

# DIVERGENT BOUNDARIES

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## MAGNETIC LINEATIONS OF THE WORLD'S OCEAN BASINS

Look at the plate boundary system in the Indian Ocean. At present, the divergent boundary system in the Indian Ocean consists of three different divergent boundaries (separating the African, Indian, and Antarctic plates from each other) and a triple junction where the three spreading centers meet.

Now consider the magnetic anomaly pattern in the Indian Ocean. Your goal is to outline the spreading history of the Indian Ocean from anomaly 34-time to the present. To do such an analysis, you will want to keep the following principals of sea-floor spreading (and of the magnetic anomalies contained in the sea floor) in mind:

1. Anomalies are parallel to the ridges that make them.  
Look for panels of parallel anomalies. These are made by one ridge operating during the time range of the parallel anomalies.
2. Spreading is symmetric.  
You don't need a record of all anomalies everywhere in order to do an accurate reconstruction. You can estimate their position on either side of a ridge segment based on this principle.
3. Ridges spread at a constant rate along their length at any given time.  
This principle is true - but hard to apply with precision on a 2D map when the principle is based on a spherical earth. Spreading rate is constant in terms of degrees of arc about a pole of rotation, not in terms of linear km. The principle can be safely applied locally, over short distances, but will not work on the scale of the Indian Ocean. Expect distortions.
4. Reconstruction to a previous time period entails removing younger ocean crust and sliding plates back together until anomalies of the desired time period are abutting along the ridge position.  
This means cutting along anomalies and along transforms in a rectilinear pattern to remove younger crust. Slide plates back together by motion parallel to transform faults. On a spherical reconstruction, all plate edges - both transform and ridge segments - should close tightly with no gaps or overlaps. On a 2D reconstruction of this large scale you should expect distortions (gaps and overlaps).

**METHOD:**

On one copy of the map, color in panels of parallel anomalies made by a single divergent boundary system. (Get a few fat-tipped highlighter markers in different colors to do this.) How many different ridge systems operated in the Indian Ocean between anomaly 34-time and the present? For each system, what was the time period (in terms of anomaly numbers) over which it operated? How many million years does that represent for each? How many ridges and/or triple junctions operated in each system?

Next, make reconstructions of the Indian Ocean system at the beginning of each period in which one of these ridge systems operated. To do this, you will need to cut out the panel of younger ocean floor made since the time period of your reconstruction. Show the locations of all plate boundaries at the time of each reconstruction.

What have you learned about the dynamics of divergent boundaries from this exercise?