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Neotectonic characterization of potential seismogenic structures in NW Argentina

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Historical and instrumental seismicity records from the Central Andes of north-western Argentina spanning the last ca. 350 years have been the primary data source to characterize this region's exposure to seismic hazard as "moderate" to "high" (0.18-0.25 PGA). Despite the relevance of the existing dataset in seismic hazard assessments (SHA), we propose that the lack of detailed neotectonic and paleoseismological studies regarding widespread evidence of Quaternary seismogenic deformation has prevented a more accurate SHA in the vicinity of densely populated areas, such as the metropolitan regions of San Salvador de Jujuy, Salta, and San Miguel de Tucumán, which together total almost 2 million inhabitants and host important infrastructure.

In order to improve the neotectonic characterization of potential seismogenic sources in this region our research efforts we have employed a multidisciplinary and multimethodological research approach to develop an improved register of active Quaternary structures. This approach includes remote sensing analysis, detailed structural and geomorphic mapping and topographic surveying, interpretation of seismic reflection lines and near-surface geophysical surveys, structural modeling, the deployment of temporary local seismic networks, as well as geochronology. The geochronological methods include terrestrial cosmogenic nuclide dating (TCN) and U-Pb dating of volcanic ashes to establish the age of abandoned fluvial terraces (104 to 105 yrs) and optically stimulated luminescence (OSL) and AMS14C dating to constrain the depositional ages of sedimentary sequences on centennial to multi-millennial timescales.

These efforts have shed light on important parameters for SHA (i.e. fault geometry and kinematics, Late Pleistocene-Holocene slip rates) of at least a dozen of potentially seismogenic faults that were not very well known before. Our results show that besides the expected N-S-striking structures related to shortening, oblique, transpressive fault systems also exist that are probably related to the highly diachronous compressional reactivation of Cretaceous normal faults. Mean fault lengths are of around 15-20 km with extremes between 10 and 50 km, while mean slip rates typically reach 1 mm/a, with some structures reaching 2 mm/a.

Among the analyzed structures in the transition between the Eastern Cordillera and its foreland, two affect directly urban areas (Medeiros fault, Salta; Los Alisos fault, Jujuy) or they occur in the vicinity of critical infrastructure (Medina fault, El Tunal hydroelectric power plant). Further detailed studies are being carried out on these structures in order to better constrain their paleoseismological behavior and seismogenic capability.