8th International Symposium
on Andean Geodynamics
(ISAG)

Evidence for a great Mw>7 Pre-Hispanic (AD 1300-1400) Crustal Earthquake in the Forearc of Peru

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Seismic hazard in South Peru is thought to be dominated by earthquakes on the subduction interface (e.g. Villegaz-Lanza et al., 2016). Little is known about other possible sources of major earthquakes, such as the ~300-km-long Incapuquio Fault System (IFS) outcropping in forearc, active during Cenozoic times (e.g. Jacay et al., 2002; Audin et al., 2006). It is seismically active, but no study deals with its actual potential activity and its seismic hazard. From fieldwork and high-resolution DEMs, we evidenced that the IFS is active with an inverse motion associated to a left-lateral component: the surface is displaced (up to 4.5 m vertical cumulative offset) with outcrops of free faces over ~100 km distance, recent fluvial terraces are overthrusted by Paleozoic rocks, rivers beds are bent, etc. Despite the hyper-arid environment, we found charcoals of roots killed by the earthquake located in the fault plane. Their 14C dating gives a cluster of ages around AD 1325. We interpret it as the last earthquake that occurred along this fault segment with an Mw>7 magnitude (0.7 m vertical, 1.2 m total).

The timing of the Mw>7 earthquake coincides with the end of the Chiribayas civilization in Moquegua valley, which has previously been attributed to the “mega-Niño” Miraflores climatic catastrophe (1300-1350) that may have induced the collapse of the irrigation and thus agricultural system (e.g. Satterlee et al., 2000; Goldstein & Magilligan, 2011). This last hypothesis is discussed because in some places, no evidences of mega floods that may have destroyed the canals have been found (Clement & Moseley, 1991), and also because that it has been shown that these human civilization living in this hyper arid area adapted their agricultural system and subsistence to the El Niño climatic fluctuations (Zaro et al, 2013). We thus propose that this collapse could also be due to the ~AD 1325 Mw>7 earthquake on the IFS, or to the sum of the earthquake and the Miraflores climatic Catastrophe.

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