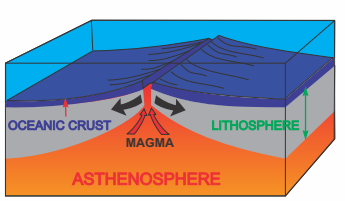
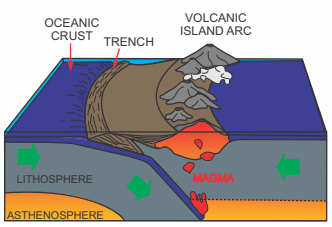
Geology 1203 Earth history
Assignment- plate motion

One of the great advances of the twentieth century for geologists was the formation of the theory of plate tectonics. We now know that the Earth is made up of many rigid plates, composed of the crust and upper mantle, called the lithosphere. These lithospheric plates float on the underlying less ridged layer of rock called the asthenosphere. This rigid outer layer of the Earth is divided into seven major and a number of smaller tectonic plates. There are also some very small "microplates" as well as areas that are very complex structurally and in some cases still not well understood. These plates all in motion (albeit very slowly) and where they contact each other along the edges zones of deformation and seismic activity as a result of this motion.

The boundaries between the plates can be divided into three basic types:



Divergent – the direction of relative plate motion is away from the boundary. Basaltic lava flows upwards from the mantle to the surface where it cools and solidifies. These types of boundaries are most often found in oceans, where the lava forms new ocean crust, and so will be often called mid-ocean ridges (MOR). But divergent-type boundaries have also formed in continents where the early stages are rifts systems – regions marked by deep valleys and volcanic activity. The predominant force at work along divergent boundaries is tension – pulling apart.

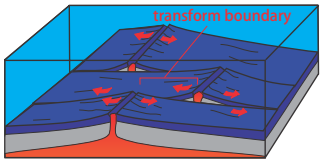


Convergent – the direction of relative plate movement is toward the boundary. Usually one plate is forced under the other (subducted) where it is eventually absorbed into the mantle. This region is usually, but not always, marked a deep trench that parallels the boundary, and so are often referred to as a subduction zone. A subduction zone marks the location of a convergent-type boundary but not all convergent boundaries will have a subduction zone.
The predominant force at these plate boundaries is compression – pushing together.
There are three different types of convergent boundaries based upon the types of crust that collide.

Ocean crust collides with continental crust – the ocean is denser and so is subducted.

Ocean crust collides with ocean crust – the older, colder crust is subducted.

Continental crust collides with continental crust – because both are considerably less dense than the mantle this results in deformation, uplift and mountain building.



Conservative – the direction is parallel to the plate boundary where the two plates slide past each other. They are marked by long transform faults and they are often referred to as transform boundaries.

Because the Earth has remained the same size any new crust that is created at divergent boundaries must be balanced by the same amount of old crust being destroyed at convergent margins.

Note: *When I use the term "crust" I am referring to the lithosphere that is composed of the crust and upper mantle - it is just easy for people to grasp plate boundaries if they think in terms of ocean and continental crust.*

What do I have to do?

Print the map figure of plate boundaries on the last page and use it to answer the following questions. I have included a colour version with brief explanation of the symbols used to identify the boundaries on this figure.

You will be required to submit a photo of your annotated map figure with your assignment answers. You should use coloured pen or pencils to mark on the figure so that it will show up. Take some care when drawing the arrows on your figure - if they are in the wrong location, indicate the wrong direction, or are just too messy I will mark them wrong.

Do not use the internet to try to look up the answers!. All answers will be based up on the plates as identified in this assignment.
Refer to the figures on plate boundaries in this module and/or figure 1.16 on pages 18 -19 of your textbook.

Questions:

Mid-Atlantic Ridge
Locate the Mid-Atlantic Ridge on the map. [*it will extend from north of the figure and end on the east side*]

Draw a red line along this boundary. Add arrows on either side to indicate the direction the direction of plate motion.

1.If you have drawn you line correctly there will be 4 major plates bounded by the Mid-Atlantic Ridge. What are their names?

2. If you were standing at Point **A** in which direction would someone at Point **B** be moving?

Towards you Away from you Parallel to you

South America
Locate the west coast of South America on the map.

3. What type of boundary do you think runs just along the coast?

Draw arrows on either side of the boundary to indicate the direction of plate movement.

