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Segmentation of the seismogenic coupling zone in Chile at 38° S: Preservation of subduction channel deposits and damage zones

U. Micksch (1), C.M. Krawczyk (2), and . TIPTEQ Research Group ()

(1) Deutsches GeoForschungsZentrum, Potsdam, Germany, (2) Leibniz Institute for Applied Geophysics (LIAG), Hannover, Germany (lotte@liag-hannover.de)

The crustal structure of the subduction zone in south central Chile was revealed with high-resolution reflection seismic imaging within project TIPTEQ (from The Incoming Plate to mega-Thrust EarthQuake processes). The near-vertical incidence reflection seismic profile spans across 140 km from the coast of the Pacific Ocean to the Central Valley. The downdip end of the seismogenic coupling zone and the hypocenter of the great Chilean earthquake of 1960 (Mw =9.5) lie in the center of the seismic section. Here, we show the structural inventory of the Chilean fore-arc at 38.2° S.

The downgoing oceanic plate can be traced from 27-55 km depth. The oceanic crust has a varying reflectivity. A smooth increase in reflectivity below 30 km depth may be caused by the release of fluids because of the porosity collapse in the oceanic basalt. A zone of high Vp/Vs ratio supports this observation. A clear structurally imaged continental Moho could not be found, but it may be inferred together with constraints from gravimetrical modelling. Strong reflectivity above the plate interface may be associated with a subduction channel with a varying thickness of 2-5 km. Local seismicity possibly defines its upper boundary. The segmented crust of the overriding plate has two great seismically transparent zones, devided by the crustal Lanalhue Fault Zone. The eastern transparent zone may be caused by the Coastal Batholith which is covered by sediments in the Central Valley. A nearsurface first-break tomography of the TIPTEQ data set revealed the subsurface continuation of the batholith and a sediment thickness of ca. 1 km in the western part of the Central Valley.

The combination of the seismic depth section with magnetotelluric, gravimetrical and seismological findings results in an integrated interpretation along the TIPTEQ transect at 38.2° S.