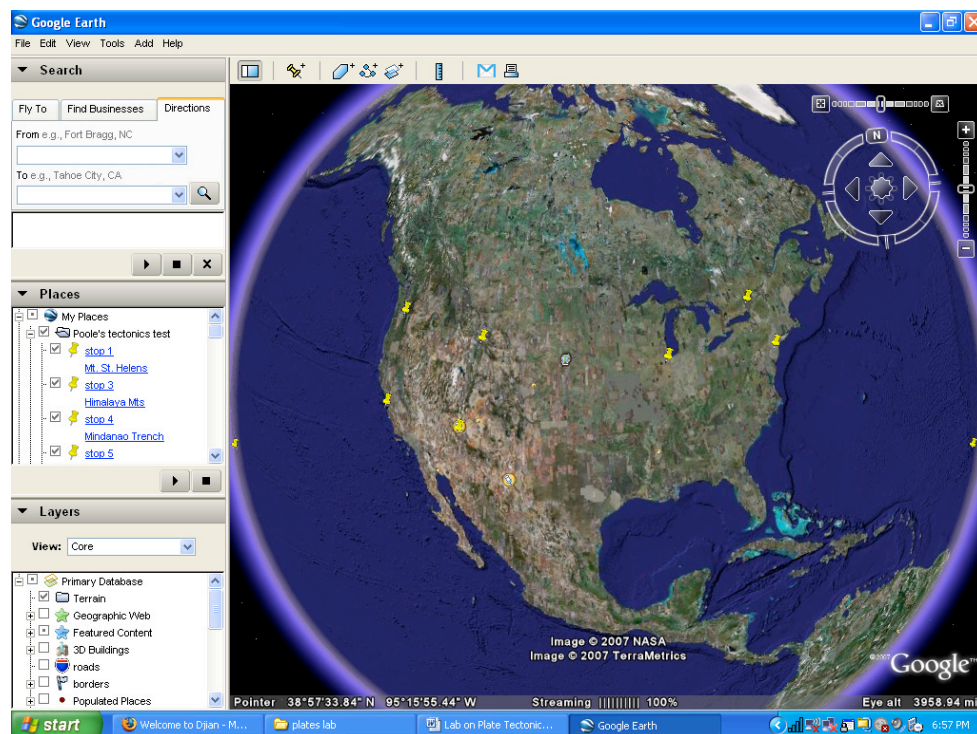
Your Task: In this lab we are going to explore the nature of Earth's tectonic plates using Google Earth. To do this, login to a computer in the computer lab and launch the Google Earth program by double clicking on the Google Earth icon on your Desktop:



(1) Google Earth Features

The Google Earth Desktop has four main features: 1. View Screen, 2. Navigation Bar, 3. Controls, and 4. Side Bar (includes the Search Panel, Places Panel, and Layers Panel).

Side Bar



Controls



View Screen



Navigation Bar

View screen. This feature takes up most of the Google Earth window. Often when opening up the Google Earth program, the view screen will be a view of the entire Earth from space.

Navigation bar. This feature is located at the bottom of the screen, a colored a gray transparent color with white text. This lets you know where you are viewing Earth from at any time.

- **On the left** are numbers that show the position of the mouse at any time. The position is given in latitude and longitude.
- **In the middle** is a streaming scale that shows you whether the image has finished loading. The image is not completely loaded until the scale reads '100%'.
- **On the right** is the apparent elevation of your point of view at any given time. Latitude and longitude, as well as elevation, can be set to different units using the **Options** menu, available in the **Tools** menu on a PC. On a Mac, you can change these units under the **Preferences** menu.

Controls. The following picture shows the controls for the current version of Google Earth. Just like a video game, each portion of the control panel moves you in a different way. Note that you can also use the wheel and buttons on your mouse to navigate to different locations.

