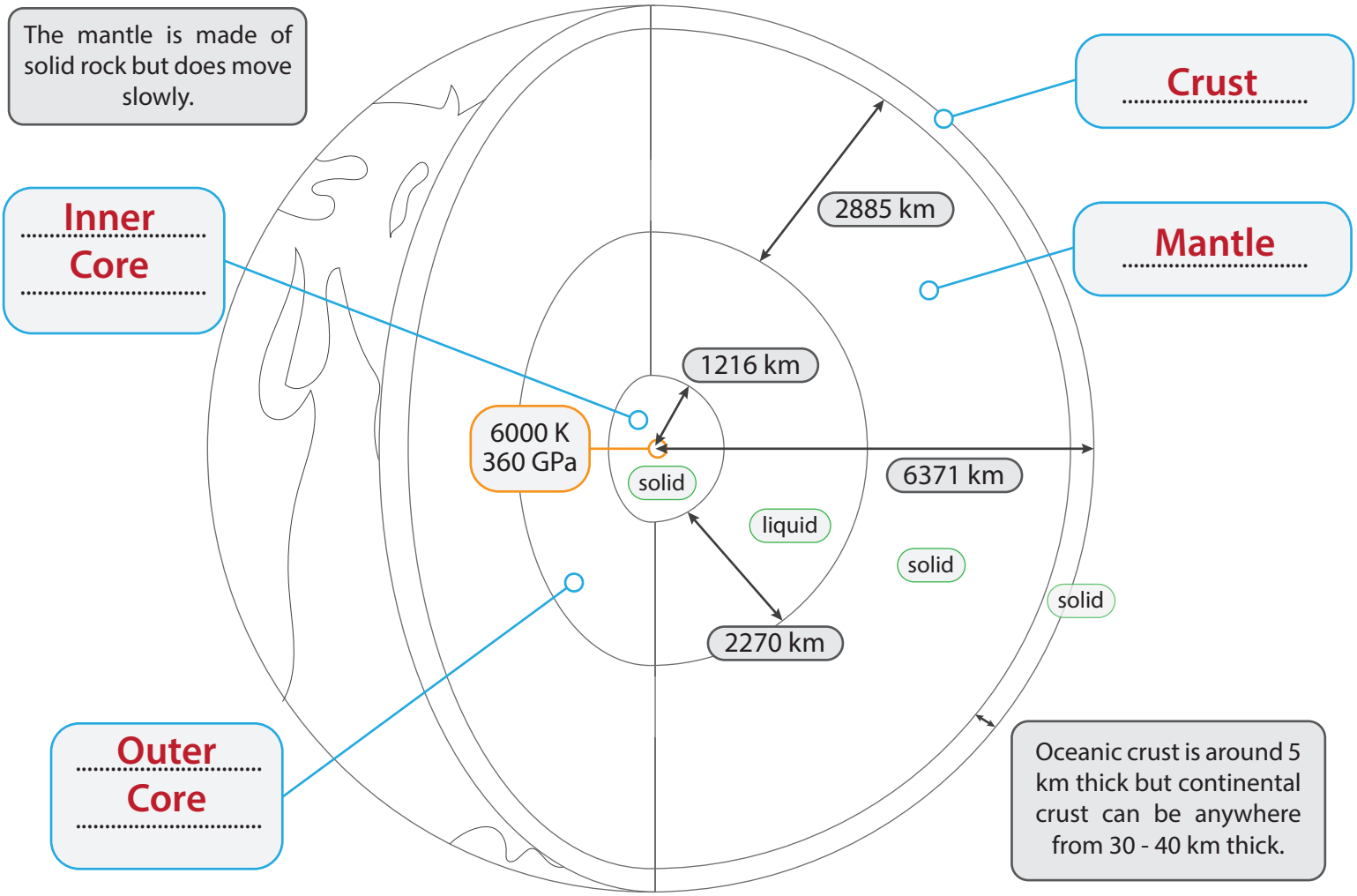
The Structure of the Earth

Our Earth is split up into layers.

The outer layer of the Earth (the one you are standing on) is called **the crust**. Below that you will find the solid **mantle** and right in the centre of the Earth you will find the core, split into the solid iron ball called **the inner core** and the surrounding liquid outer layer called **the outer core**.

