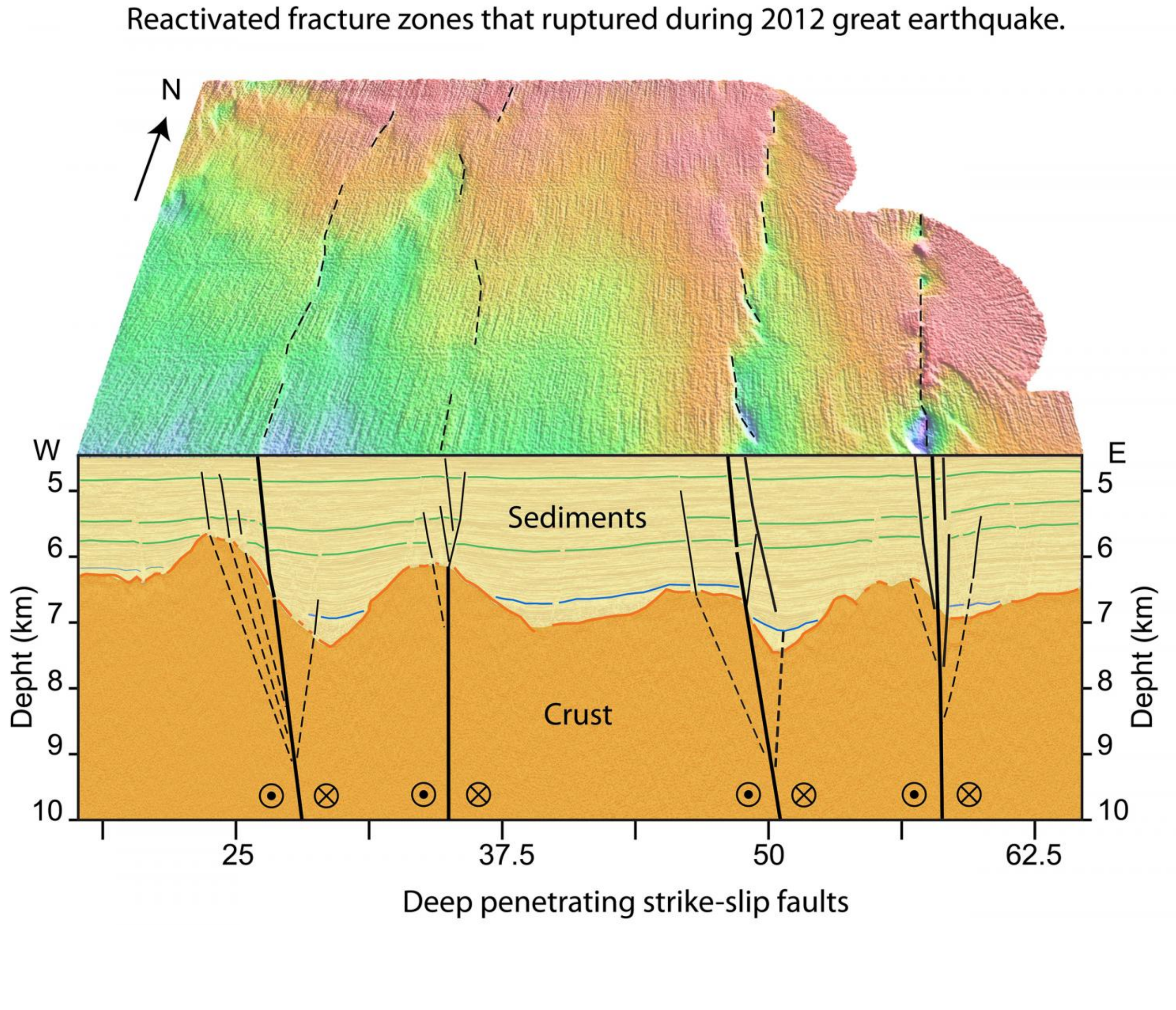
Data from 2012 earthquake suggests new plate boundary may be forming in Indian Ocean

