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Upper lithospheric structure of the subduction zone in Southern Chile - comparison of differently aged incoming plate

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Seismic imaging of the crust and upper mantle of the subduction zone system was conducted during the RV Sonne cruise SO181 around the Chile Triple Junction, in particular in the area of the 1960 Great Chile megathrust earthquake (Mw=9.5). As part of the TIPTEQ project (from The Incoming Plate to mega-Thrust EarthQuake processes), funded by the German Ministry for Education and Research (BMBF) and the German Research Foundation (DFG), three data transects compare subduction zone structures of differently aged incoming Nazca plate (between 3 and 14.5 Ma at the trench) and its influence on the overlying South American plate. The oceanic lithosphere entering the subduction thrust is around 5 km thick on all lines. The trench basin along the deformation front consists of an almost homogeneous sedimentary cover of about 2 km thickness from the Chile Ridge in the south to the Juan Fernandez Rise in the north, indicating an efficient sedimentary transport system to the north in the direction of a deepening seafloor. Seismic velocities in the oceanic lithosphere are low around the spreading centres and increase with plate cooling. However, a localized velocity decrease at the outer rise on the older transect exists, which is interpreted as lithospheric hydration effects associated with plate bending (see also Contreras-Reyes et al., this conference) and relatively deep outer rise seismicity (see Tilmann et al., this conference). The dip of the subducting slab at the imaged first tenth of kilometres into the subduction zone are shallow, around 4 to 7 degrees, steepening marginally with age, which affects the thermal structure as modelled by Heesemann et al. (this conference) and Völker et al. (also this conference). Finally, the overriding continental plate appears to be strongly deformed within about 80 km of the deformation front as

indicated by strongly lowered seismic velocities in this region. This effect is seen along much of the Chile margin and seems independent of the age, i.e. thermal structure of the incoming plate. Thus, the plate geometry appears rather age-independent, playing only a minor role on the seismogenic zone. This could explain why the 1960 great Chile earthquake ruptured over the entire 800-1000 km length despite encountering thermally strongly varying structures.