Using the bold words in the text above to help you, fill in the missing names in the following diagram (in the blue boxes), then colour in your picture to create a labelled structure of the Earth.



In the diagram above you have identified the major layers in the Earth, but the question we are seeking to answer here is how do we know about them?

The deepest anyone has dug into the Earth is the Kola Superdeep Borehole, a 7.6 mile (12.2 km) deep hole that's 9 inch (23 cm) in diameter and can be found in Russia. But even at that depth it's still a long way to the centre of the Earth!

One of the major pieces of evidence for layers in the Earth comes from seismic waves.

Seismic Waves in the Earth

Use the previous activities and your notes to help you answer the following questions:

1. Which seismic wave is detected first on a seismometer? A P Wave
2. What seismic wave (P or S) is a longitudinal wave? A P Wave
3. What causes an earthquake? Rocks breaking underground

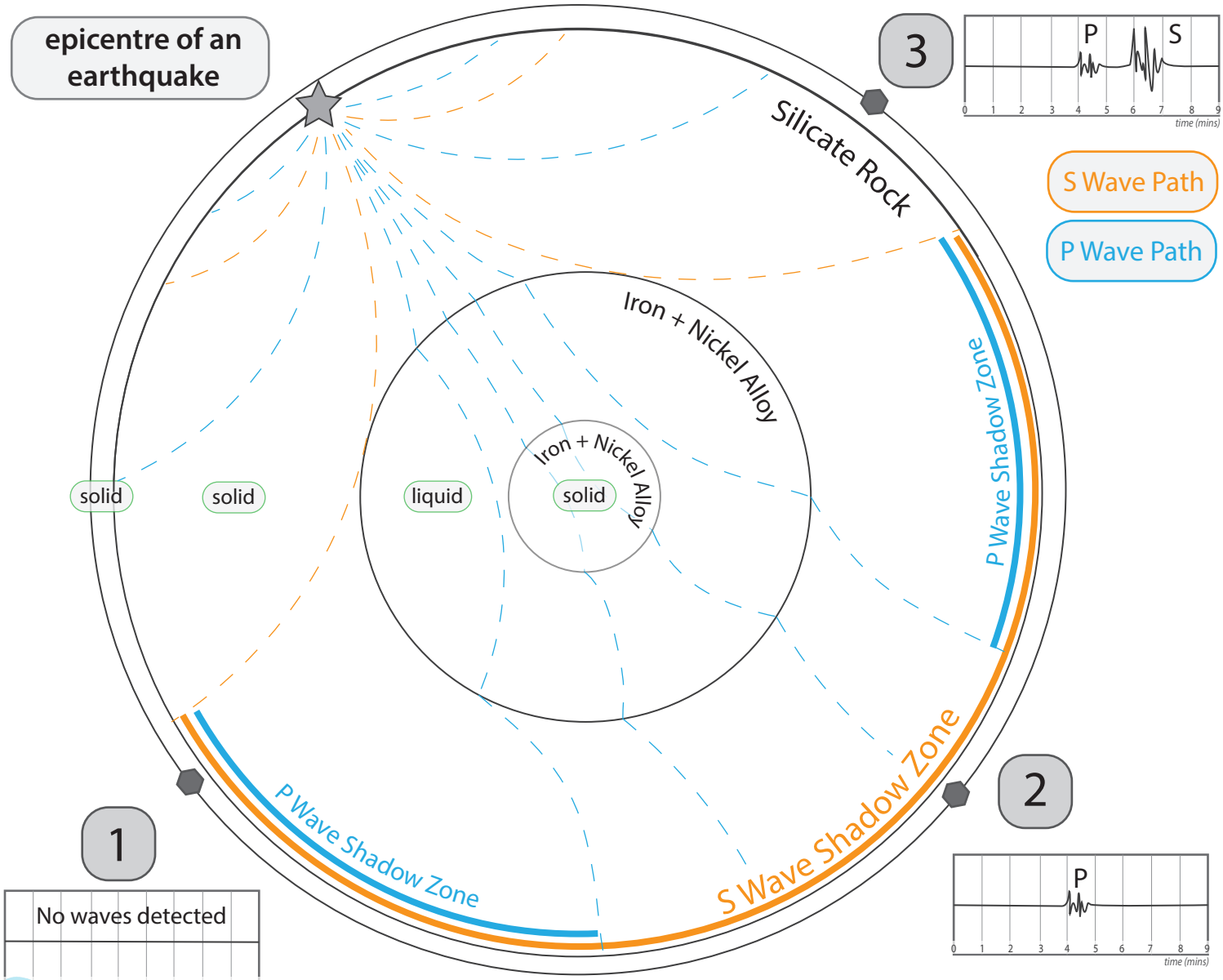
P waves are longitudinal waves that travel at different speeds inside the different layers of the Earth.

