Construction Instructions for a Seafloor Spreading Box Model

(8" cardboard box version) Tanya Atwater, 2016

*This model is used to demonstrate the common pattern of spreading centers offset by perpendicular transform faults. It clarifies the motions across active transform faults and shows how fracture zones were formed in the sea floor as scars left by ancient transform faults. This box works best when accompanied by maps of the Atlantic seafloor topography showing segmented, offset midocean ridges with fracture zones streaming across the sea floor (**Maps 1&2**). Animation clips demonstrating various aspects of spreading systems can be viewed and downloaded from*
http://emvc.geol.ucsb.edu/2_infopgs/IP1GTect/fSFSpreadingSeries.html

Materials needed: ***Figure 1.***

Cubical cardboard box: 8" X 8" X 8"
Extra pieces of cardboard: two 8" X 8" squares
Exacto knife and/or razor blade cutting tool
paper clamps: 6 small, 6 medium
erasible pencil, black magic marker
cloth scissors, clear tape, glue
sturdy blue cloth: 7.8" X 24" strip (best cloth type: one whose cut edges don't ravel)

The Box: ***Figure 2.***

Tape or glue the top flaps closed on your box.
Trim off the bottom flaps to about 1" from the folds.
Fold these in and tape/glue them in place to form a big hole in the box bottom with an edge all around (to help the box hold its shape).

Continent Underlay pieces: ***Figure 3 and Pattern 1.***

Note: This step (and pattern1) sets the configuration for the box top and all its pieces.

On one of your cardboard squares, draw your spreading system: Use ***Pattern 1***, three spreading centers connected by transform faults, or design your own.*
Cut this out. To reduce confusion, write "THIS SIDE UP" on each of these pieces.

Spreading slots in the box top: ***Figure 4 and Pattern 2.***

Position the underlay pieces on the box top and mark the locations of the spreading centers (but not the transform faults) on the box top. Cut out the slots with a razor blade about 1/4 " wide. For best results, the slot ends should extend to the very edge of the box top and should extend slightly beyond their neighbors' ends.

Cloth Strip ocean floor: ***Figure 5 and Patterns 3a and 3b.***

On each end of the strip, cut off about 3/4", leaving a round pull tab in the middle.
Position the continental underlay pieces at each end of the strip and mark the transform fault locations (but not the spreading center locations). Draw parallel straight lines on the strip from the marks near one end to the marks near the other. Cut along these lines, but <u>do not cut all the way to the ends</u>! (Suggestion: Mark the edges and lines with black marker then cut down the middle of each line.)

Continent Overlays with Rifted Continental Edges: ***Figure 6 and Pattern 4.***

These Overlay pieces represent the continents that rift apart to make room for the new ocean. The rifted continental edges should mimic the shapes of the Underlay edges, but with softer corners, since continental crust never breaks as cleanly as oceanic crust.

Position the Underlay pieces onto the other cardboard square and lightly trace the edges of your cuts. Modify the tracing to round the corners. Cut out these pieces. To reduce confusion, stipple the tops of these pieces.

Construction of the Continental Crust Sandwiches: ***Figure 7.***

We now attach the continents to the ends of the cloth strip. At each end make a carefully aligned sandwich: underlay, then cloth, then continental overlay, then clip them together with three small clamps each.

Construction of the spreading centers: ***Figure 8.***

Holding the continent sandwiches over the box, have a friend poke the sea floor strips into their slots, then, reaching up through the box-bottom hole, pull them all the way in.

Weight the strips: ***Figure 9*****.**

Inside the box (awkward), find the center of each strip, fold it and clip on two medium clamps. These keep the strips from pulling all the way out of their slots, and they act as weights to pull the sea floor back into the slots when you reset the model.

Work the model: ***Figures 10 and 11.***

Pull the tabs sideways, splitting the continents apart. The sea floor strips should come smoothly out of the slots. When you stop pulling and let go of the tabs, the strips should smoothly pull themselves back into the slots.

Also, it is useful to draw symmetrical stripes on the the cloth strips, as shown on ***Figure 11***. This is easily done by pulling them partway out (have someone hold them there), and drawing the stripes onto the strips where they are coming out of the slots.

* Note that the pattern of spreading centers and transform faults in *Pattern 1* is quite simple and symmetrical. You can design your own if you like. Any rectilinear pattern will work as long as you are consistent: the underlays, continental overlays, boxtop slots and cloth strip cuts all need to follow the same geometric pattern. For example, ***Figure 11*** shows a more complicated 10" box version.

You probably want to start by building a box with Pattern 1, then go wild with additional boxes.

Optional finishing touches:

The cloth edges - You may want to paint the cut edges of your cloth with clear fingernail polish or other goop to keep the edges from unraveling.

The continental sandwich - Once you are satisfied with the workings of your model, you may want to remove the small clamps from the continental sandwich and glue those pieces together.

The weights - You may want to make more permanent weights by sewing the center folds of the strips into pockets and filling them with sand or small stones.

Wooden Version: Figure 12. At U .C. S. B., we use versions of this box in our introductory geology labs. After a couple of years, our cardboard versions caved in and we replaced them with wooden versions. The latter have held up well through many years of hard use.

Figures, Patterns, and Maps to accompany the Construction Instructions for the Seafloor Spreading Box Model

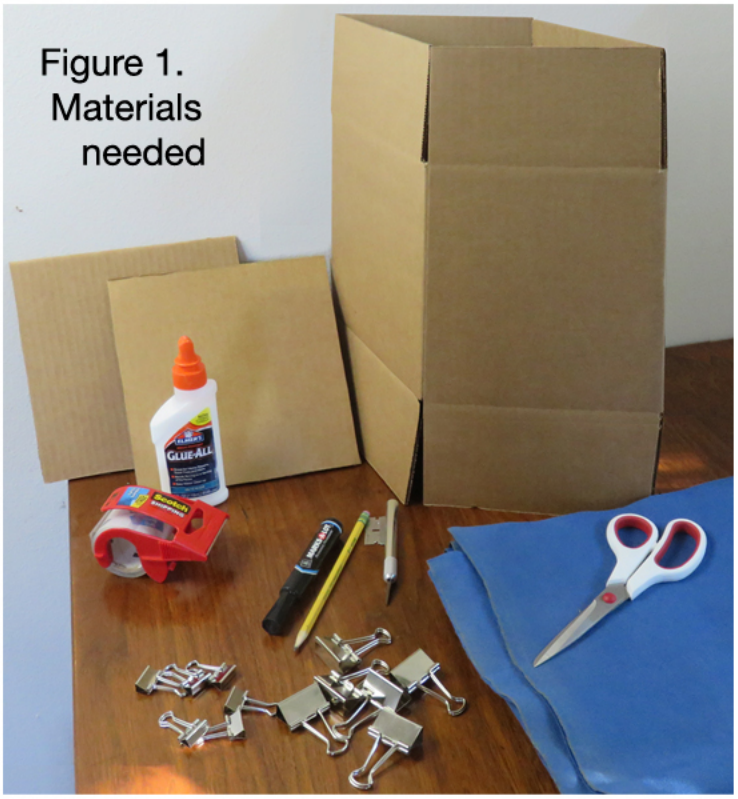


Figure 1. Materials needed

Figure 2. Box top sealed, box bottom cut out.

