



## **Landslide and Surface Deformation associated to the Earthquake of 7.9 (MW) of August 15<sup>th</sup>, 2007 in Peru**

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On August 15<sup>th</sup> 2007, at 23:45(UTC), a mayor earthquake of magnitude (Mw) 7.9, affected the south-center of Peru. The epicenter was located 74 km offshore the Paracas peninsula. The earthquake affected mainly the cities of Pisco, Chincha, Ica and Cañete (south of Lima), leaving 519 people dead and 655 674 homeless. One of the most important geological site effects were landslides that occurred within the Andean basins, as well as at the coastal bluffs at the National Reserve of Paracas (NRP) and lateral spreads and liquefaction along the coastal plains. We mapped these landslides and collected an inventory data base during a 45 days long field work using the INQUA data sheet.

Our analysis shows that landslides occurred at 134 sites with a total accumulative volume of  $\sim 42,000 \text{ m}^3$ . The largest volume of that is concentrated in four landslides with volumes up to  $8750 \text{ m}^3$ . The remaining landslide sites displaced only an accumulative volume of  $\sim 10,000 \text{ m}^3$ . The landslides were classified as: Rock or debris falls, collapses, topples, rock-, debris- and soilslides. Volumetrically the most important landslides have been collapses and rotational and translational slides while the total number of falls has been the higher. The most distant landslide triggered by the earthquake was found at a distance to the epicenter of 197 km. These landslides affected the coastal cliff and the roads for access to the towns in the high part of the Andean Mountains, leaving some villages without communication for up to several weeks. However no human losses were related to landsliding.

Along the coast, the most effected area was the NRP, where 15 rockslides and falls with volumes up to 535 m<sup>3</sup> occurred along the coastal bluffs and destroyed a national natural monument called “La Catedral”. Landslides, topples and rock falls with volumes between 10 to 150 m<sup>3</sup> affected also areas where prior to the earthquake sea lions came to rest, the whole sequels at the natural habitat of this species is still unknown.

All access roads to the Andean basins were partially blocked by landslides. The most common landslides were rock and debris falls (individual slides had a maximum volume of 60m<sup>3</sup>). Other types of mass movements (rock-, debris-, and soilslides) have also been relatively small displacing in total an estimated maximum of 15,200 m<sup>3</sup> of material in all the Andean basins.

Several villages constructed on top of relict rock avalanche deposits (Laraos, Chocos, Huangascar and others) were much more destroyed than nearby villages build on other deposits or on the mountain slopes. We attribute this to rearrangement and compaction of the landslide deposit material due to the shaking as clear evidence of subsidence was visible in one case. However, increased ground acceleration on top of the landslide deposits may also contributed to destructions.

Along the coastal plains most of the surface deformation was associated with lateral spreads and liquefaction. Especially along a topographic 12-m-high step less than 1 km away from the coast line all fluvial fans were dissected by ground cracks and graben structures. In this area lots of damage to houses was caused by liquefaction.