



Detailed analysis of the Valdes slide: a landward facing slope failure off Chile

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The Chilean continental margin is a very active area interested by important tectonic movements and characterized by a fast morphological evolution.

Geophysical data acquired during cruise JC 23, aboard RV JAMES COOK in March/April 2008 and previous cruises cover most of the active Chilean continental margin between 33° and 37°S. Integrated interpretation of multi-beam bathymetric, sub-bottom profiles, side-scan sonar and seismic data allowed the identification of a number of slope failures.

The main topic of this project is the morphological and sedimentological analysis of the Valdes slide, a medium-sized submarine landslide offshore the city of Talcahuano (300 km south of Santiago). In contrast to most other slides along continental margins, the Valdes slide is located on the landward facing eastern slope of a submarine ridge. This setting has important implications for the associated tsunami wave field (first arrival of positive amplitude).

We measured geometrical parameters of the failure and adjacent slope. The slide affected an area of 19 km² between ~1060 m and >1700 m water depths. Its is ~ 6 km long, up to 3 km wide and involved a total sedimentary volume of about 0,8 km³. The failure process was characterized by a multiple-event and we assume its tsunami potential to be high. Using the high resolution bathymetric data and the seismic profiles along the slide deposit it was possible to reconstruct the original morphology of the area in order to understand the relation between the slide event and the structural evolution of the ridge.

Through the analysis of the data and bibliographic information about the Chilean margin, we analyzed potential trigger mechanisms for the landslide. The Valdes slide is situated on a steep ridge flank. The ridge follows an elongated fault zone running app. parallel to the margin. This fault zone has a dextral component which in combination with the faults elongation results in a compressional regime that is superimposed on the overall subduction-related compression and ultimately generated this ridge. Over-steepening (slope angle >6°) of rapidly accumulated sediments (high sedimentation rate) and the huge uplift of the ridge seem to be the most important preconditioning factors of this slide. Seismic data and core analysis suggest that a weak layer acted as sliding surface. The most likely trigger can be assumed one of the frequently occurring strong earthquakes in this area.