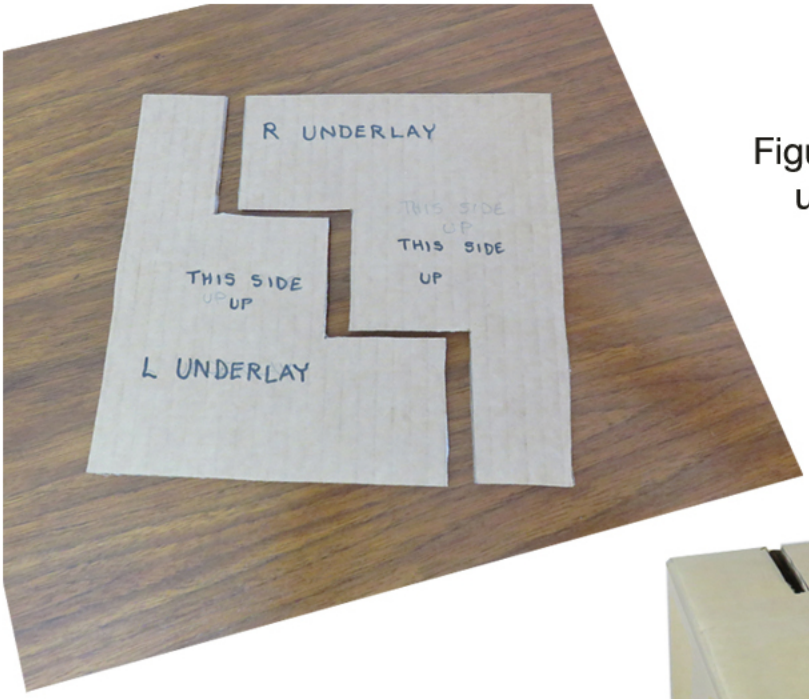


Figure 3. Continent underlay pieces

Figure 4. Box with top slots cut out.

(Figure 5 on next page)

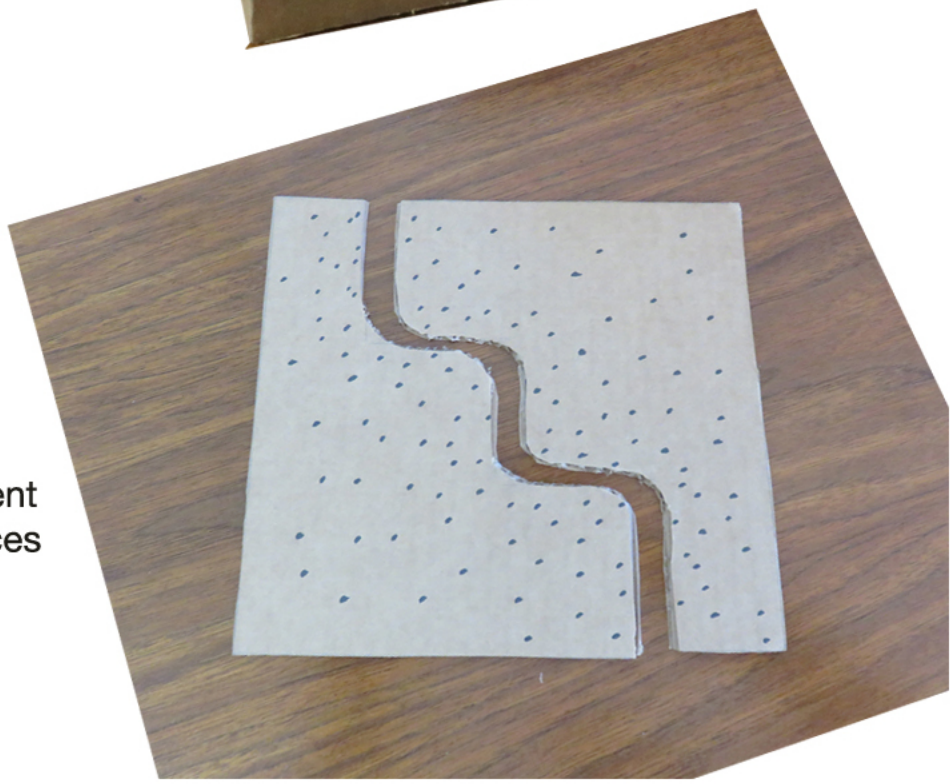
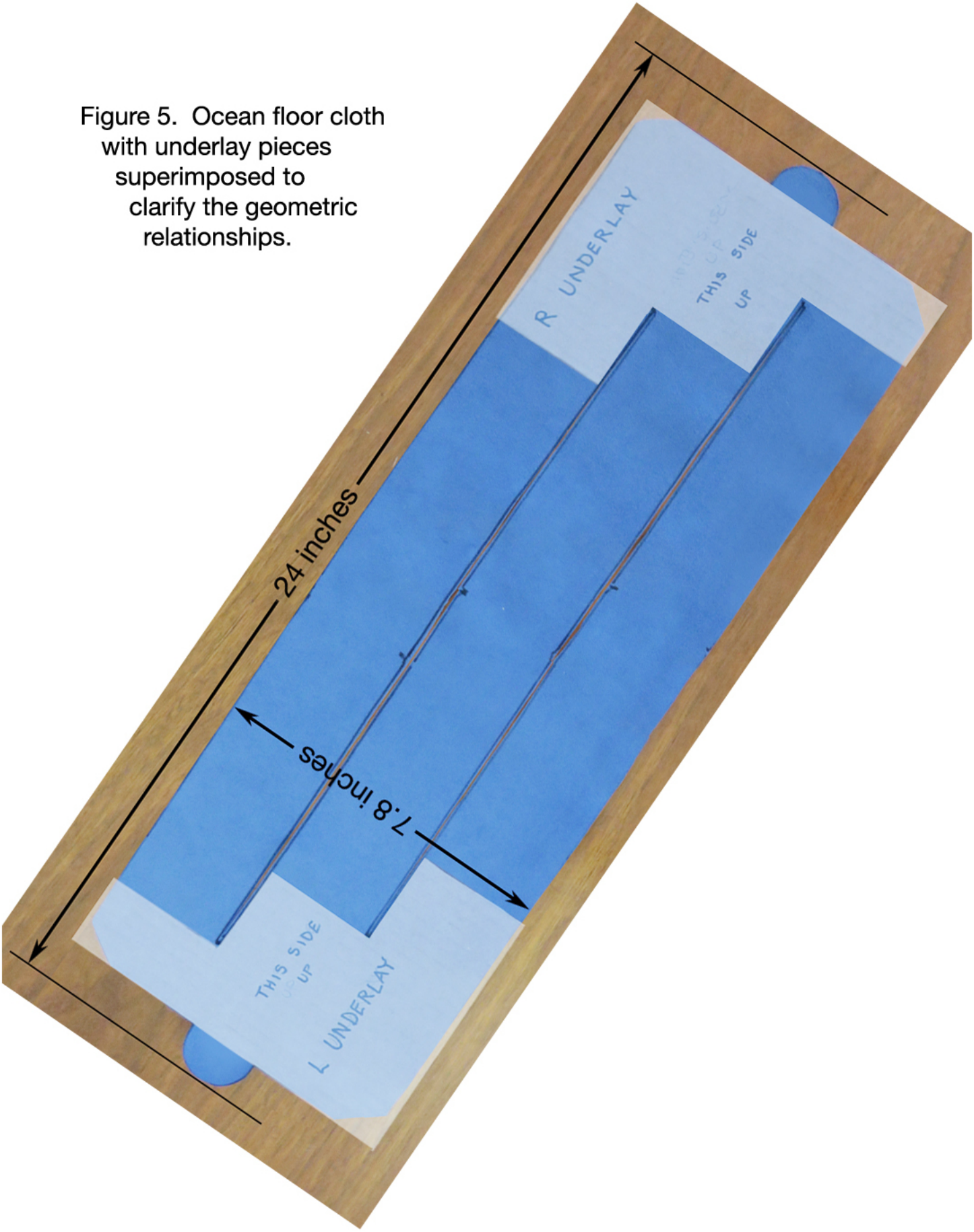
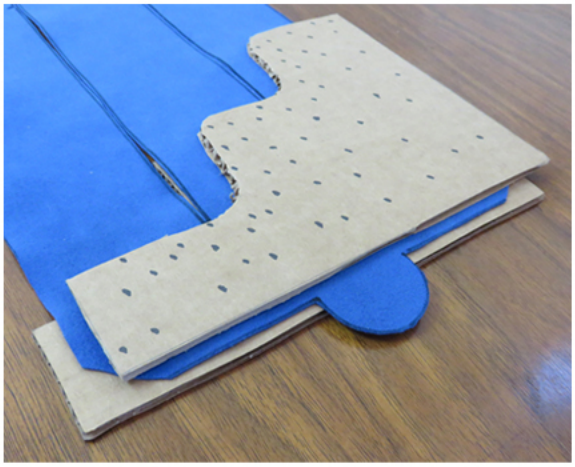


