Geophysical Research Abstracts
Vol. 16, EGU2014-1539, 2014
EGU General Assembly 2014

Seismic reflection images of lithospheric deformation in the Wharton Basin

Yanfang QIN (1), Satish C. SINGH (1), and James MARTIN (2)

(1) Institut de Physique du Globe de Paris, Paris, France (qin@ipgp.fr), (2) Reece Innovation, Newcastle Upon Tyne, United Kingdom

The Central Indian Ocean basin is deforming actively: west of Ninety-east Ridge (NER), the deformation is taken as N-S compression whereas east of NER in the Wharton Basin, the deformation is taken along re-activated N-S fracture zones as left-lateral strike-slip motion. This was recently confirmed by a series of strike-slip earthquakes in 2012, including one of the largest strike-slip earthquake on the earth of Mw=8.6 earthquake on April 11, 2012. All these earthquakes seem to have ruptured down to 40-50 km but we do not have any direct evidence of these ruptures. Here, we present deep seismic image from the Wharton Basin that provide image down to 45 km depth. In order to obtain seismic image at great depths, we use a 12 km long streamer and a low frequency enhancement technique. The low frequency image reveals many bright dipping reflectors in the top 10 km of the upper mantle, and the number of reflectors decreases with depth, with one continuous reflector is imaged down to 45 km depth. Given that these reflectors lie in the deformation zone with great earthquakes, we suggest that these reflectors correspond to deep penetrating faults. The apparent dip of the deepest reflector decreases with depth from $\sim$40 to 12°, which when projected along the N-S fracture zones becomes $\sim$50 to 20°. We find that amplitude of this deep penetrating reflector decreases linearly with depth down to 25 km depth (10 km below the Moho) and then remains constant down to 45 km depth. The number of faults imaged along a 230 km long profile and the number of earthquakes as a function of depth show similar patterns. As well as the statistical analysis of number of earthquakes as a function of depth/temperature for oceanic lithosphere of 50-60 Ma. These observations indicate that the 25 km depth, which corresponds to 400° C for a lithosphere of 55-56 Ma of age, might be the lower boundary of the intense deformation and surpentinization. This depth also has a good agreement with the separation of double Benioff zones. Below this depth, the deformation might be associated a great earthquakes of the type Mw=8.6 and the reflectors might result from shear zones.