Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10909, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10909
EGU General Assembly 2008

Why do large subduction earthquakes in South America often break the downgoing slab: example of the recent Tocopilla earthquake.

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A large Mw=7.7 earthquake occurred on 14 November 2007 in the Northern Chile gap from 21 to 22.5 S, North of the area of Antofagasta where a large Mw=8 event took place in July 1995. This earthquake ruptured the interplate seismic zone over a length of more than 150 km and generated a series of plate interface aftershocks that are still active. On 16 December 2007 a large M=6.8 aftershock took place near the southern bottom of the fault plane of the main event. This event is of the “slab push” type, i.e. an event that occurred inside the subducted Nazca plate due to along slab compression. The mechanism of this event as determined by CMT and Body wave methods is completely different of the mechanism of the main event. This event is similar to other slab push events studied by Lemoine et al and Gardi et al in Central Chile Peru and Mexico. These slab-push events occur on sub-vertical faults located inside the subducted plate just bellow the transition from seismic to continuous slip. The 16 December event has very similar characteristics to the Punitaqui earthquake that occurred on 15 October 1997 in North Central Chile and shares with it several characteristics in position with respect to the transition zone from continuous slip to the seismogenic zone. The 1997 event occurred two months after a swarm of Mw=6-6.7 events on the plate interface, the december 2007 event took place just a month after a large interplate event. We propose that both are due to stress redistribution following seismic events in the interplate zone. The events can not be simply explained by static Coulomb stress transfer because they occurred in an area that is usually considered as a stress shadow. We prefer a fracture propagation mechanism as already proposed by