S waves are transverse and cannot travel through the liquid outer core.

Seismometers can then be used to identify the varying density and layers inside of the Earth.

When waves travel from one material into another with a different density, they change direction. At a boundary, waves can reflect, refract or become absorbed, so when they travel through the Earth they will form curved lines. *Seismic waves travelling through the Earth can also change into other waves, but more on that later!*

The dashed lines on the diagram below show the paths followed by S and P waves away from the epicentre of an earthquake and through the Earth. Seismograms show which seismic waves are detected at three points on the Earth. What do you notice?



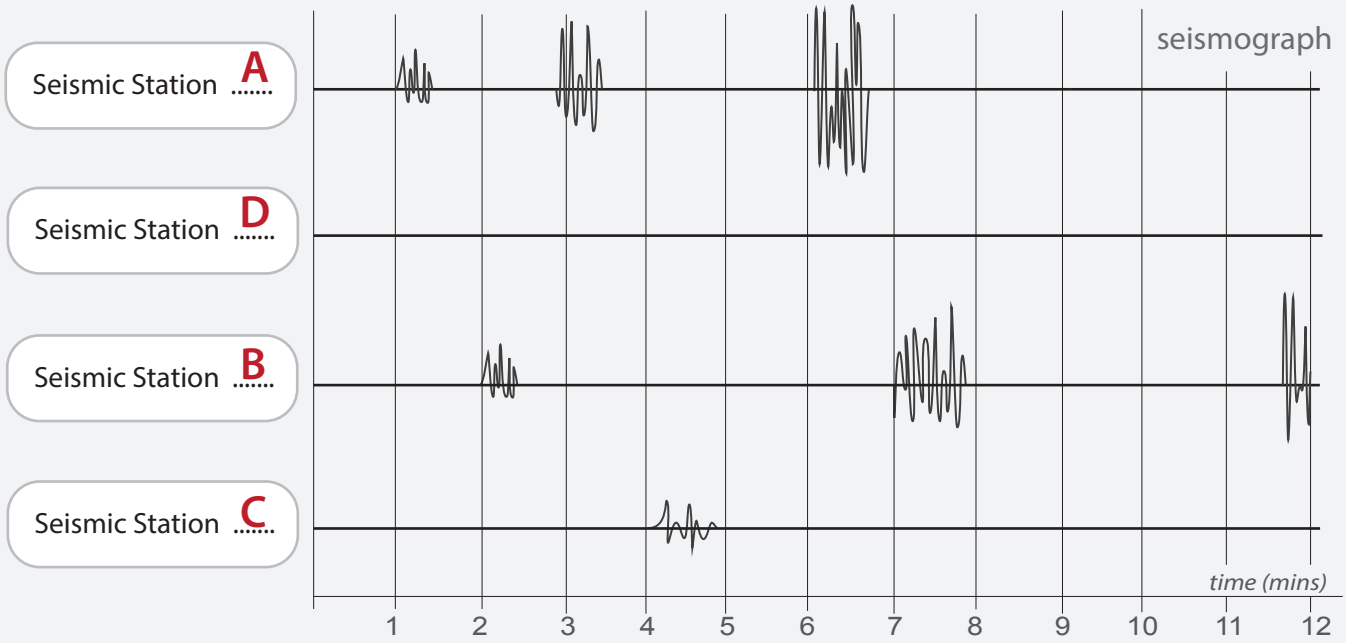
The Shadow Zone

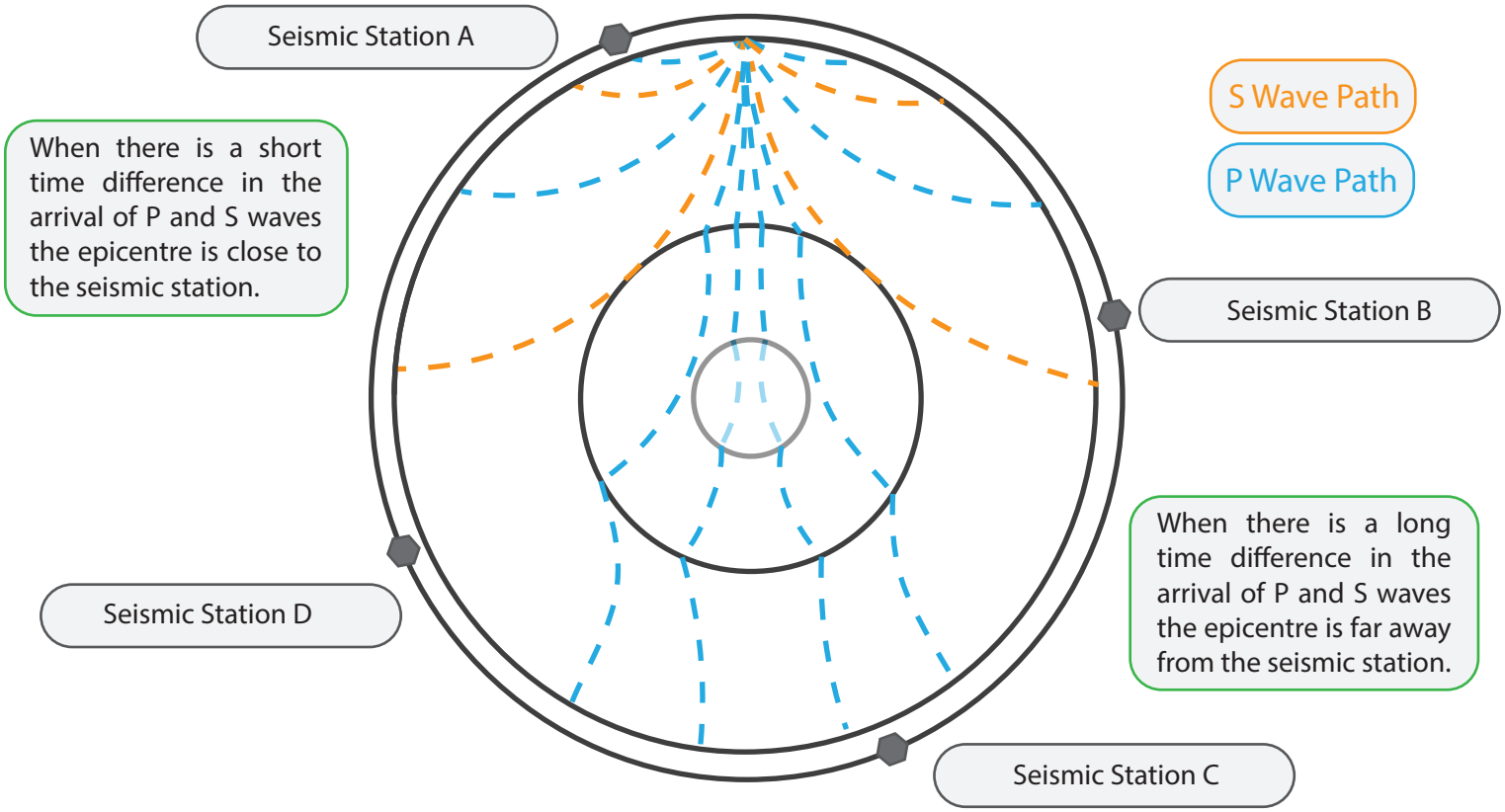
The S wave shadow zone is evidence for the Earth's liquid outer core.

Seismic S waves cannot propagate through liquids, and so they are not able to travel through the liquid outer core of the Earth.

The P wave shadow zone is caused by P waves refracting at the core-mantle boundary.

Put your sesimology skills to the test and match the seismic traces in the seismogram below to the correct seismic stations (A, B, C or D).
You will need to identify the seismic waves detected, the correct location and the S -P time difference (see Activity 1b for help) to correctly match all four stations.