January 5 2017, by Bob Yirka



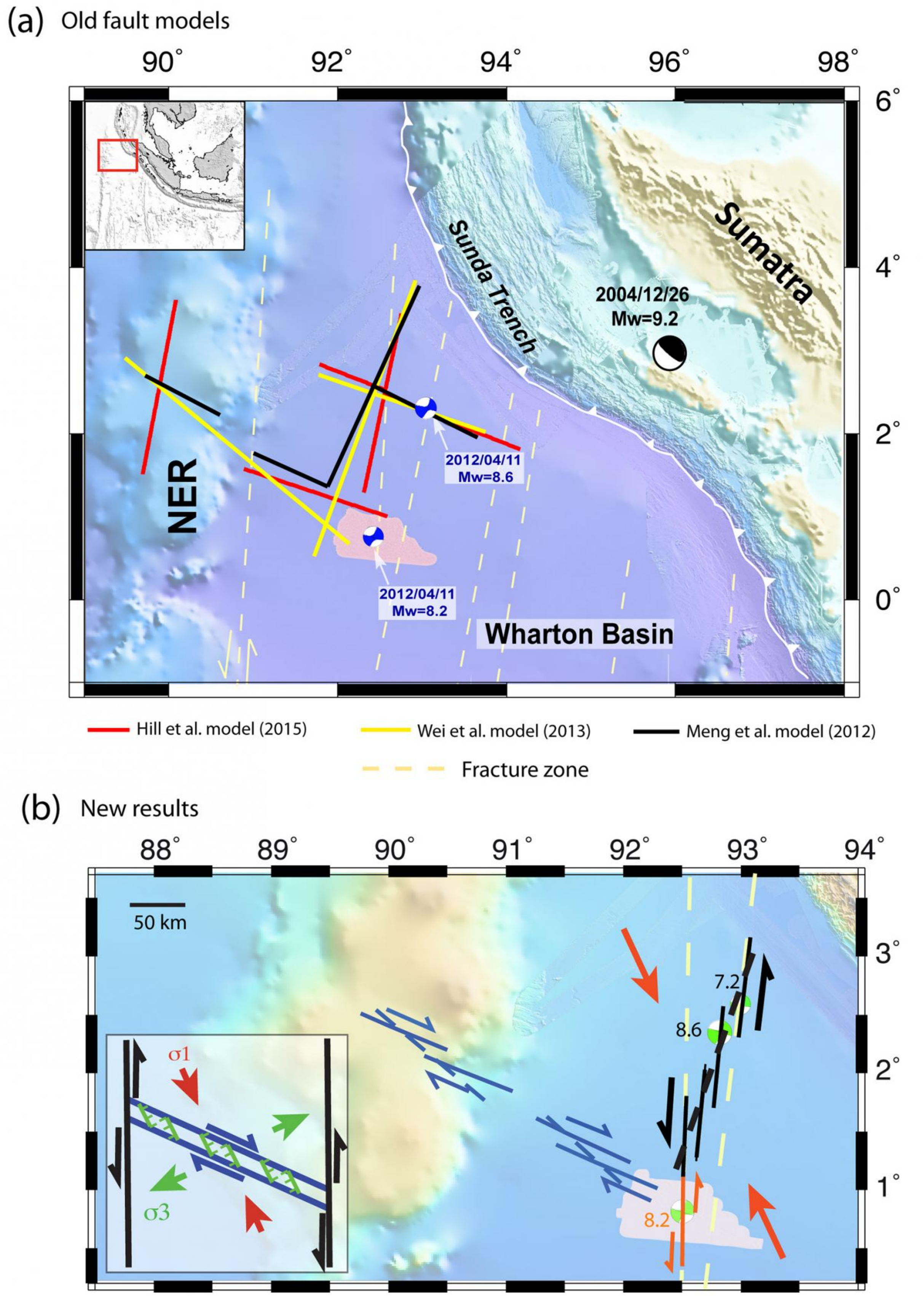
Reactivated fracture zones ruptured during Wharton Basin earthquakes in 2012. Credit: Yanfang Qin, Satish C. Singh

(Phys.org)—A team of researchers with members from several institutions in Singapore, France and Indonesia has found evidence of a possible new plate boundary forming on the floor of the Indian Ocean in the Wharton Basin. In their paper published in the journal *Science Advances*, the team reports that they studied seismic and ocean floor topology to learn more about tectonic plate deformations in the region and what they found by doing so.

Most people are aware of earthquakes that occur when tectonic plates push against one another, but there is another kind called a slip-strike quake. It occurs when two plates slide horizontally against one another. Such quakes can be caused by deformations that occur in plates distant from fault lines as pressure builds up across a plate. In some cases, such deformations can cause what are known as interplate earthquakes, and they can also sometimes cause a plate to break, resulting in a new plate boundary, which in turn can lead to even more quakes. It is this scenario that the researchers believe happened in 2012 when two earthquakes struck the Andaman-Sumatran region (northwest part) of the Indian Ocean—the largest interplate earthquakes ever recorded.

To better understand what occurred during the 2012 quakes, the researchers studied seismic data that was recorded before, during and after the quakes and also conducted sea floor depth analysis by venturing into the ocean aboard the research vessel Falkor—that allowed them to create high-resolution imagery of the sea floor, which in turn allowed them to note the deformations that had occurred.

Their analysis revealed a new fault system had developed in the area off the coast of Sumatra that was involved in the 2012 quakes. They noted the system was oriented in a way that set it off against those that were around it—a clear indication of deformation. The data also showed that strike-slips in the same area (and distant from known plate boundaries) suggested that the plate had broken along a 1,000k fracture zone, resulting in a new plate boundary—one that is likely to be the site of future fault-slip quakes.


(a) Old fault models
90° 92° 94° 96° 98°
6° 4° 2° 0°
Sumatra
Sunda Trench
2004/12/26
Mw=9.2
2012/04/11
Mw=8.6
2012/04/11
Mw=8.2
NER
Wharton Basin
Hill et al. model (2015)
Wei et al. model (2013)
Meng et al. model (2012)
Fracture zone
(b) New results
88° 89° 90° 91° 92° 93° 94°
3° 2° 1°
50 km
7.2
8.6
8.2
σ1
σ3

Past fault models (a) and Sing and colleagues' new results (b). Credit:Yanfang Qin, Satish C. Singh

More information: Satish C. Singh et al. The discovery of a conjugate system of faults in the Wharton Basin intraplate deformation zone, *Science Advances* (2017). DOI: 10.1126/sciadv.1601689

Abstract
The deformation at well-defined, narrow plate boundaries depends on the relative plate motion, but how the deformation takes place within a distributed plate boundary zone remains a conundrum. This was confirmed by the seismological analyses of the 2012 great Wharton Basin earthquakes [moment magnitude (Mw) 8.6], which suggested the rupture of several faults at high angles to one another. Using high-resolution bathymetry and seismic reflection data, we report the discovery of new N294°E-striking shear zones, oblique to the plate fabric. These shear zones are expressed by sets of normal faults striking at N335°E, defining the direction of the principal compressional stress in the region. Also, we have imaged left-lateral strike-slip faults along reactivated N7°E-oriented oceanic fracture zones. The shear zones and the reactivated fracture zones form a conjugate system of faults, which accommodate present-day intraplate deformation in the Wharton Basin.

plate-boundary-indian-ocean.html