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Paleoseismic investigations at the Cal thrust fault, Mendoza, Argentina

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Along the active mountain front of the Andean Precordillera between 30°S and 34°S in western Argentina several earthquakes occurred in recent times, including a 7.0 Ms event in 1861 which destroyed the city of Mendoza and killed two thirds of its population. The 1861 event and two other earthquakes (Ms = 5.7 in 1929 and Ms = 5.6 in 1967) were generated on the Cal thrust fault, which extends over a distance of 31 km north-south and runs straight through the center of Mendoza. In the city, which has now more than 1 million inhabitants, the fault forms a 3-m-high fault scarp. Although the Cal thrust fault poses a serious seismic hazard, the paleoseismologic history of this fault and its long-term slip rate remains largely unknown (Mingorance, 2006).

We present the first results of an ongoing paleoseismologic study of the Cal thrust at a site located 5 km north of Mendoza. Here, the fault offsets Late Holocene alluvial fan sediments by 2.5 m vertically and exhibits a well developed fault scarp. A 15-m-long and 2-3-m-deep trench across the scarp reveals three east-vergent folds that we interpret to have formed during three earthquakes. Successive retrodeformation of the two youngest folds suggests that the most recent event (presumably the 1861 earthquake) caused $\sim$1.1 m of vertical offset and $\sim$1.8 m of horizontal shortening. For the penultimate event we obtain a vertical offset of $\sim$0.7 m and a horizontal shortening of $\sim$1.9 m. A vertical displacement of $\sim$0.7 m observed on a steeply west-dipping fault may be associated with an older event. The cumulative vertical offset of 2.5 m for the three inferred events is in excellent agreement with the height of the scarp. Based on the retrodeformation of the trench deposits the fault plane dips $\sim$25° to the west. In the deepest part of the trench evidence for even older seismic events is preserved beneath an angular unconformity that was formed during a period of erosion and pre-dates the present-day scarp. Dating of samples to determine the recurrence interval of these seismic events and the long-term slip rate of the fault is in progress.

References

Mingorance, F. (2006): Morfometría de la escarpa de falla historica identificada al norte del cerro La Cal, zona de falla La Cal, Mendoza. Revista de la Asociación Geológica Argentina, 61 (4), 620-638.