Create your own 3D globe

How to make your own globe:

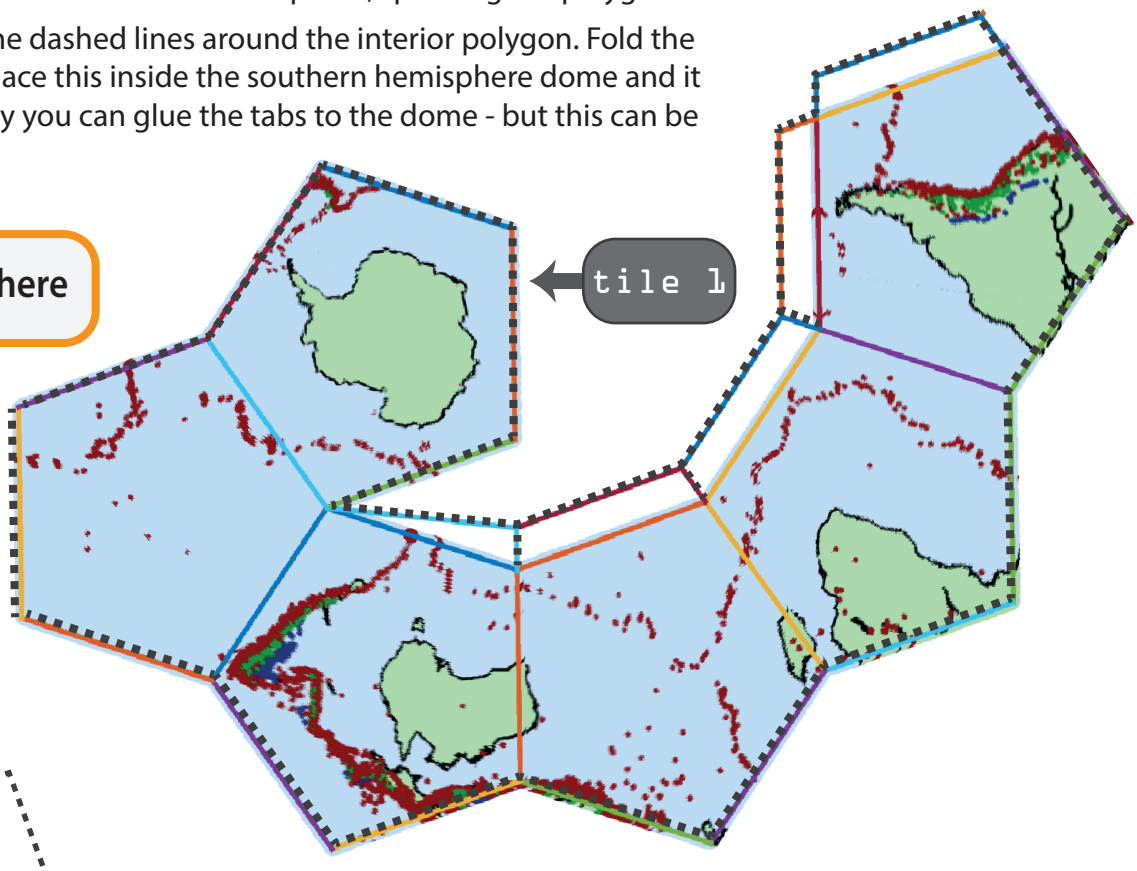
Step 1: Cut along all the dashed lines (the outlines of the two shapes and along the edges to create tabs - these will be used for sticking the globe together!). Create folds along all the remaining coloured edges.

Step 2: Starting with the southern hemisphere spiral the polygons around tile 1.

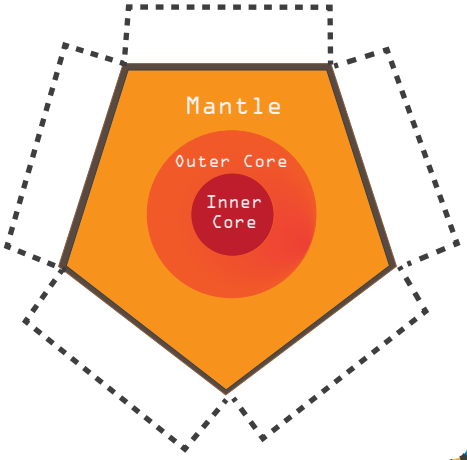
Step 3: Use either glue or sticky tape to secure the polygon using the tabs (sticking them on the inside of the globe).