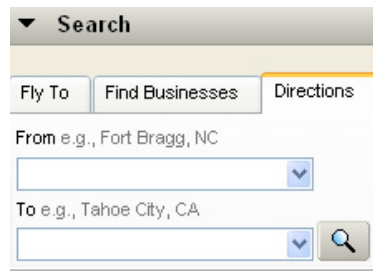


- **The Knob in the middle and the four arrows around it** will slide you along the Earth's surface in the direction you point. This allows you to move around on the Earth's surface.
- **The Ring** allows you to spin your view. Using the ring, you can view a feature from different directions.
- **The Bar on the right** zooms in (+) and out (-). This brings you closer to the Earth's surface and reveals more detail.
- **The Bar at the top** changes your view from looking straight down (left) to looking along the Earth's surface (right).

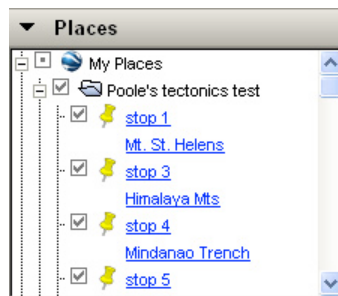
The Sidebar. This is a series of panels (Search, Places, Layers), located on the left side of your window, which can be used to navigate to points of interest. We will use this extensively in this lab.

The Search panel. This control is usually found in the **top** of the **Sidebar**. There are three tabs available in the Search panel:

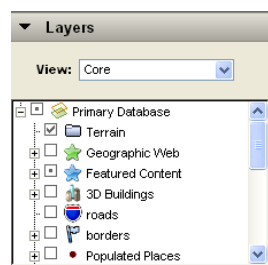
- **Fly To** lets you find locations.
- **Find Businesses** lets you find the closest business you want.
- **Directions** will give you directions to get from one place to another.



The Places panel is below the **Search** panel. This contains two main folders. First is the **Temporary Places** folder. If you open any new Google Earth files, this is where the file contents will be stored. The second is the **My Places** folder that can be used to save places you want to go back to.



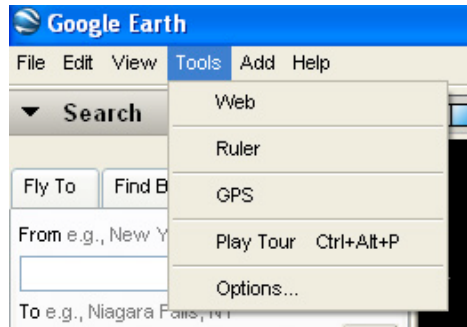
The Layers panel is at the **bottom** of the **Sidebar**. There are literally hundreds of layers that can be added to show different information, including names of roads, points of interest, state and national boundaries, popular places, etc. To turn a layer on, just click on the appropriate box. Once you turn on a layer, it stays on until you turn it off again.



(3) Google Earth Tools Menu

The **Tools** menu allows you to do several interesting things:

- **The Ruler** allows you to measure distances so that you can see how large different features are.
- **The Options** command lets you change the features inside Google Earth (PCs only).



(4) Practice!

- Now spend a few minutes on your own practicing how to move around using the viewer, panels, and control options in Google Earth. Try using the Ruler tool, as described above, to get a feel for how to measure distances.
- Next, try the following practice example, where you will search for a specific location: **UTEP**.

To do this, simply type " *UTEP* " in the search box. Note the results of your search will appear in the search bar, where Google's locations are shown with **red** markers, and the user community placemarks are shown by **blue** markers. You may find that many "hits", or answers, are returned for your query. Usually the one you want will be listed in the top 5, but look through the names and click on the one that makes the most sense to you.

Challenge Question 1: What is the latitude and longitude of the UTEP Sun Bowl? How large is the Sun Bowl football field, in feet?

(5) Downloading Google Earth files

Next you will practice downloading two Google Earth files from the Internet. Google Earth files can be identified by a “.kml” or “.kmz” in their file name.

