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Subduction along the Sunda-Banda Arc transition: Marine multichannel seismic profiling

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After the Indian Ocean Mw 9.3 earthquake and tsunami on December 26, 2004, intensive research activities focussed on the Sunda Arc subduction system offshore Sumatra. For this area a broad database is now available interpreted in terms of plate segmentation and outer arc high evolution. In contrast, the highly active easternmost part of this subduction system, as indicated by the south of Java Mw 7.7 earthquake and tsunami on July 17, 2006, has remained almost unexplored until recently.

During RV SONNE cruise SO190 from October until December 2006 almost 5000 km of marine geophysical profiles have been acquired at the eastern Sunda Arc and the transition to the Banda Arc. The SINDBAD project (Seismic and Geoacoustic Investigations along the Sunda-Banda Arc Transition) comprises 30-fold multichannel reflection seismics with a 3-km streamer, wide-angle OBH/OBS refraction seismics for deep velocity control (see poster of Shulgin et al. in this session), swath bathymetry, sediment echosounder, gravimetric and geomagnetic measurements.

We present data and interpretations of several 250-380 km long, prestack depth-migrated seismic sections, perpendicular to the deformation front, based on velocity models from focussing analysis and inversion of OBH/OBS refraction data. We focus on the variability of the lower plate and the tectonic response of the overriding plate in terms of outer arc high formation and evolution, forearc basin development, accretion and erosion processes at the base of the overriding plate. The subducting

Indo-Australian Plate is characterized by three segments: i) the Roo Rise with rough topography offshore eastern Java ii) the Argo Abyssal Plain with smooth oceanic crust offshore Bali, Lombok, and Sumbawa, and iii) the Scott Plateau with continental crust colliding with the Banda island arc.

The forearc responds to differences in the incoming oceanic plate with the absence of a pronounced forearc basin offshore eastern Java and with development of the 4000m deep forearc Lombok Basin offshore Bali, Lombok, and Sumbawa. The eastern termination of the Lombok Basin is formed by Sumba Island, which shows evidence for recent uplift, probably associated with the collision of the island arc with the continental Scott Plateau. The Sumba area represents the transition from subduction to collision.

Our seismic profiles image the bending of the oceanic crust seaward of the trench and associated normal faulting. Landward of the trench, they image the subducting slab beneath the outer arc high, where the former bending-related normal faults appear to be reactivated as reverse faults introducing vertical displacements in the subducting slab. The accretionary prism and the outer arc high are characterized by an ocean-verging system of imbricate thrust sheets with major thrust faults connecting seafloor and detachment. Compression results in shortening and steepening of the imbricated thrust sheets building up the outer arc high. Tilted piggy-back basins and downlaps of tilted sediments in the southern Lombok forearc basin indicate ongoing uplift of the entire outer arc high, abrupt displacements, and recent tectonic activity.

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