Geophysical Research Abstracts
Vol. 12, EGU2010-1734-2, 2010
EGU General Assembly 2010

Slip rates of active thrusts at the front of the Precordillera revealed by exposure dating and fault scarp profiles, Mendoza, Argentina

Silke Schmidt (1), Ralf Hetzel (1), Jan Kuhlmann (1), Francisco Mingorance (2), and Victor Ramos (3)

(1) Institut für Geologie und Paläontologie, Universität Münster, Corrensstraße 24, Münster, 48149, Germany, silkeschmidt@uni-muenster.de, (2) Instituto de Mecánica Estructural y Riesgo Sísmico, Universidad Nacional de Cuyo, Casilla de Correo 405 - Correo Central, Mendoza, 5500, Argentina, (3) Laboratorio de Tectónica Andina, Universidad de Buenos Aires, Ciudad Universitaria - Pabellón II, Buenos Aires, 1428, Argentina

Although large historical earthquakes occurred in the Andean back-arc region between 28° and 34°S, the slip rates of active reverse faults remain unknown; hence the seismic hazard related to these faults is poorly constrained. Here we report long-term slip rates for two faults - the Peñas and the Cal thrust - which define the front of the Andean Precordillera north of Mendoza. Both thrusts displace several Late Pleistocene to Holocene river terraces and form well-preserved fault scarps. At the Peñas thrust three terraces (T1, T2, and T3) are displaced vertically by ∼0.9, ∼1.9 and ∼11 m, respectively. ^{10}Be exposure dating constrains the age of T2 and T3 as 2.9 ± 0.8 ka and 11.1 ± 1.7 ka, which yields an uplift rate of 0.9 ± 0.1 mm/a. The horizontal shortening rate of the Peñas thrust - calculated by using the age of T3 and the dip angle of 25° - is 1.9 ± 0.2 mm/a. At the Cal thrust a fault scarp has displaced a terrace with a maximum age of 12 ka by 7 m. As the Cal thrust dips ∼25°, this yields a shortening rate of ≥ 1.3 mm/a. Our results demonstrate that the two thrusts accomodate about half of the present-day shortening rate in the back-arc region of the Andes, which is constrained as 4.5 ± 1.7 mm/a (Brooks et al., 2003).
Using the compilation of Well & Coppersmith (1994), the 50-km-long Peñas and the 31-km-long Cal thrusts are capable of producing earthquakes with a magnitude of Mw 6.7 to 7.0. This is supported by a magnitude Ms ∼ 7.0 earthquake on the Cal fault, which devastated Mendoza in 1861 and killed two thirds of its population. Earthquakes of this magnitude have presumably generated the smallest fault scarps (∼0.9 m vertical offset) present at both thrusts. The higher scarps are interpreted to record multiple offsets generated during several Holocene earthquakes.

References

Brooks, B.A., Bevis, M., Smalley, R., Kendrick, E., Manceda, R., Lauria, E., Maturana, R. & Araujo, M. (2003): Crustal motion in the Southern Andes (26° - 36°S): Do the Andes behave like a microplate? Geochem. Geophys. Geosyst., 4 (10), pp. 14, 1085, doi 10.1029/2003GC000505.

Wells, D.L. & Coppersmith, K.J. (1994): New empirical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement. Bull. Seis. Soc. Am., 84, 974-1002.