

# THE JUNE 13<sup>TH</sup>, 2005, $M_w$ 7.8 TARAPACÁ (CHILE) EARTHQUAKE

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On June 13<sup>th</sup> 2005 at 18:45 local time (22:45 Coordinated Universal Time) the region of northern Chile and southern Perú was shaken by a large earthquake with a moment magnitude ( $M_w$ ) of 7.8. The earthquake epicenter was located in the Andes, approximately 125km east-north-east from Iquique (Chile) and 250km south-east-east from Tacna (Perú). The event was felt as far as Bolivia (La Paz) and Brazil (São Paulo).

Ground shaking was strongest in northern Chile, where modified Mercalli intensities (MMI) of VII and VI were estimated for the towns of Iquique Calama, Tocopilla. The strong motion stations in Iquique and Pica recorded a peak horizontal ground acceleration (PGA) of 0.26g and 0.72g respectively. Less severe but nevertheless significant shaking was felt in southern Perú where MMI values were estimated to be V to IV in the towns of Tacna , Moquegua, Punto de Bombón and Ilo. A PGA of 0.12g was recorded in Tacna.

The earthquake killed 11 people, including a family of 6 that perished in a landslide located between the towns of Iquique and Alto Hospicio. At least 100 people sustained injuries during the event. The earthquake destroyed at least 180 houses and damaged approximately 1400 homes, most of which were of adobe construction. It is estimated that more than 60% of the houses suffered irreparable damage in many of the small towns in the Andes. In this region the impact of the earthquake was exasperated by road closures, which effectively isolated these communities and required relief supplies had to be delivered by military planes. The earthquake left 30 electric substations out of service, which cut off the water supply to the region located near the town of Iquique.

Critical structures such as coastal ports, hospitals and airports generally faired well in the earthquake; however, a significant portion of the transportation infrastructure in the region was severely damaged. Much of this was the result of landslides, which occurred at locations at throughout northern Chile including Chumiza, Huara, Camiña, Mamiña, Pica, Tarapacá, Pisagua and Mocha. Landslides disrupted traffic along many highways in the region, including the Panamericana, the major north-south artery.

In southern Perú the damage was less severe then northern Chile and no fatalities were reported. In state of Tacna approximately 30 houses were damaged and many of the surrounding adobe walls tumbled. A very large landslide occurred along the highway Tacna-Palca (km 27), and a number of small, isolated rock falls were reported along other highways. In the state of Moquegua, only minor damage was reported. Here, isolated rock falls occurred along the Ilo-Desaguadero highway (Perú-Bolivia) and close to the Moquegua state tunnels in the Panamericana highway.

Earthquakes in the region are produced by the subduction of the oceanic Nazca plate beneath the South American plate, with an inter-plate displacement rate of 7.8cm/year in an east-north-east direction. This process is responsible not only the seismic activity of

the region but also the creation of The Andes mountains. The large subduction events often occur on the interface between the subduction plate and the overriding plate with depths of 50km or less. The earthquake of June 13<sup>th</sup>, 2005 was deeper, occurring on the subducted plate at a depth of 117km. Many large earthquakes have occurred in the region in the past including the 1922  $M_W = 8.5$  Chile-Argentina border earthquake, the 1960  $M_W = 9.5$  Chile earthquake (the largest ever recorded), and the 2001  $M_W = 8.4$  southern Perú earthquake.

