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Compressive active fault systems along the Central Andean piedmont

J. Macharé[1], L. Audin[2], C. Benavente[1], M. Saillard[2], V. Regard[2], & S. Carretier[2]

[1] INGEMMET, Lima, Peru (jmachare@ingemmet.gob.pe)
[2] LMTG-IRD, Toulouse, France (laurence.audin@ird.fr)

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Introduction

It's now established that Andean forearc is not concentrating as much tectonic shortening as the foreland since Middle Miocene. GPS measurements are neither available to inform on the long-term deformation across the Andes in Peru and anyway rather describe the elastic response of the Andean forearc to the Nasca-South American Plate convergence. Few neotectonic studies focuses on the Western side of the Andes and little is known about the active deformation in the Central Andes Pacific lowlands (Sébrier *et al.*, 1988). Recent publications mainly improved the description of geomorphic surfaces (Thouret *et al.* 2007) and cosmogenic dating of the latter show much younger ones than expected (Hall *et al.*, 2008). The topographic gradient on the western side of the Peruvian Andes is quite high as the trench (-7000m) lies only 200km away from the highest point (6000m). Moreover, authors still question the fact that the Andes build through a giant focused monocline or normal fault and demonstrate doing so the need of further mapping of the fault systems on the western side of the Central Andes (Schildgen *et al.*, 2007).

Figure 1: Google earth 3D image on the Calientes Fault system from South to North.

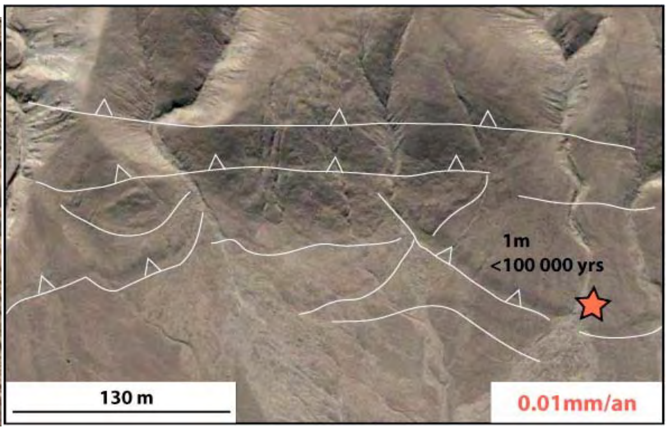

Figure 2: Zoom on white dot, figure 1; with details of the recent scarplets on the main fault.

Geomorphic evidences of recent tectonic activity are observed from the Coastal Cordillera to the piedmont of the Western Cordillera (Audin *et al.*, 2008). We present here evidences of newly mapped compressional fault system, together with evidences of their activity since at least the Pliocene in the southern Peruvian forearc, near Tacna. Examination of aerial photographs , satellite data, and focused field work not only confirms that there is recent tectonic activity but also revealed the presence of additional active structures that should be taken into account in the description of Andean deformation. In response to active tectonics, these fault systems affected very young terraces and Quaternary pediments along the piedmont of the Central Andes (Figure 1). We present

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some of the geomorphic signatures, such as active fault traces, scarplets (Figure 2), sag ponds, river terraces and some major and minor landslides, which are demonstrative of active tectonics in this area. Mapping of fault trace geometry and identifying recent surface offsets are used to determine the kinematics of the Calientes active thrust fault.

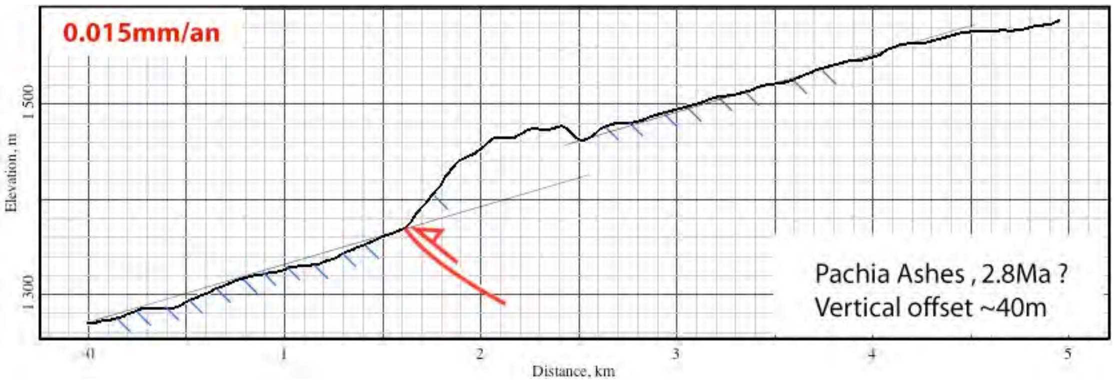

Figure 3: Topographic profile for the offset of the Pachia Fm (2,8Ma; Flores *et al*., 2002 and 2005).

Discussion and Conclusion

The purpose of this work is to show the existence of previously undescribed crustal fault systems in the forearc of the Central Andes in Southern Peru (Figure 1). Some of these markers are robust enough to allow us to characterize the kinematics of Quaternary active faults (Figure 2). The main active faults identified along the Central Andean Piedmont in Peru are trending parallel to the trench and aare part of compressional or transpressional fault systems (see the Incapuquio Fault System). At the scale of a single structure, even being part of a segmented fault system, the deformation is comparatively small with respect to the Andean uplift that accomodates the building of the mountain range, but at a larger scale the fault system could be responsible of quicker uplift rates (than those proposed here on Figure 3 on one segment). We propose that despite the large degree of segmentation that is observed along those fault systems, some crustal seismic events can occur in this area of the Andean forearc, on the Calientes Fault system (Figure 2). Many of these faults we have identified are capable of generating earthquakes, some small and local (as the October 2005 one, Ml 5.7), others major and capable of impacting human activities. Even if today we do not calculate a recurrence interval, we can at least place bounds on this and we argue, that it should be less than historical times (~1000 yr). Moreover, both the piedmont of the Western Cordillera in its lower parts and the central basin experienced extremely low denudation rates (Kober *et al*., 2005), much of which is likely accommodated by mass movements triggered by active tectonics or subduction earthquakes (Figure 1).

Our morphological data suggests an interpretation that differs from the GPS measurements and models which report that no active deformation is observed in the forearc of southern Peru (Khazaradze and Klotz, 2003). Some major tectonic structures (that belongs to the Incapuquio Fault system for exemple) shows Quaternary activity, mainly compresionnal or transpressional. Although there is only one permanent GPS station; segmentation of the faults, small displacements and long recurrence times are probably the cause of the uncomplete mapping of active faults in Southern Peru.

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