Figure 6. Continent overlay pieces

Figure 5. Ocean floor cloth with underlay pieces superimposed to clarify the geometric relationships.





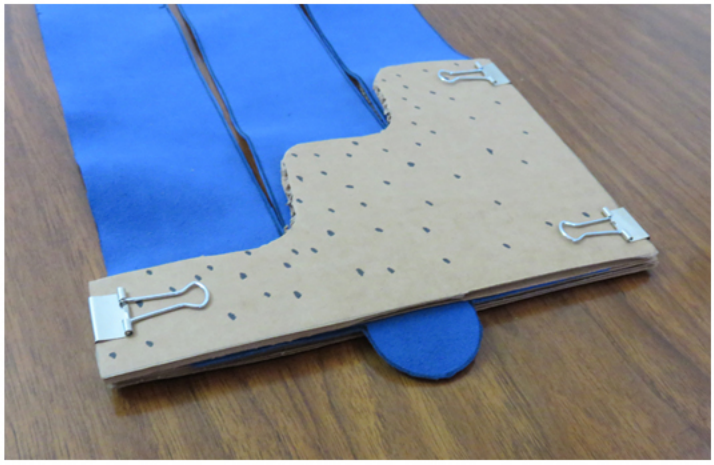


Figure 7. Make a continent sandwich at each end of the cloth strip: underlay, then cloth,then overlay. Carefully align and clip together.

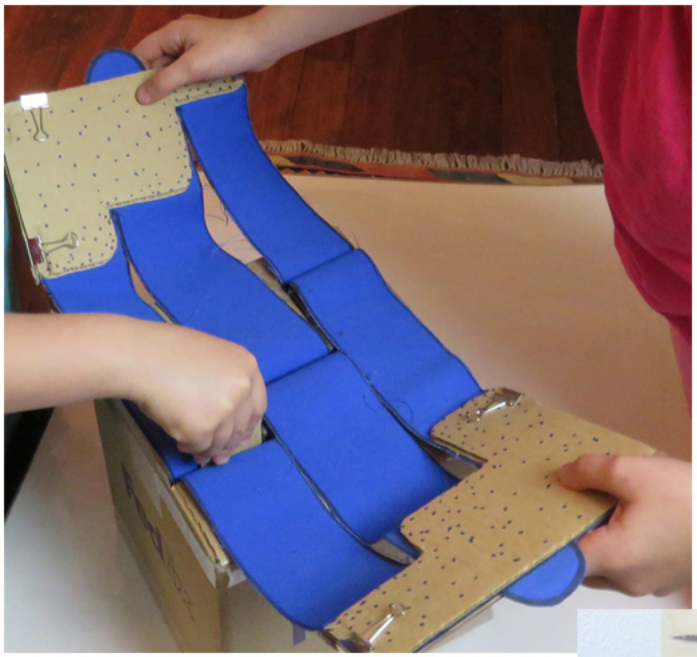


Figure 8. Insert the centers of the cloth strips into the box-top slots, then pull them through from below.

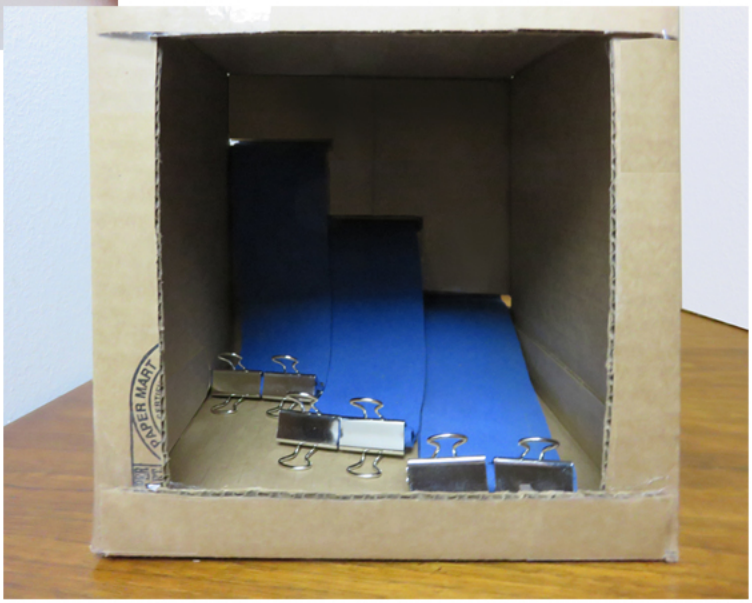


Figure 9. Attach clamps or other bulky weights to the center folds of the strips.

