Subject offered for a contract starting October 2017

SUBJECT TITTLE: ***Great earthquakes, intraplate deformation and nascent plate boundary in the Wharton Basin***

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Financing: IPGP and/or Earth Observatory of Singapore

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The 2012 great Wharton Basin earthquakes (Mw=8.6 and Mw=8.2) were the largest intra-plate strike-slip earthquakes ever recorded on Earth. These earthquakes occurred in the Wharton Basin, on the ocean side of the Sumatra subduction, which hosted the 2004 Mw=9.2 great Andaman-Sumatra earthquake. The analyses of seismological and geodetic data of the Mw=8.6 earthquake require the rupture of several lithospheric faults oblique to each other for which there was no known seafloor evidence from limited existing bathymetric data coverage. A deep seismic reflection study in the region has shown faults going down to 45 km depth (*Carton et al., 2014; Qin and Singh, 2015*). Recent high-resolution bathymetry and seismic reflection data centred on the rupture zone of the Mw=8.2 aftershock have shown the presence of a conjugate system of active faults (*Singh et al., 2017*).

In order to map fault traces at the seafloor and possibly image the surface rupture of these earthquakes, and to study their links with the large-scale intra-plate deformation in the Indian Ocean, we acquired over 900, 000 square kilometre of bathymetry and reflectivity data along with 3.5 kHz sub-bottom profiles in July 2016. In 2017, we plan to acquire a grid of 4500 km of seismic reflection profiles using a 6 km long streamer to image the oceanic crust and uppermost mantle. The new bathymetry data show the presence of long (> 450 km) active strike-slip faults (possibly marking a nascent plate boundary between India and Australia), extensive shear zones, and thrust faulting. The seismic reflection data would allow to image the depth extent of these faults, which combined with the 2016 IODP offshore Sumatra drilling results would allow to construct an evolutionary model of the intra-plate deformation in the Wharton Basin.

Students with a background in geophysics and interested in earthquake and deformation processes are encouraged to apply. The Ph.D. student will receive training in the analysis and interpretation of bathymetry, reflectivity, 3.5 KHz sub-bottom profiler and seismic reflection data. He/she will be working in the Marine Geosciences team at IPGP and may also spend some time working with the active tectonics group at the Earth Observatory of Singapore. The student is expected to participate in the seagoing survey scheduled for September-October 2017 onboard R/V *Marion Dufresne*. Start date of the Ph.D. will be September 1, 2017.

References:

Carton, H., Singh, S.C, et al. (2014). Deep seismic reflection images of the Wharton Basin crust and upper mantle offshore northern Sumatra: Relation with active and past deformation, *J. Geophys. Res.*, 119, 32-51, doi: 10.1002/2013JB010291.

Qin, Y., and Singh, S. C. (2015). Seismic evidence of a two-layer lithospheric deformation in the Indian Ocean, *Nature Communications*, 6:8298 doi:10.1038/ncomms9298.

Singh, S.C. et al. (2017). The discovery of a conjugate system of faults in the Wharton Basin intra-plate deformation zone, *Science Advances* 3, e1601689, 1-8.