Geophysical Research Abstracts, Vol. 7, 00155, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00155

A 3-component Reflection Seismic Survey across the Chilean Subduction Zone – Structural Seismic Imaging of the Seismogenic Coupling Zone within the Project TIPTEQ

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One of the main tasks in subduction zone research is that of the structural and petrophysical understanding of the seismogenic coupling zone, and especially its down-dip end. Here, mega-thrust earthquakes are suggested to initiate, but the trigger and processes that shape them are less understood.

Amongst 13 sub-projects within TIPTEQ (from The Incoming Plate to mega-Thrust EarthQuake processes), the reflection seismic sub-project aims at the imaging and identification of processes in the seismogenic coupling zone of the present state of the ruptured plate interface at the southern Central Chilean margin. Together with the marine SPOC data, the newly acquired high-resolution 3-component reflection seismic land data will yield a reflection seismic section that will cover the entire seismogenic coupling zone from its up-dip to its down-dip end. In addition, an expanding spread experiment component focuses on the down-dip limit (30-50 km depth). S-wave source signals will be generated and S-waves obtained with 3-component recordings to yield an improved picture of the petrophysical contrasts within the subduction zone system.

In January/February 2005, a 90 km long reflection seismic profile was shot in southern Central Chile at c. 38˚ S. 180 three-component geophones were deployed along an 18 km long spread, moving 4.5 km in a daily-roll along for three weeks. Explosive shots, with a spacing of 1.5 km, allowed an up to 8-fold CDP coverage. The W-E trending line runs across part of the Central Valley (starting due west of Victoria) and continued over the costal cordillera towards the Pacific, thereby passing the relocated hypocenter

of the 1960 Valdivia earthquake. This event, starting at c. 38˚ S at a hypocentral depth between 30-40 km below the continental forearc, ruptured the margin progressively towards the south for approximately 1000 km, and had a coseismic slip of up to 40 m.

Here, we will present the first reflection seismic data and preliminary results from the January 2005 experiment which should deliver a high-resolution image of the seismogenic coupling zone between the subducting Nazca Plate and the South American continent.