4. If you were standing at Point **C** in which direction would someone at Point **D** be moving?

Towards you Away from you Parallel to you

East Pacific Rise
The East Pacific Rise is a long divergent boundary. [*it extends from near Antarctica to southern California*]

Locate it on the map; mark it with a red line. Now draw arrows on either side of the boundary to indicate the direction of plate movement.

5. If you have drawn your line correctly there should be 5 plates that have a boundary on the East Pacific Rise. What are their names?

China
Locate China on the map figure. This region is subject to frequent and often devastating earthquakes.

6. What two plates do you think are responsible for these earthquakes?

Outline this boundary and draw arrows on either side to indicate the direction of plate movement.

7. What type of boundary is it?

8. If you were standing at Point **E** in which direction would someone at Point **F** be moving?

Towards you Away from you Parallel to you

California
Next locate the state of California, on the West coast of North America.

9. What two plates are in contact here?

Outline this boundary and draw arrows on either side to indicate the direction of plate movement.

10. If you were standing at Point **G** in which direction would someone at Point **H** be moving?

Towards you Away from you Parallel to you

British Columbia
Located the province of British Columbia, on the west coast of North America. This area experiences an earthquake almost every day; most are never noticed. However, in recent years this area has experienced several larger earthquakes that have been noticed.

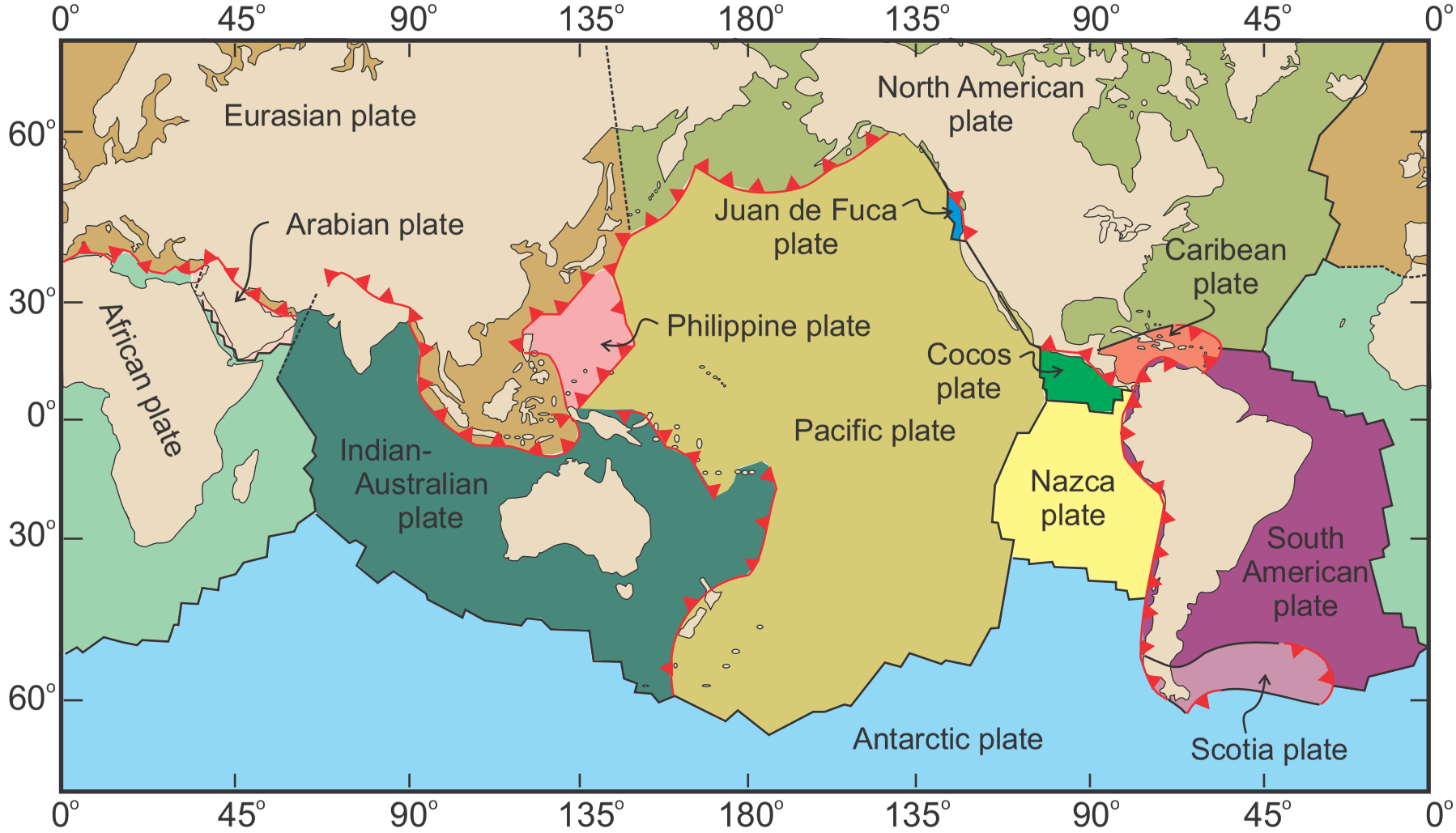
11. Looking at the map of plate boundaries what 2 plates do you think are responsible?

