Resource from animation found at: <http://www.iris.edu/hq/inclass/search>

**Narration from the animation:**

**Sumatra: A tale of two earthquakes**

(This animation accompanied an IRIS Recent Earthquake Teachable Moment from the April 11, 2012 earthquake: <http://www.iris.edu/hq/retm/event/1599>

In 2004 a Magnitude 9.1 subduction earthquake triggered a tsunami that killed over 230 thousand people. Yet a nearby magnitude 8.7 earthquake in 2012, caused little damage and generated minimal ocean waves. Although the earthquakes appeared similar in magnitude and were close in proximity, they were caused by different tectonic processes related to the greater Indo Australian plate. Two surprising elements of the latter earthquake include, that it was both the largest *intra-plate* earthquake *and* the largest *strike-slip* earthquake ever recorded.

This north-northeast migrating plate is pushing into Eurasia where an initial ocean-continent subduction zone became a continental collision zone with the Asian continent slowing the northward movement of the plate. Southeast of the Himalayan collision zone, the plate is diving beneath the Sunda plate. Lets look at the 2004 earthquake in cartoon cross section . The locked plates are pushing east ward building strain between the plates.The magnitude 9.1 earthquake occurred at the contact *between* the plates as they released. The upward thrust generated the tsunami that swept the region.

The 2012 earthquake was not in the subduction zone but was 430 km west of the trench. So what was that about?On April 11, 2012 data captured by a global network of seismometers quickly revealed that this was a *powerful* strike-slip earthquake. Which was odd. Earthquakes of this magnitude have only occured in subduction zones.

To explain it we will simplify the setting.

Although the combined motion of the IndoAustralian plate is north-northeast, varying deformation of the plate is due to both a distant response to compressionon the north where it is crushing into the Himalayas, and some stretching due to slab pull where the oceanic plate is diving beneath the Sunda Plate.

*Geodetic data and plate modeling have revealed differential plate motions across the plate.**Australia is moving northward at 5.6 cm per year, and India, pushing against the Himalayas has slowed to 3.7 cm per year.**This differential movement is resulting in the compression of the plate near its center where it is slowly being squeezed*.". Although we are generalizing these movements, the curvature of the Earth makes simple plate motion complicated, and beyond the scope of this animation. The strain across this broad zone may eventually lead to dividing this plate into two sub plates, **t**he Indian and Australian plates, along this boundary

Lets look more closely at the actual earthquake.Earthquakes in this intraplate zone are common. The magnitude 8.7 event, was not a simple release on a long fault.Let’s watch what happened. The initial mainshock rupture raced along at more than a kilometer a second expanding bilaterally on a right=lateral strike-slip fault, That triggered a perpendicular rupture on a left-lateral strike-slip fault, first to the south, then a second rupture along the same line to the north. ~~Then~~ 150 km south of the initial rupture, a similar right lateral fault was unleased. That triggering yet another westnorthwest-trending fault to rupture. Together this event unleashed the equivalent of four magnitude 8 earthquakes. Adding them together yielded a total event magnitude of 8.7 Making it also one of the most *complex* earthquake ever recorded.

What caused this complex configuration at the heart of the Indo Australian plate? Remember that we suggested that, according to recent theories this area is being compressed as the northern half is being halted by the Eurasian plate and the southern half is still pushing northward. This area is in the process of becoming a future subduction zone where one plate, here selected as the Australian oceanic part of the plate, will relent in the pushing contest and dive beneath the Indian plate, eventually creating an island arc, similar to Sumatra and Japan.

This process which began millions of years ago, will take millions more to form the new boundary, releasing countless earthquakes in the process.