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The Flat subduction in Central Chile-Western Argentina (30-32˚S): a mineralogical interpretation based on P- and S- tomographic velocity models.

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The oceanic Nazca plate, topped by the tight Juan Fernandez ridge, subducts beneath the continental South America plate with a “low angle” at ∼100 km depth and on a distance of ∼480 km away from the trench in Central Chile-Western Argentina (30˚-32˚S). There, no Quaternary volcanism exists and the continental crust thickens till 60 km depth underneath the Andean Cordillera (70˚W). The origin of the volcanism in a “normal” subduction zone is the result of partial melting in the mantle if temperature and water content conditions are fulfilled.

In this flat-slab region, a mineralogical model including the lower continental crust, the continental upper mantle and the oceanic crust of the dipping plate, is proposed and based on thermal and seismic velocity models. 3D velocity models are determined by inverting in a tomographic imaging process P- and S-waves arrival-time of local earthquakes, locally recorded by temporary seismic networks. Moreover, at 31˚S, we perform three 2D numerical thermal modelings of the medium with globally the same general boundary conditions, but using different numerical codes with different thermo-mechanical behaviours. Next, we calculate seismic velocities computed in MORB, harzburgite and lherzolite diagrams for a considered Pressure-Temperature couple and then compare them to those of the 3D velocity models.

We observe that the oceanic plate is mainly composed of blueschists between 20 and 80 km depth, which dehydrates into eclogite facies at greater depths. In addition, the upper mantle is principally made of garnet harzburgite and garnet lherzolite, with some “blobs” of eclogite. We find a mantle wedge mainly of chlorite harzburgite and more punctually with serpentine and chlorite lherzolite mineralogical phases. Consequently, in the flat-slab region, the upper mantle is relatively dry. We notice an eclogitization at the base of the lower continental crust and the presence of mantelic material into the lower part of the crust where it is the thickest.