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Subduction along the Sunda-Banda Arc Transition: Marine Wide-Angle Seismic Modelling

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The Sunda-Banda arc transition is the region of active convergence and collision of the Indo-Australian Plate in the South and the Eurasian Plate in the North. The style of subduction changes from an oceanic-island arc type along the eastern Sunda margin to a continental-island arc collision along the Banda margin. Moreover, the character of the incoming oceanic plate varies from the rough topography of the Roo Rise subducting off eastern Java, to the smooth oceanic seafloor of the Argo Abyssal Plain subducting off Bali, Lombok, and Sumbawa. Forearc structures along this margin include well-developed forearc basins and an accretionary prism/outer forearc high of variable size and shape. The tectonic evolution of forearc structures is obviously closely linked to the variability of the lower plate. In order to quantify the variability of the lower plate (sediment supply, crustal thickness and velocity structure, upper mantle structure, geometry of subduction/subcretion processes) and the resulting tectonic consequences on the upper plate (development of outer forearc high and forearc basin, accretionary and erosive processes), a refraction seismic survey was carried out on RV Sonne cruise SO190-2. A total of 245 ocean bottom hydrophones and seismometers were deployed along 1020 nm of wide-angle seismic profiles in four major north-south oriented corridors on different sections of the margin. To assess the velocity structure we used a tomographic method which jointly inverts for refracted and reflected phases. Applying a top to bottom approach, we consecutively used secondary arrivals like sediment refractions and distinctive reflections from different interfaces. Where available, the sedimentary layers of the models, obtained by the analysis of

high-resolution BGR MCS data, were incorporated into the starting model and held fixed during the iterations. The obtained models exhibit strong changes of the incoming oceanic crust for the different portions of the margin: The westernmost profile off eastern Java shows a crustal thickness of more than 15 km, most likely related to the presence of an oceanic plateau (Roo Rise). Profiles off Lombok reveal an oceanic crust of 8-9 km average thickness in the Argo Abyssal Plain. The crust and the trench are largely devoid of sediments. Crustal and upper mantle velocities are slightly decreased within an area of about 50-60 km seaward of the trench, indicating fracturing and related serpentinization due to bending of the oceanic crust and associated normal faulting. Reflections from the top of the subducting plate constrain the dip of the subducting slab down to 13 km depth. The outer forearc high is characterized by velocities of 2.5-5.5 km/s. For the Lombok Basin, the profiles show a sedimentary infill of up to 3.5 km thickness and typical sediment velocities of 1.75-3.0 km/s. A reflector at 17 km depth and velocity values of 7.4-7.8 km/s beneath this reflector suggest the presence of a shallow forearc mantle and a hydrated mantle wedge in this part of the margin. Shallow mantle material underneath the forearc high and forearc basin would have important implications for the seismogenic behavior of this margin in terms of minimizing the extent of the seismic coupling zone. This project is funded by the German Federal Ministry of Education and Research (BMBF).