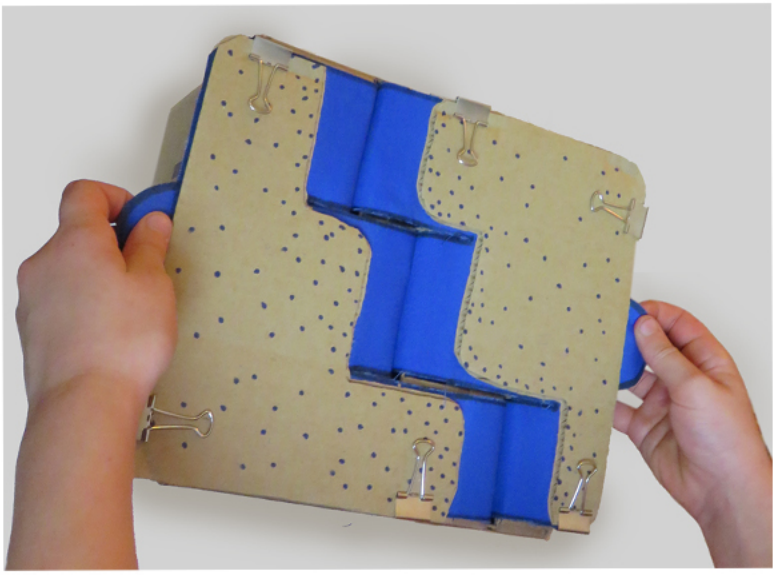
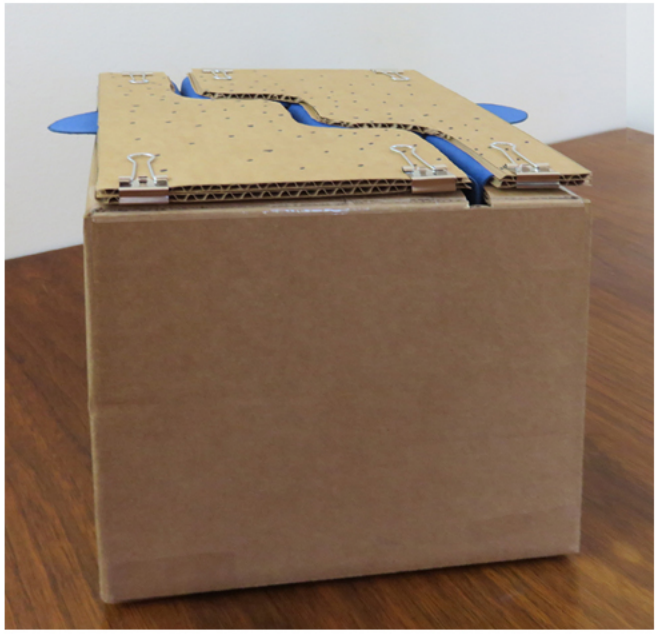


Figure 10. Work the model by pulling the continents apart.

