Geophysical Research Abstracts
Vol. 16, EGU2014-3976, 2014
EGU General Assembly 2014


# Structure and properties of the lithosphere subducting beneath Indonesia, consequences on subduction

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We make inferences on the structure, age and physical properties of the subducting northern Wharton Basin lithosphere by (1) modeling the structure and age of the lithosphere subducted under the Sumatra trench through two- and three-plate reconstructions involving Australia, Antarctica, and India, and (2) superimposing the resulting fracture zones and magnetic isochrons to the geometry of the subducting plate as imaged by seismic tomography. This model provides an effective means to study the effect of varying physical properties of the subducting lithosphere on the subduction along the Sumatra trench.

The age of the oceanic lithosphere determines its thickness and buoyancy, then its ability to comply with or resist subduction. The "subductability" of the lithosphere is the extra weight applied on the asthenosphere by the part of the bulk lithospheric density exceeding the asthenospheric density. A negative subductability means that the bulk lithospheric density is lower than the asthenospheric density, i.e. the plate will resist subduction, which is the case for lithosphere younger than ∼23 Ma. The area off Sumatra corresponds to oceanic lithosphere formed between 80 and 38 Ma, with a lower subductability than other areas along the Sunda Trench.

The spreading rate at which the oceanic lithosphere was formed has implications of the structure and composition of the oceanic crust, and therefore on its rheology. In a subduction zone, the contact between the subducting and overriding plates is considered to be the top of the oceanic crust and the overlying sediments. The roughness of this interface and the rheology of its constitutive material are essential parameters constraining the slip of the downgoing plate in the seismogenic zone, and therefore the characteristics of the resulting earthquakes. Whereas the rough topography of a slow crust may offer more asperities than the smooth topography of a fast crust, the weak rheology of serpentines in a slow crust would favor a regular slip, unlike the brittle magmatic rocks of the fast crust and the underlying dry olivine mantle.

The presence of peculiar features such as fracture zones, seamounts, or oceanic plateaus also affects the seismic segmentation of the subduction zone at different scales. Many seamounts have been mapped in the Wharton Basin between 10°S and 15°S, and similar seamounts belonging to the same province may have existed further north and subducted in the Sunda Trench from southern Sumatra to Java and eastward. Conversely, the Roo Rise, a larger plateau located south of Eastern Java, may resist the subduction, as suggested by the geometry of the Sunda Trench in this area, diverting from the regular arc by a maximum of 60 km.