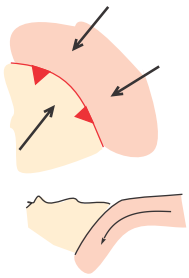
Outline this boundary and draw arrows on either side to indicate the direction of plate movement.

12. What type of boundary is this?

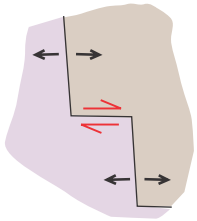
13. If you were standing at Point **I** in which direction would someone at Point **J** be moving?

Towards you Away from you Parallel to you





convergent or subduction boundary
The triangles indicate the direction of the plate being subducted. n this example the pinkish plate is being forced under the other plate. The black arrows indicate the direction of movement relative to the plate boundary.



divergent and transform boundaries
The black arrows indicate the direction of movement of the two plates along the divergent boundary. The red arrows show the relative movement along the transform boundary.

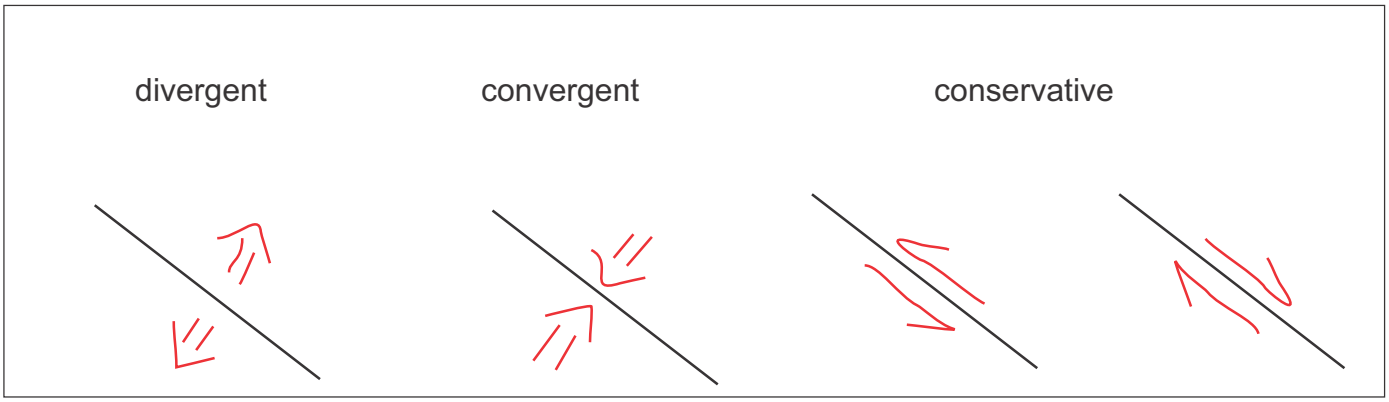
unknown type of boundary
In some regions the exact nature of the boundary is not clear.