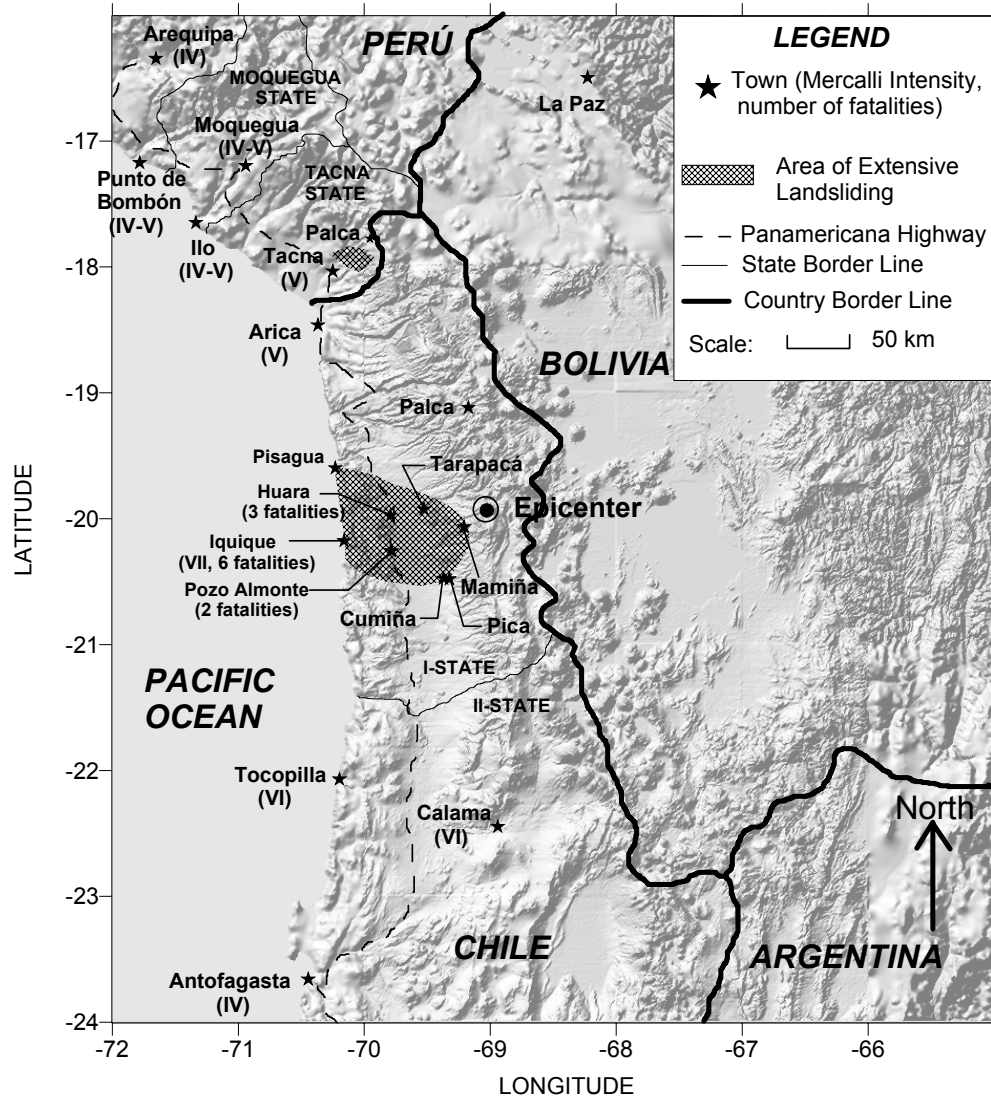


Figure 1. Intensities and landslides distribution in the affected region.



**Figure 2 Collapsed homes in the region (from “La Nación”).**

**Sources:** The information in this article was obtained through telephone interviews with local authorities, from articles published in Chilean newspaper “La Nación,” [[www.lanacion.cl](http://www.lanacion.cl)], University of Chile and CISMID (Perú) reports, and interviews broadcast on the Peruvian radio station. “Radio Uno” [[www.radiouno.com.pe](http://www.radiouno.com.pe)]

**About the author:** Efraín A. Rondinel-Oviedo holds a degree in civil engineering from the Catholic University of Perú. He is currently studying ground failure in the 2001  $M_w$  8.4 southern Perú earthquake as part of his doctoral research at Drexel University.