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Structural images of the Southern Chile subduction zone system offshore

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In order to evaluate the influence of the incoming plate on mega-thrust earthquake zones, we examine the lithospheric structure along several transects across the subduction zone system offshore north of the Chile Triple Junction, the area of the largest historic earthquake (Mw=9.5, in 1960). As part of the large collaborative project TIPTEQ (from The Incoming Plate to mega-Thrust EarthQuake processes), seismic reflection and refraction data were collected during RV SONNE cruise SO181 and are being analysed to obtain structural images of the incoming oceanic Nazca plate and the overlying continental South American plate. We present three transects on differently aged subducting crust, respectively 3 Ma, 6.5 Ma, and 14.5 Ma old at the trench. Although the data analysis is not complete at this stage, some clear age-dependencies are apparent in the structures of these lines: With increasing age the trench basin becomes wider (20-40 km), the roughness of the upper plate decreases, the thickness of the oceanic crust increases slightly (4.5-5.5 km), and the dip of the subducting slab also increases (4-6 degrees). These effects can be directly related to the thermal structure which we measured to roughly 70, 100, and 190 mW/m^2 at the trench, respectively. Little systematic changes have yet been found in the overlying plate, suggesting that the age-dependence of structure of the incoming plate plays only a minor role on the seismogenic zone. This may explain why the 1960 great Chile earthquake ruptured over the entire 800-1000 km length despite encountering thermally strongly varying structures.