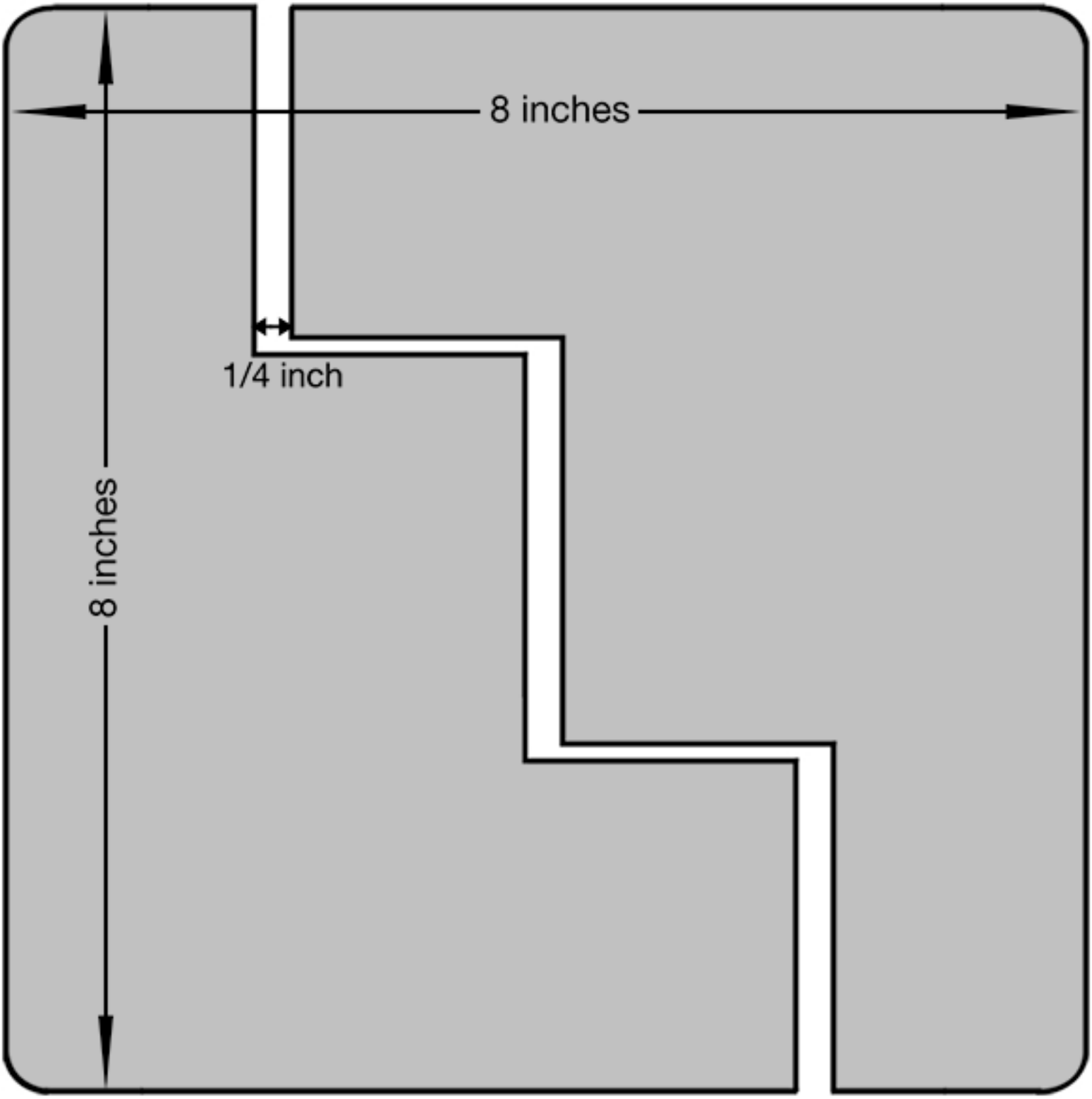


Completed box model of sea floor spreading

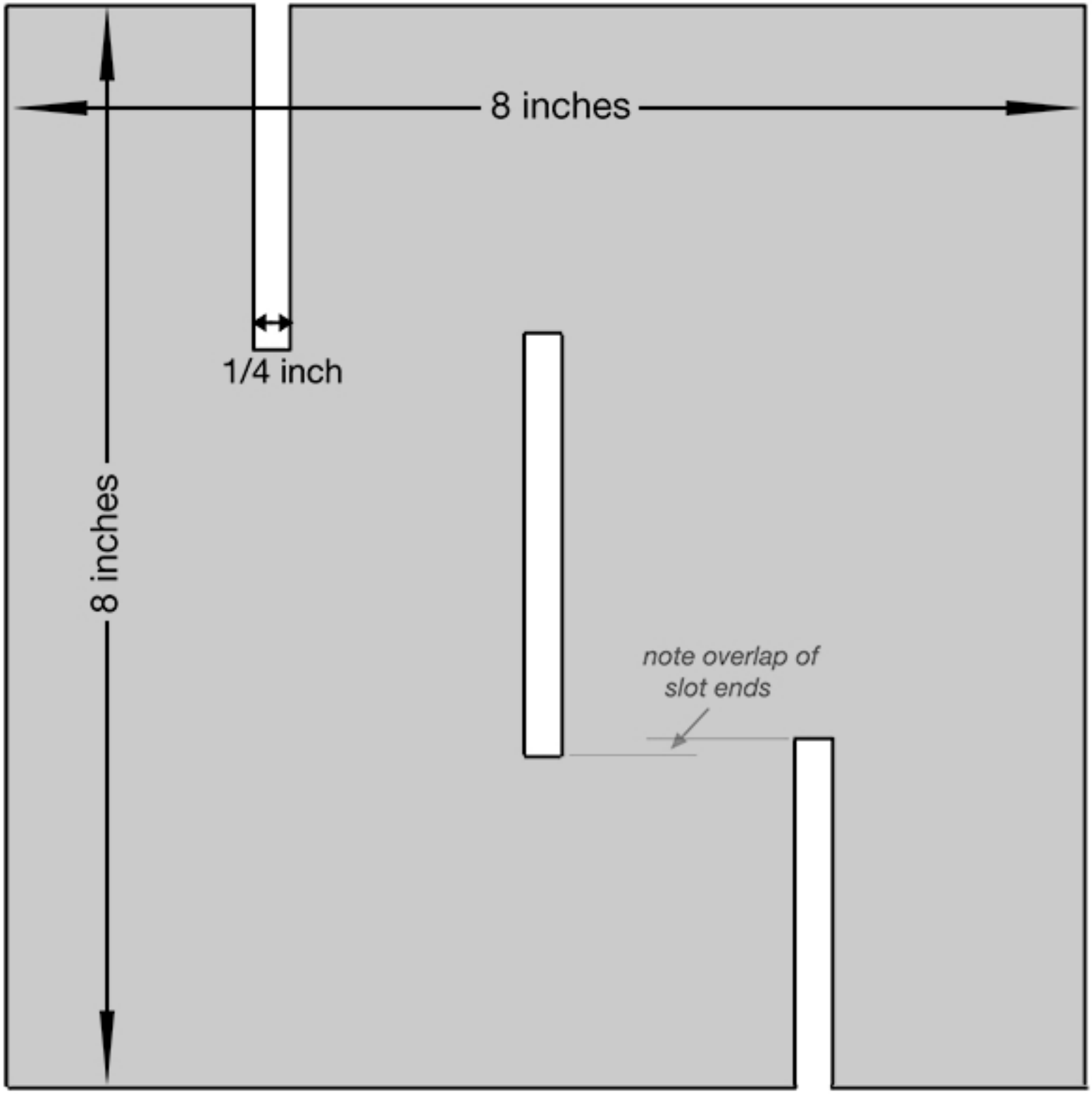
Figure 11. Larger version, with more spreading centers and with symmetrical markings (isochrons) on the cloth strips.

Figure 12. Wooden version of the model.

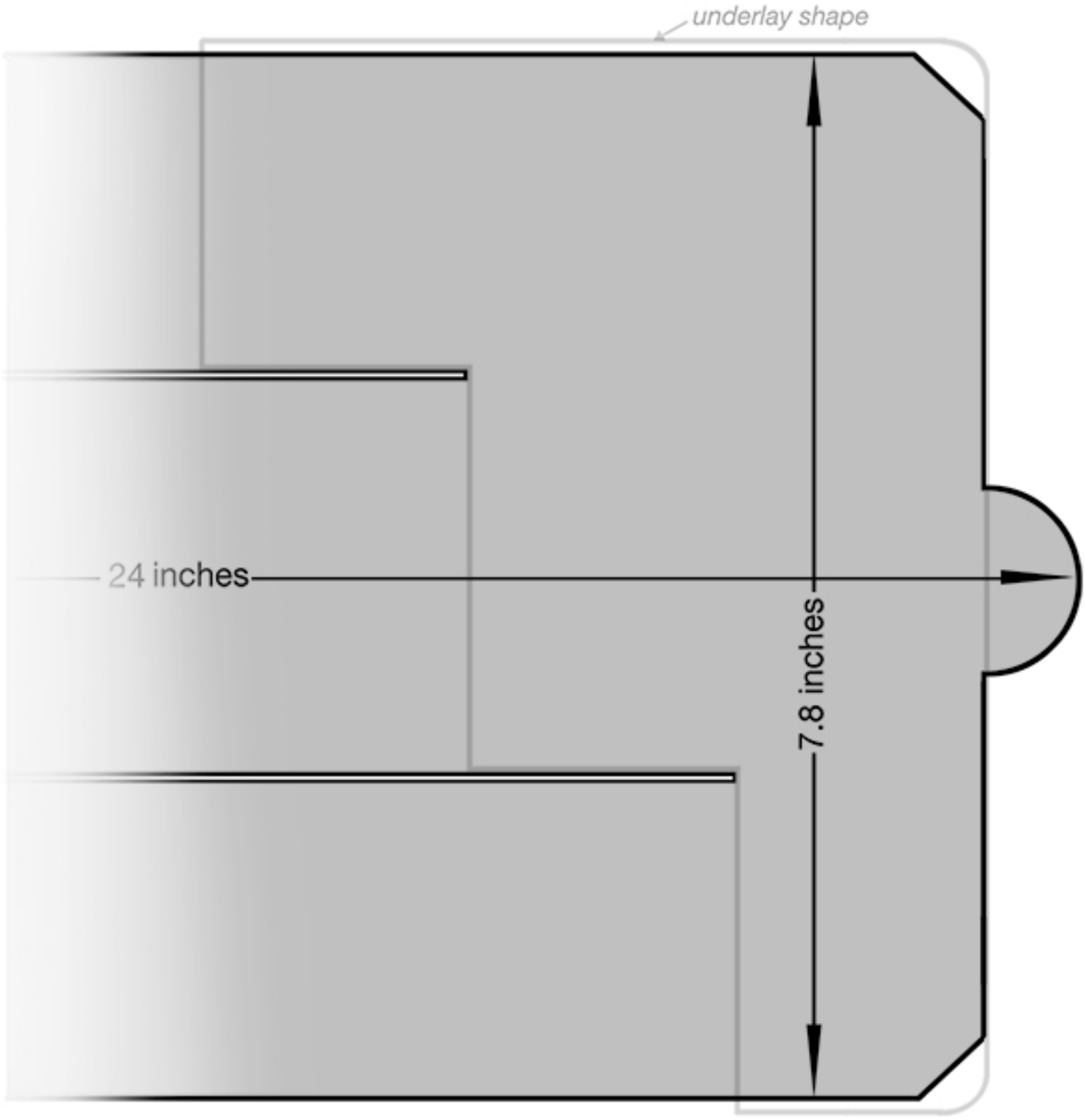
Pattern 1. Recommended pattern for Continental Underlay pieces with spreading centers and transform faults