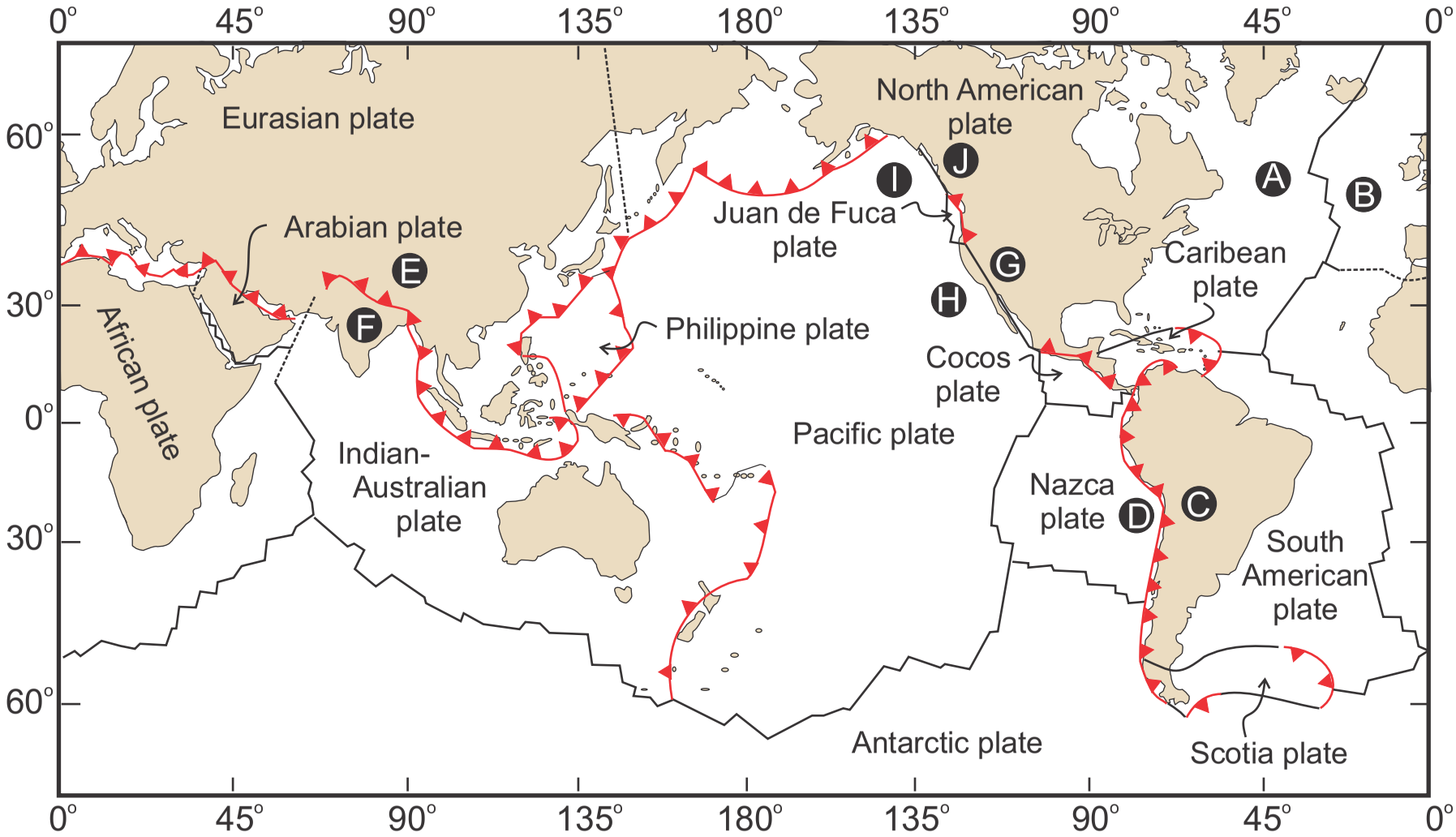
What do I submit?

Print the next page with the map figure. Annotate it as instructed in the question section.
Make sure the arrows are neat and correctly placed. Do not forget to include your name and student number.
Upload a picture of your annotated map figure -if the map is missing you will be given only half the value for any questions you get correct.

You must also submit the answers to the questions - this can simply be the question number followed by your answer. But do not mix them up - I will mark them in the order they are numbered above and if you have the wrong answer with the wrong number it will be considered wrong.
If you want to be sure then you can repeat the question with the number. **Do not scribble the answers to the questions on this sheet.**

When indicating a direction of movement for a plate boundary the arrows should show the main direction the plate is moving at that point.





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