

## Active faulting, paleoseismology and seismic hazard in forearc of southern Peru: First evidence of a crustal earthquake in the 19th century

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Subduction earthquakes are considered the main source for seismic hazard in Peru (Villegas-Lanza et al., 2016). However, in recent years, it has been made an effort to generate a database of active faults for southern Peru (Benavente Carlos et al., 2017, Benavente et al., 2018), to propose these as a potential danger. In this way, we carried out morpho-structural and paleoseismological analyzes to get data for use it in empirical relationships and propose the magnitude of a potential earthquake.

The Purgatorio Mirave fault (PMF) is located at forearc of southern Peru. Benavente et al. (2017) propose its activity in the last 6 ka, through TCN (Be10) dating over the fault scarps.

In order to reconstruct the deformation and seismic history of PMF, we carried out studies of paleoseismology. Before the excavation of paleoseismological trench, we acquired high resolution DEM and imagery with LIDAR and drone with the purpose to do a detailed mapping of all segments associated to PMF and to identify favorable areas for morpho-structural and paleoseismological analyzes. With these, we determine 200km of superficial ruptures, that are distributed inside an area of 70 km for length and 2 km for width. The high resolution images (5cm x pixel) shows sub-parallel segments, forming sigmoidal structures, in echelons, pop-up and pressure ridges.

The trench was excavated at the bottom of a valley (near the town of Mirave-Tacna), where there is a 2-meter-high fault scarp, that is affecting unconsolidated alluvial deposits. The trench (5 m long and 4 m deep) shows a reverse fault that places Oligocene rocks (Fm. Moquegua) over Holocene deposits. We identified two colluvial wedge, which are dated in 15 191-14 690 cal BC and 1668-1787 cal AD by radiocarbon C14. The most recent event generated a vertical rupture of 0.90 m.

According to our results (rupture length and vertical displacement of the PMF) and using the scale proposed by Wells and Coppersmith (1994), we determine a magnitude of 7.5Mw for the last event. In this sense, between the end of 18th and the beginning of 19th century, in southern Peru important geological processes were registered: a) A large cortical earthquake associated with the reactivation of the PMF, and b) The explosive eruption of the Tutupaca volcano (Samaniego et al., 2015), located 30 km from the PMF.