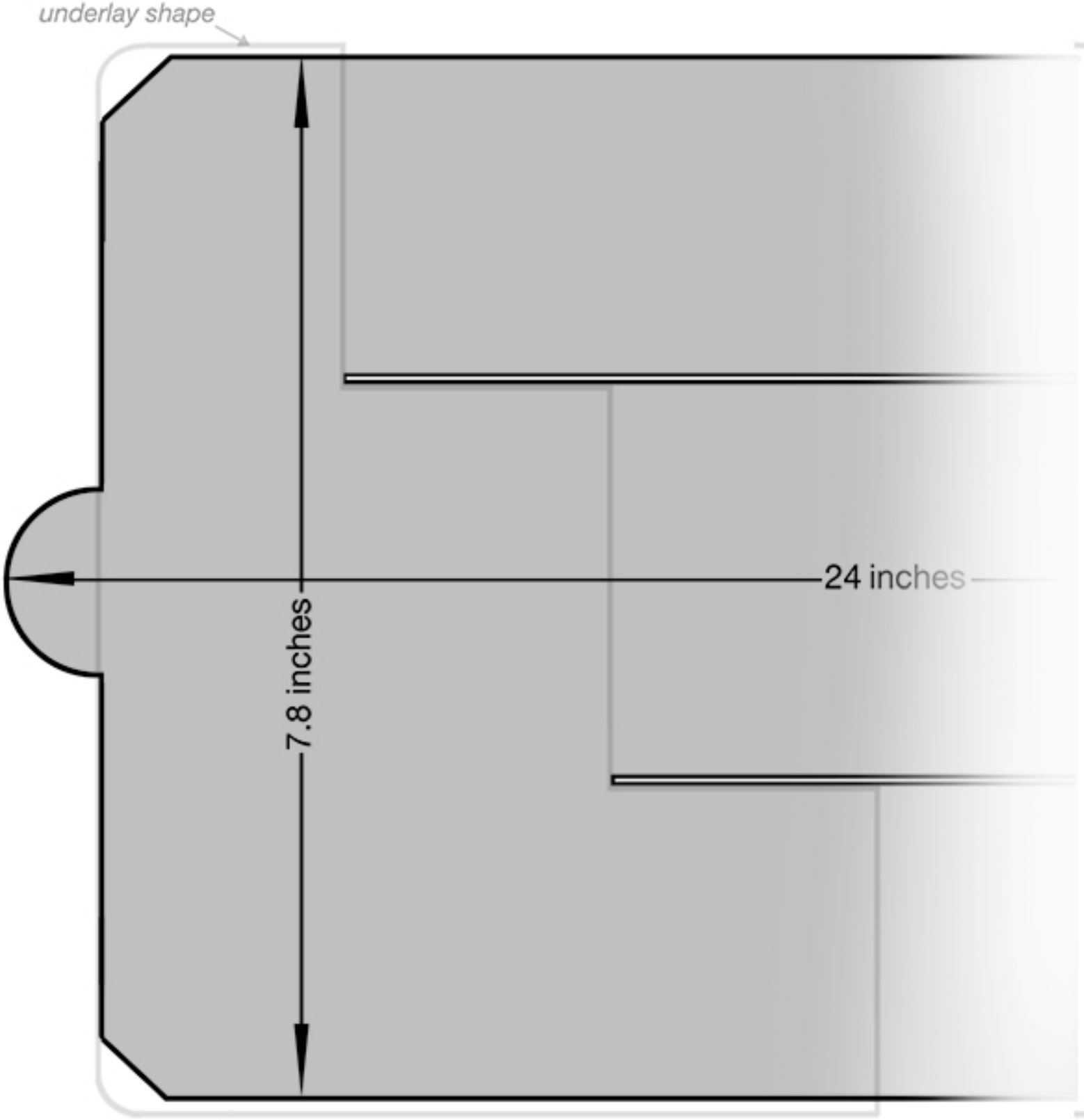
Pattern 2. Recommended pattern for Slots to be cut into the box top



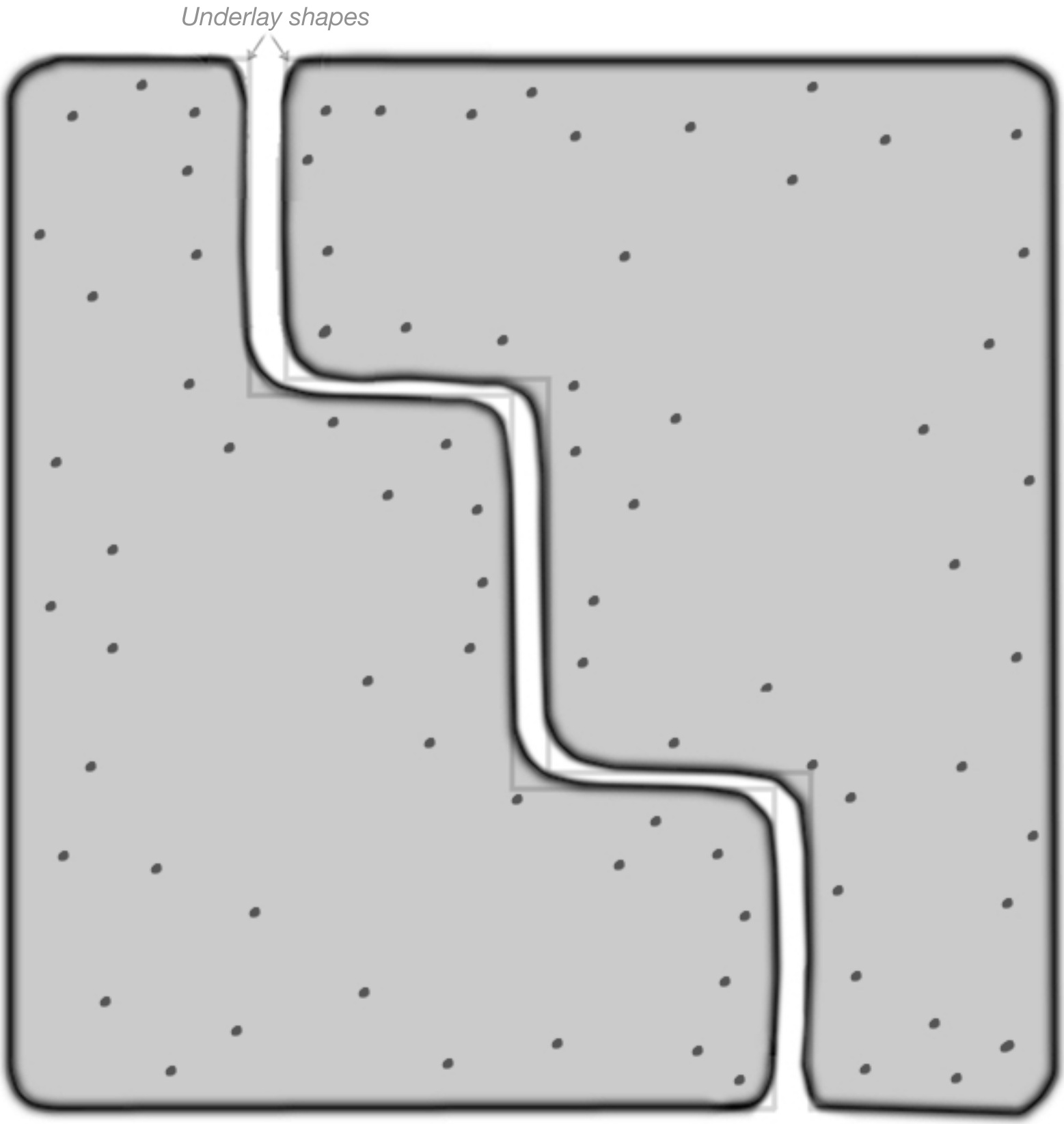
Pattern 3a. Recommended pattern for right hand end of the blue cloth Oceanic strip.

