WorldStrides®

Plate Detective Activity Guide - TCU Idea Factory

A quick overview is provided here – for more detailed instructions and to see the activity in action, go to the TCU Idea Factory website for this activity using the QR code provided here:

Place maps inside the sheet protector in the following order:

1. Sea Floor Map
2. Volcano Data Set
3. Earthquakes Data Set
4. Sea Floor Age
5. Magnetic Patterns
6. Current Boundary Map

1. Look at the map of the **Sea Floor** – look at the question at the top of the map!
   What do the bumps on the map indicate?
   Do you see trenches? Mark the trenches with dotted lines on the sheet protector.

2. Remove the Sea Floor Map so that the **Volcano Data Set** is now shown.
   Choose a different color marker and make a dot on the sheet protector at the location of each of the volcanos.
   What patterns do you see?

3. Remove the Volcano Data Set so that the **Earthquake Data Set** is now shown.
   Choose yet another color marker and make a dot on the sheet protector at the location of each of the earthquakes.
   What patterns do you see?

4. Remove the Earthquake Data Set so that the **Sea Floor Age Map** is now shown.
   Choose yet another color marker and trace the location of the youngest sea floor.
   What patterns do you see?

5. Remove the Sea Floor Age Map so that the **Magnetic Patterns Map** is now shown.
   This is one of the more complex maps to investigate – it can be left out based on the knowledge base of the students.
   Look at the Mid-Atlantic Ridge – we see symmetric patterns of color because of the switching of the magnetic poles. As rocks are formed, the magnetic materials will indicate which way the magnetic poles were situated. As time passes, new rock is formed and if the magnetic pole is switched, the new rock will have a magnetic field pointing the opposite direction. We can see a symmetry across the Mid-Atlantic Ridge. The patterns in the Pacific Ocean are much more challenging to discover!

6. Finally, remove the Magnetic Patterns Map so that the **Current Boundary Map** is shown.
   Investigate the plate boundaries that scientists have confirmed exist.
   Now you can think about what the sea floor map and the age of the sea floor tells us about plate boundaries and what the location of volcanoes and earthquakes tells us about plate boundaries!

DISCUSSION QUESTIONS are located at the bottom of each sheet…

SEA FLOOR MAP:

Q = How would knowing whether the map feature was a ridge or trench lead us to predict the type of plate boundary?
A = *Ridges like the Mid-Atlantic Ridge are usually associated with divergent boundaries. Trenches are usually associated with convergent boundaries.*

VOLCANO DATA SET:

Q = How do we explain the location of isolated volcanoes (like the Hawaiian Islands) in the model?
A = *The model does not explain them. Models have limitations. This model describes volcanic activity at plate boundaries. The Hawaiian Islands have volcanoes that arise by a different mechanism, hot spots!*

Q = Can the uneven distribution of volcanoes on the planet—concentrated in the ring of fire—lead us to predict the type of boundary?
A = *The data will reveal that the Pacific is ringed by subduction zones of the convergent boundaries arising from a fast growing/moving Pacific plate.*

EARTHQUAKE DATA SET:

Q = Can we use the depth information to predict the type of plate boundary?
A = *Yes. Deep earthquakes occur at subduction zones of convergent boundaries. Shallow earthquakes occur at transform boundaries.*

Q = Should the model accommodate all of the earthquake data?
A = *No. Ancient plate boundaries exist that are still geologically active.*

Q = How do we explain data that does not fit easily into the model?
A = *We need to either refine our model or recognize that all models have limitations.*

SEA FLOOR AGE:

Q = Can we identify different types (convergent, divergent, transform) of plate boundaries?
A = *Yes. Divergent boundaries produce new crust and are red on the map. Convergent boundaries occur when plates collide and colors are very different. See the collision of Philippine Plate and Pacific Plate where orange meets blue, respectively. Transform boundaries are easily seen close to the divergent boundaries. A divergent boundary grows at different rates and the banding that is seen in the eastern Pacific derives from divergent boundaries that are offset and connected by transform boundaries. These transform boundaries produce a striping feature that runs horizontal across this portion of the Pacific.*

Q = Consider the Atlantic and Pacific coasts of North America. What does the difference in width of the red/orange/yellow regions tell us?
A = *Divergent boundaries produce crust at different rates. The width of a "new crust" red area is large if crust is produced fast (like the Pacific), but is narrow if crust is produced more slowly (like the Atlantic).*

MAGNETIC PATTERNS:

Q = Is it fortunate that the first data was collected in the North Atlantic?
A = *Yes. The Pacific is more complicated*

Q = What does the direction and symmetry of the banding pattern in the North Atlantic reveal?
A = *That crust grew out from the mid-Atlantic ridge pushing the continents apart horizontally (as depicted).*

Q = How can we estimate the time of a magnetic pole reversal (See the inset for a hint)?
A = *By dividing the total amount of time by the number of magnetic reversals (colored bands) we count, we can estimate the value. The data shown here do not provide the most accurate of measurements, because it is hard to count bands. Mathematically, 10 million years/9 bands = about 1 million years per reversal.*