- First, let's download an **earthquake locations** file from the USGS. Using an Internet web browser (either Firefox or Internet Explorer), type in the following web address:

<http://earthquake.usgs.gov/eqcenter/catalogs/>

This page is the website for all recent (last 7 days) earthquake activity cataloged by the U.S. Geological Survey. If you scroll through the page, you will see many data types that you can download (Excel format, text format, Google Earth, etc.) You want to download a Google Earth file, so click on the link for earthquakes colored by age:

-  [M 1+ earthquakes, past 7 days \(colored by age\)](#)

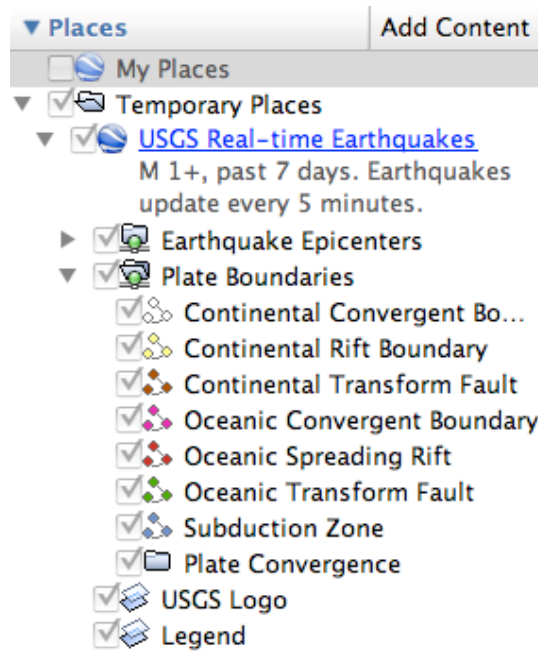
By clicking on this link, a Google Earth file, named **eqs7day-age.kmz** should automatically download to your **Desktop** (or perhaps to some other mysterious location – if you don't see it on your Desktop, let Bridget or Cecilia know).

This file contains earthquakes over the last 7 days, color-coded by age, and also includes plate boundaries.

- To open the file in Google Earth, either:
 1. **Double click** the file, and it will automatically load into Google Earth, **or**
 2. In Google Earth, choose **File → Open** and select the location of your file.

Once your file opens, it should appear in your Temporary Places panel on the left side of your Google Earth window. You will also likely see a legend for earthquake **Magnitude** on the upper left side of your viewing window, which provides you with information about the sizes and ages of the earthquakes you are about to inspect. This legend doesn't say much about the plate boundaries though, but if you look along the Sidebar, in your **Places** panel (shown below), you may notice different plate boundaries listed, labeled in different colors. Use these colors to help you interpret the different types of plate boundaries. Note that you may have to “expand” the Plate Boundaries folder to see all of its contents – to do this, simply click on the arrow on the

left side of the folder name, so that it points in a “down” direction.



- Feel free to explore some of the earthquake locations (clicking on them will give you detailed information) and plate boundaries.

Challenge Question 2: How many earthquakes occurred in Texas this past week? How many earthquakes occurred in California (its okay to give a rough estimate here, for example 10, 100, 1000).

- Next, you will download a **volcano locations** file from the Smithsonian. Back at your Internet web browser window, type in the following web address:

<http://www.volcano.si.edu/>

Click on the Google Earth link on left side of the page:

Google Earth
Placemarks

Then click on link for **Holocene Volcanoes:**

 [Download Holocene Volcanoes](#)

A file named **GVPWorldVolcanoes.kml** should download to your computer. This file contains known, or inferred, volcano locations from the Smithsonian Global Volcanism Program.

- Open the file up in Google Earth and explore some of the volcano locations on Earth.

Challenge Question 3: What symbol (shape, color) is used to represent volcanoes in this file? How many active volcanoes can you find in Hawaii? How many in New Mexico/Texas?