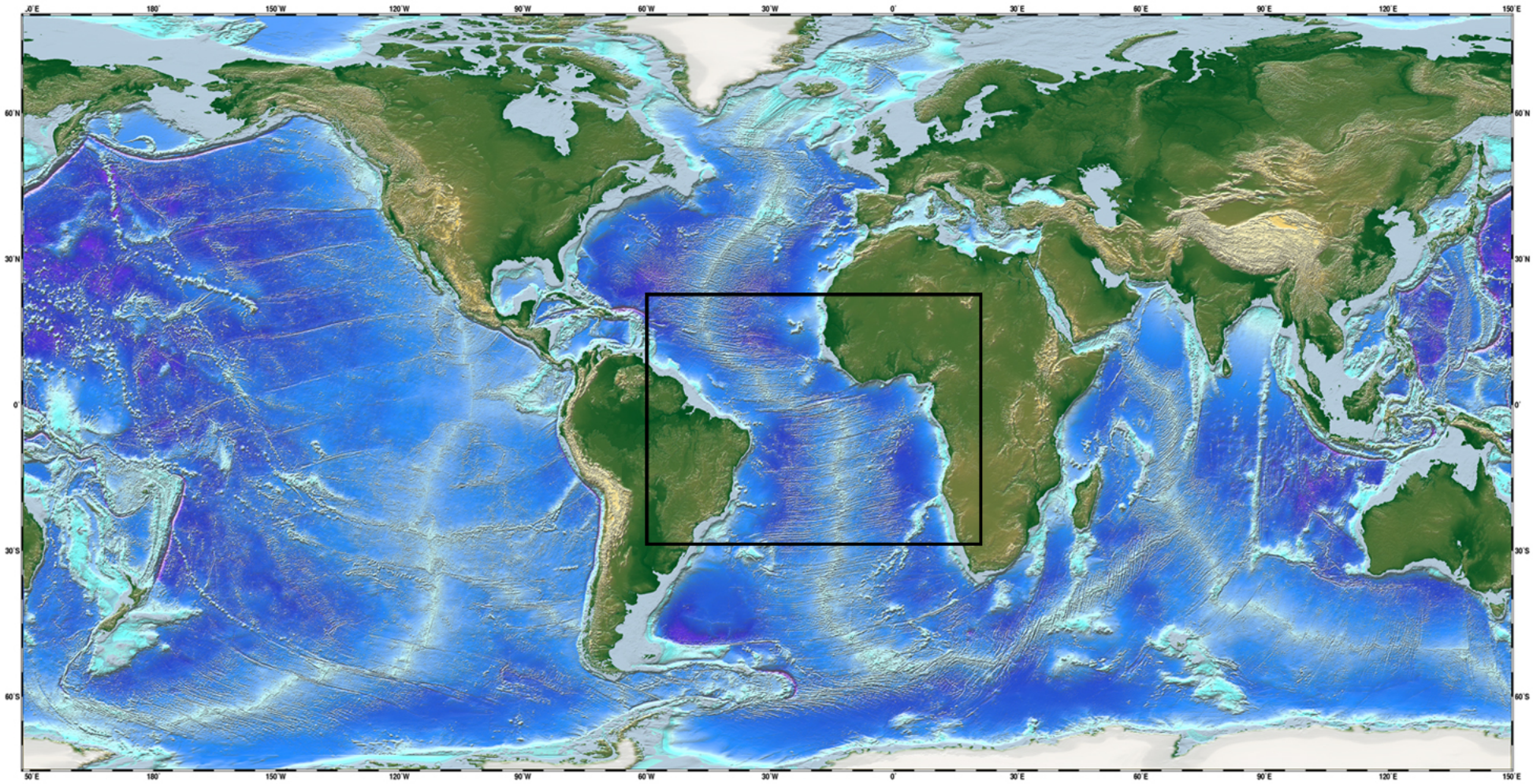


Pattern 3b. Recommended pattern for left hand end of the blue cloth Oceanic strip.



