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Structures of the convergent margin of north Chile between 28˚S and 33˚S and impact of coupling along the plate interface between the South America Plate and the subducting Nazca Plate

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Eleven multichannel reflection seismic lines acquired by BGR with RV SONNE offshore Chile between 28˚S and 34˚S are the base to decipher structures of the Chilean continental margin in detail.

The continental slope of this active margin can be divided like the slope off north Chile into an upper, middle, and lower slope. The main structural unit of the margin consists of the continental crust of South America and extends as far as the western boundary of the middle slope. The lower slope unit is formed by slumped sediments and by disaggregated material of the continental crust. In the area of the middle slope an about 1 to 2 km thick subduction channel forms the interface between the continental upper plate and the subducting oceanic Nazca Plate. In this unit slumped sediments and disintegrated continental crust are transported landward.

The upper plate is affected by strong extension centered at the boundary between the upper and the middle slope. The middle slope unit is formed by downfaulted continental crust which is broken by numerous seaward dipping normal faults. This unit is separated from the upper slope unit by a huge deep reaching seaward dipping listric synsedimentary active fault. The surface of the continental crust of the upper slope is intensively dissected by numerous landward dipping normal faults. The boundary of the middle to the upper slope is pronounced by an active fault. A similar fault system is observed off north Chile.

The upper limit of the seismogenic zone is located near the boundary between the middle and the upper slope in a depth of about 20 km. The continental crust of the upper slope is transported landward by the strong coupling with the subducting plate. By this process landward dipping normal faults are generated at the surface by rotation and by tilting of crustal blocks. In contrast, the continental crust of the middle slope is not affected by coupling because the sediment-rich subduction channel-unit prevents interplate friction. So blocks of the continental crust are slumping seaward along normal faults by gravity forces according to the progress of tectonic erosion.

The fault systems at the surface are influenced by differences in coupling between the continental upper plate and the subducting lower plate. It is speculated here that the N-S directed Atacama F. Z. is reactivated by the difference in coupling, too, because there the lower boundary of the seismogenic zone is located.