(6) Exploring Earth's plate tectonic features

Now that you are familiar with the Google Earth viewer, you will next take a tour of some of the plate tectonic features of Earth.

- To do this, you will need to download a file prepared for this lab, named **Lab3_PlateTectonics.kmz**. You can find this file on the class website, under the materials page:

http://www.geo.utep.edu/pub/bkonter/geol_5303/materials.html

- Download this file to your Desktop and open it up in Google Earth.
- Once the file opens, it should appear in your **Places** panel in the **Sidebar**. Click on the small triangle on the left side of the file name to expand the contents of the file.
- To “fly” to each of these locations, simply double click on the name. Use these places to answer the questions below.

Divergent Margins

- **Rio Grande Rift**

Double click on the Rio Grand Rift name in the **Places** panel and zoom in a bit to where you can make out a fairly large tectonic “rift” feature, located to the left of the pushpin “placemark”. Use the measure tool to measure the Rio Grande Rift at this location.

Challenge Question 4: Approximately how wide is the Rift, in miles, here?

The Rio Grand Rift actually extends south to the El Paso region. Zoom out and try to trace the rift as it makes its way south to El Paso.

Challenge Question 5: Approximately how long is the distance between the Rio Grande Rift placemark and El Paso?

- **East African Rift**

Next double click on the East African Rift name in the **Places** panel. You should be able to identify the rift location by a plate boundary line and several other distinctive icons.

Challenge Question 6: What type of plate boundary is labeled here? Hint, use the plate boundary names listed in your Places panel to help.

Challenge Question 7: What other geologic features are labeled here? Did we see quite as many of these features along the Rio Grande Rift?

- **Mid-oceanic Ridge**

Next double click on the Mid-oceanic Ridge name in the **Places** panel.

Challenge Question 8: Which two types of plate boundaries are labeled here?

Challenge Question 19: What prominent features do you notice in the Mid-oceanic Ridge that are absent in the continental rifts?

Zoom out.

Challenge Question 20: Have there been any earthquakes along the Mid-oceanic Ridge in the last week? If so, when?



Convergent Margins

- **Mariana Trench**

Next double click on the Mariana Convergent Margin name in the **Places** panel. This view shows a classic subduction zone. The Pacific plate is on the right and the Philippine plate is on the left.

Challenge Question 21: Which plate do you think is being subducted, or being pushed down into the Earth?

Challenge Question 22: An island like feature, called an Island Arc, is typically found in active subduction zones. How far from the Mariana trench is its island arc?

Challenge Question 23: Big earthquakes are frequently found in these regions. What is the largest earthquake to have occurred along the Marianas Trench in the last week?

- **Himalayas (Continental Collisions)**

Next double click on the Himalayas name in the **Places** panel. The Himalayas were built by the collision of two continents, India and Asia.

Challenge Question 23: How wide are the Himalaya Mountains?

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Transform Boundaries

- **San Andreas**

Next double click on the San Andreas name in the **Places** panel. Find the San Andreas Fault, the boundary between the Pacific plate and the North American plate. The San Andreas fault is actually a combination of two types of plate boundaries, convergent (think: pushing together) and transform (think: sliding by).

Challenge Question 24: Looking at the topography in the region, are the mountains along the San Andreas fault primarily associated with convergent or transform boundaries?

Challenge Question 25: Are all of the earthquakes located right along the plate boundary line? If not, can you think of an explanation for why they are along other places?

What to turn in, due next Wednesday, February 8th:

1. This completed lab (Challenge Worksheet), plus with any remarks or notes on the back/in the margins regarding clarity, how you might adjust the procedure for your students, etc. **(50 pts)**
2. A completed Teacher Worksheet (download from website), providing one additional exercise that compliments this lab. **(50 pts)**
3. A completed Lab Procedure document (download from website), which provides a short overview description of the activity that you completed, exercise objectives, time required to complete the exercises, materials needed, preparation notes, and any additional miscellaneous notes that you might want to remember. **(50 pts)**