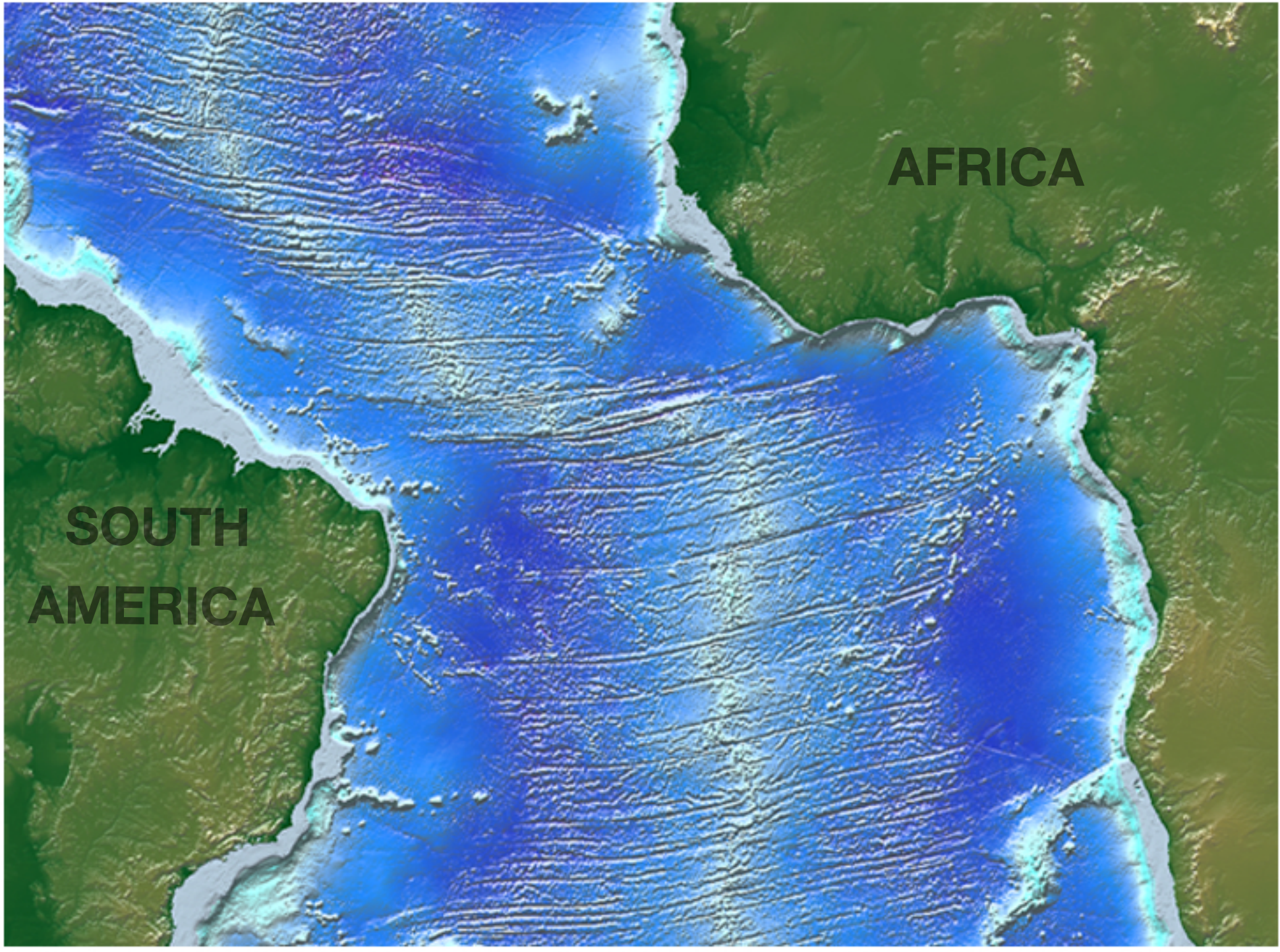
Pattern 4. Recommended pattern for Continental Overlay pieces.



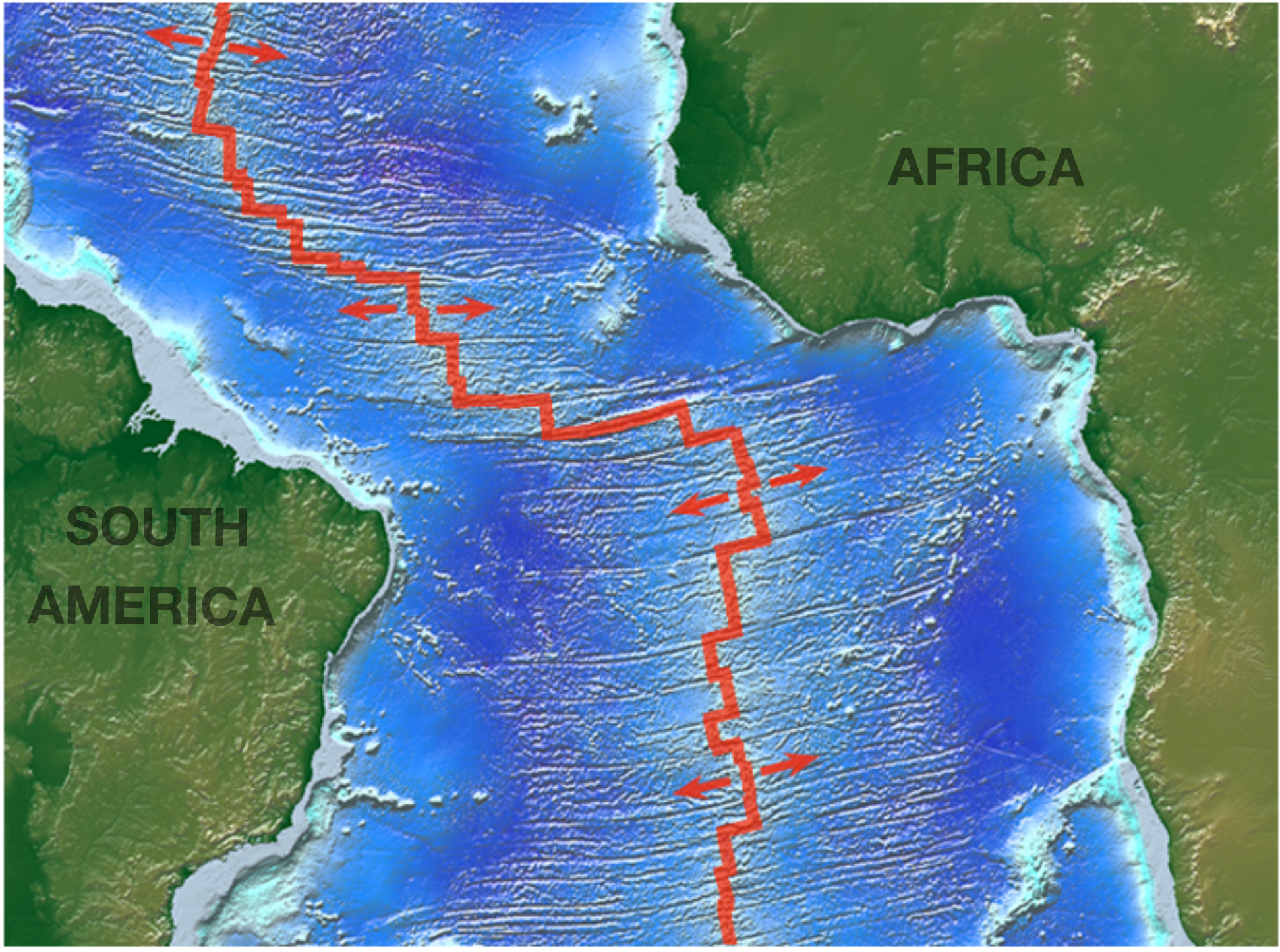


Map 1. World Physiography Map

A larger version can be downloaded from
http://emvc.geol.ucsb.edu/2_infopgs/IP1GTect/gWorldMap-Spin.html



Map 2a. Central and south Atlantic ocean floor



Map 2b. Atlantic ocean floor with spreading centers connected by transform faults