Geology 15 - Activity 2   Name _____
**Plate Boundaries and Seafloor Spreading**
We will use the map Plate Boundaries (Bird, 2003). You will also benefit with a calculator and color pencils.
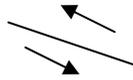

Part 1: Plate Boundaries of the Earth, Mollweide Projection.

1. Identify the major plate boundaries on the chart using the following colors and symbols:
    a. Divergent plate boundary (arrows showing direction of plate spreading)
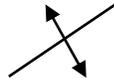
                                                           (Red)

    b. Transform plate boundary (arrows indicating direction of plate motion)

                                                           (Blue)

    c. Convergent plate boundary (teeth on the upthrown plate)

                                                           (Green)

    * Indicate where 3 plates form a Triple Junction using the letters: **TJ**.
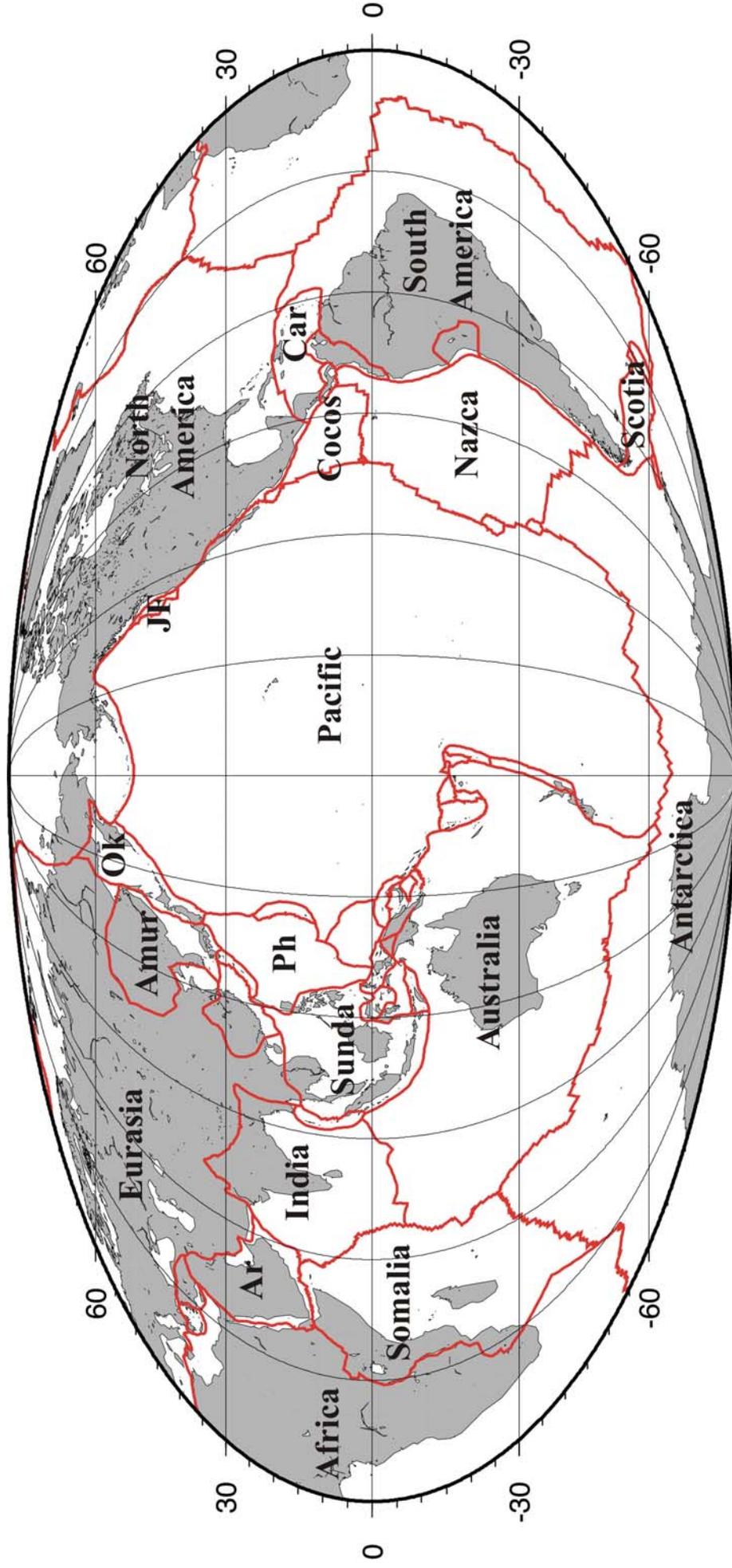

2. Hot Spots: There are about 30! Locate and label with a red circle and the name (e.g. Hawai'i, Yellowstone, Azores, Ireland, etc.)
3. Seamounts: Island and Seamount Chains form as seafloor crust moves over a hot spot. Locate seamount chains using a red line.
4. Transform Faults: Separate Mid Ocean Ridge (MOR) segments
5. Trenches: Indicate trenches using a yellow color pencil.
6. Lithospheric Plates: Color the primary lithospheric plates.

