ID de Contribution: **118**

Type: **Talk**

# Slip rates and deep lithospheric deformation along a fault ruptured during the 2012 Mw 8.6 Wharton Basin earthquake

*jeudi 22 mai 2025 14:45 (15 minutes)*

The traditional understanding of plate tectonics posits rigid plates primarily undergoing deformation at narrow plate boundaries. However, the equatorial Indian Ocean presents a unique scenario with a diffused deformation zone spanning ~3000 km within the Indo-Australian plate. Past investigations have identified N-S compression in the Central Indian Ocean basin and strike-slip motion along N-S trending reactivated fracture zones of a fossil spreading center in the Wharton Basin located at the eastern margin of the Indian Ocean. The massive Mw 8.6 earthquake on April 11, 2012, challenged the existing notions about the intraplate deformation in the Wharton Basin. Seismological and geodetic observations showed that in addition to the deep centroid depth and high-stress drop, the earthquake ruptured along a complex set of faults at high angles to the presumed north-south direction of slip motion along fracture zones, indicating the existence of additional fault systems. However, since the earthquake ruptured in the deep ocean, far away from land stations, the constraints on the fault characteristics (e.g., length, dip, strike, etc.) and rupture propagation remained poor. Recent studies in the Wharton basin mapped different classes of active faults and shear zones, compatible with the regional stress field and closely aligned with the fault plane solutions from the seismological studies. In this study, we analyzed high-resolution bathymetry, active source seismic, and sub-bottom profiler data to investigate the surface and subsurface expression of one of the faults that ruptured with a magnitude (Mw) of 8.3 during the earthquake. Bathymetry data revealed a complex fault geometry with en echelon segmentation and diffused deformation in some regions up to a total fault length of ~200 km. We found substantial evidence of both long-term deformation (since ~4-5 Ma) as well as recent deformation (since ~50 Kyr), preserved in transtensional type pull-apart basins with faults penetrating down to the basement and horizontal offsets in several bathymetric markers (such as seamount and submarine channels) due to strike-slip motion along this fault. We found seismic evidence of deep faults that penetrate down to the upper mantle compatible with the deep centroid depth (~30 km) of the earthquake. We suggest that the rupture along this fault played a significant role in transferring stress toward the epicentre of the Mw 8.2 aftershock that occurred 2 hours later after the Mw 8.6 event. We estimated the long-term horizontal and vertical slip rate along the fault to be varying between 0.1-0.7 mm/yr. Such slow slip rates could indicate a long recurrence time for large earthquakes along this fault. The results of this study will be crucial to understand the seismic hazard associated with large oceanic intraplate earth-quakes as well as the kinematics of the diffused deformation in the Wharton basin.

## Speaker information

PhD 2nd year

**Author:** ROHILLA, Saksham (IPGP)

**Co-auteurs:** CARTON, Hélène (IPGP); SINGH, Satish (IPGP)

**Orateur:** ROHILLA, Saksham (IPGP)

**Classification de Session:** Shaping the Earth: Faults, Quakes, and Erosion

**Classification de thématique:** Earth, Environment and Space Sciences: Geophysics