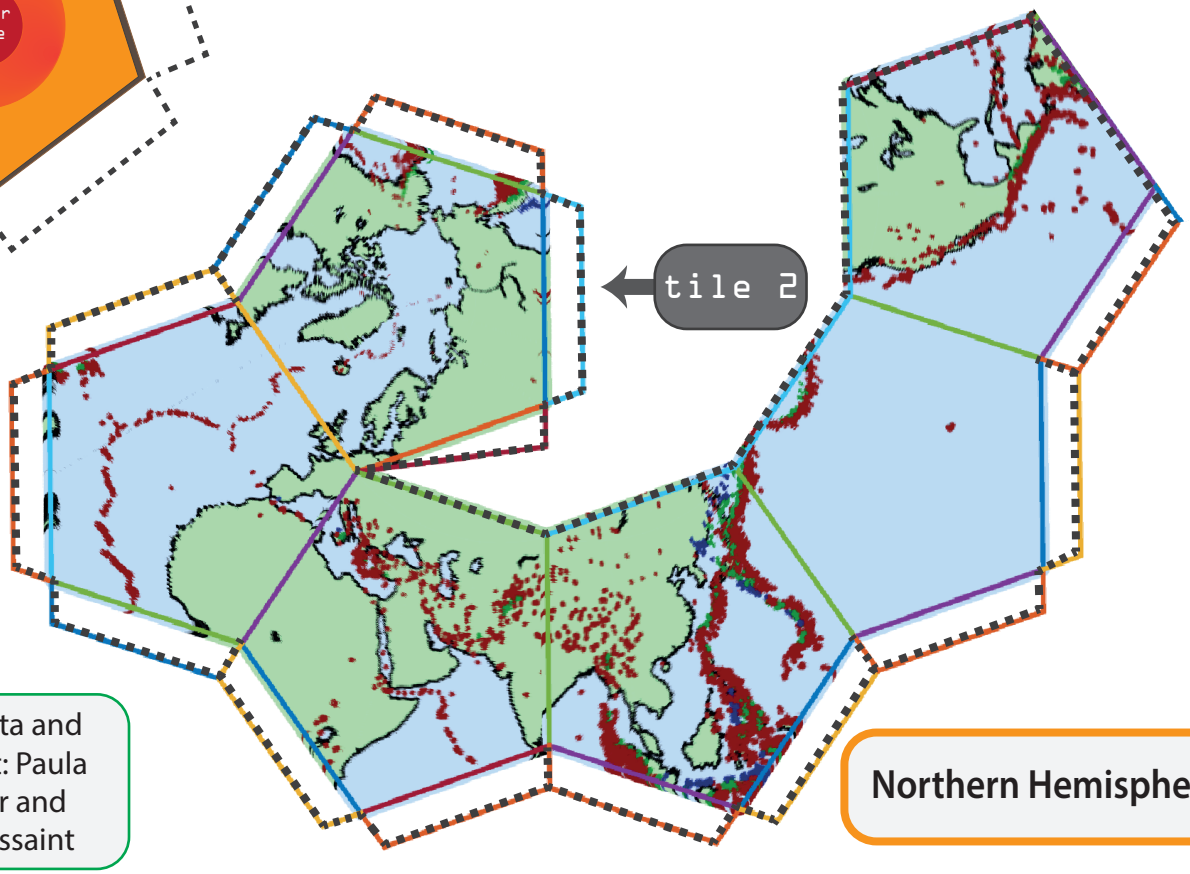
Step 4: Repeat steps 1 - 4 for the northern hemisphere, spiralling the polygons around tile 2.

Step 5: Finally, cut along the dashed lines around the interior polygon. Fold the tabs under the polygon. Place this inside the southern hemisphere dome and it will stand inside (optionally you can glue the tabs to the dome - but this can be very tricky!).



interior polygon





3D Globe data and design credit: Paula Koelemeijer and Renaud Toussaint