Part 2: Tectonic Plate Spreading Rates
        We can calculate an average rate of seafloor spreading by measuring the distance between MOR's, then divide the distance by the and age of seafloor rocks collected there (e.g. such as from ODP cores).
        Recall: Rate (r) = Distance (d) ÷ Time (t)   or   r = d / t
1.   What is the average spreading rate of the Atlantic Ocean basin measured along the Equator? Use the outer edge of the continents of S America and Africa to determine the edge of the oceanic plate. The oldest ocean floor, basalt rocks collected at the base of the continental shelf are mid-Cretaceous in age. (**Show your calculations below**)

North America

Car

Cocos

JF

Pacific

Ok

Amur

Ph

Eurasia

India

Sunda

Ar

Somalia

Africa

Australia

Antarctica

South America

Nazca

Scotia

GMT 2005 Apr 29 16:24:38   Plate Boundaries from PB2002 (Peter Bird) Dataset

Mollweide projection of the Peter Bird (2003) plate boundary dataset

2. What is the average 'half spreading rate' measured from the MOR to the continental margin of the Pacific Ocean basin along the Equator? Measure from the <u>East Pacific Rise </u>to the continental margin in the western Pacific Basin. The oldest seafloor, basalt rocks collected here are mid-Jurassic in age. (**Show your calculations below)**

3. You now can synthesize your knowledge of charts, map scales and plate tectonics to determine rate of plate movements. You will need a ruler and a calculator to make the 7 separate calculations (one for each of the Hawai'ian or Emperor Seamounts listed below). The radiometric age for each island or seamount is given in MYBP of <u>M</u>illions of <u>Y</u>ears <u>B</u>efore <u>P</u>resent. Show your work on a separate piece of paper and put your final answers in the Table below. One strategy to complete this is as follows:
1) Use latitude to determine the scale of the chart. To determine the scale, use a ruler to measure the distance on the chart (in cm) of 10° latitude. Since 1° latitude = 60 Miles, then 10° (of latitude) = 600M. Convert 600 M to centimeters (using conversion factors). Calculate the fractional scale by dividing the 600 M by the distance measured on the chart. Conversion Factors: 1 M = 1.852 km; 1 km = 100,000 cm
2) Measure the distance between the Big Island of Hawaii and each of the successive older islands in the chain.
3) Use the fractional scale to convert these to "real world" distances.
4) Divide the "real world" distance to the each island by the age shown and determine the rate of plate movement.
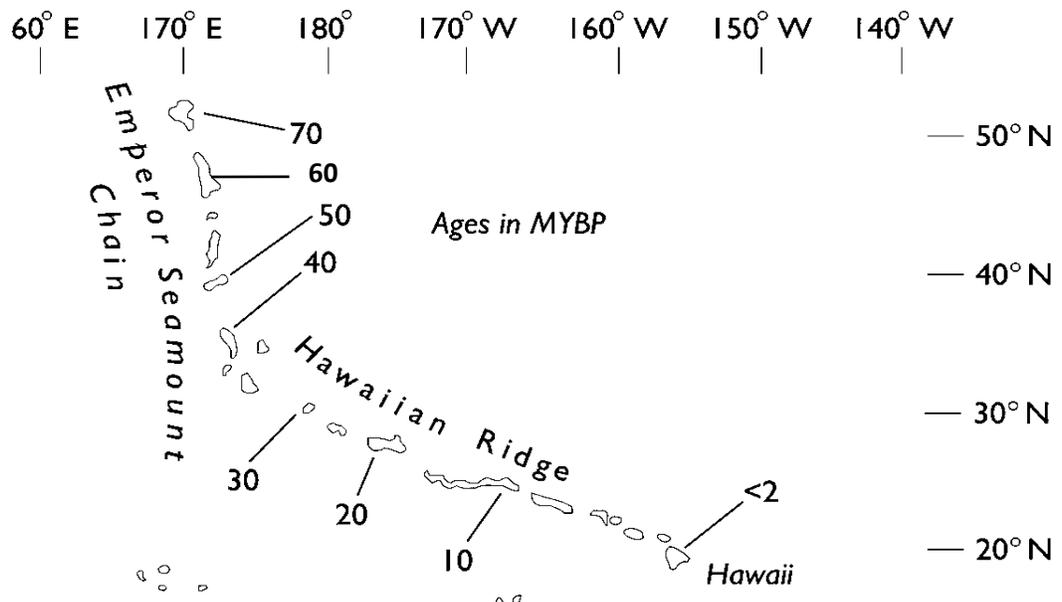Show your calculations on a separate piece of paper and place your final answers in the table below.

Figure 1: A chart showing maximum radiometric age dates and the distance from the active modern hot spot island of Hawai'i.

4) Calculate the average rate of seafloor movement of the Pacific plate over the Hawai'ian Hot Spot using the radiometric age of the volcanic islands with respect to the distance from the active Hawai'ian Island shown in Recall that rate (R) = distance (d) divided by time (t):   (R = d/t).
Put your answers in the table below and show your calculations.

Scale: _____

Age (MYBP)	1) Rate of Seafloor Movement (cm / yr)	2) Sediment Thickness (meters)
10		
20		
30		
40		
50		
60		
70		

5) Assume sediments accumulate at the rate of 2 mm per 1000yrs (2mm/1000yr), what is the expected thickness of the sediment cover for each of the 7 seamount ages listed (e.g. 10 my, 20 m.y., etc.) up to the oldest seamount. Put your answers in the table above and show your work below or a separate sheet.