

Tectonics, Fluid Flow and Slope Stability of the central Chilean Subduction Zone revealed with Multibeam Bathymetry and deep-tow Side-scan Sonar Surveys

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The convergent continental margin off Chile spans more than 3500 km providing various segments with different tectonic characteristics. Hence, it is an ideal area to study the interplay between tectonic, mass wasting and fluid flow processes at subduction zones. The northern part is clearly dominated by subduction erosion. The central part around 33°S is controlled by the subduction of the Juan Fernandez Ridge which changes the subduction style substantially. The area south of 37°S is predominantly accretionary.

Multibeam bathymetry provides a detailed map of the continental margin morphology, which displays tectonic processes, fluid flow and mass wasting structures. Large areas of the Chilean continental margin have been mapped bathymetrically in recent years by cruises with Chilean, German, and French vessels. A survey with British RRS James Cook in March 2008 completed bathymetric coverage in the central area between 37°S and 33°S, a key area for the understanding of different subduction styles, as it is characterized by the transition from subduction erosion to subduction accretion. Generally, the morphology of the continental slope in the surveyed area displays three different regions: The lower slope typically displays a rugged terrain, including collapse and mass wasting structures, whereas the middle slope is characterized by a series of smooth terraces probably representing mid-slope basins. Some small mound-like structures characterized by high-reflectivity in the backscatter signal were mapped in the mid-slope area. A deep-tow side-scan sonar survey revealed the patchy appearance of the mounds typical for carbonates indicating fluid venting. The transition from the lower to the middle slope occurs across a roughly margin-parallel 150-km-long distinct lineament of alternating narrow highs and troughs suggesting strike-slip deformation. Their sharp relief and the transition from a rugged to a smooth morphology across them suggest that faulting is currently active. Across a moderate change in slope dip, the middle slope grades into the upper slope which displays a smooth morphology

and gentle dips. The entire slope structure is cut by several large canyons that zigzag from near the coast to the trench. The canyons head is typically located at the mouth of the largest rivers in the area and possibly transport most of the sediment reaching the trench.