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Elastic stress interaction between faulting and volcanism in the Olacapato–San Antonio de Los Cobres area (NW Argentina)

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The aim of this work is to describe the relationships between Plio-Quaternary tectonics, palaeoseismicity and volcanism along the NW-trending Calama-Olacapato-El Toro (COT) lineament that crosses the Andean chain and the Puna Plateau and continues within the eastern Cordillera at about 24° S. Field and satellite data have been collected from the Chile–Argentina border to a few km east of the San Antonio del Los Cobres village. These data revealed the presence of seven Quaternary NW-striking normal left-lateral fault segments in the southeastern part of the studied area and of a Plio-Quaternary N–S-striking graben structure in the northwestern part. The NW-striking Chorrillos fault (CF) segment shows the youngest motions, of late Pleistocene age, being marked by several fault scarps, sag-ponds and offset Quaternary deposits and landforms. Offset lavas of 0.78±0.1 Ma to 0.2±0.08 Ma indicate fault kinematics characterized by a pitch angle of 20° to 27° SE, a total net displacement that ranges from 31 to 63.8 m, and a slip-rate of 0.16 to 0.08 mm/yr. This fault segment is 32 km long and terminates to the northwest near a set of ESE-dipping thrust faults affecting Tertiary strata, while to the southeast it terminates 10 km further from San Antonio. In the westernmost part of the examined area, in Chile at altitudes of 4000 m, recent N–S-striking normal fault scarps depict the 5-km-wide and 10-km-long graben structure. Locally, fault pitches indicate left-lateral normal kinematics. These faults affect deposits up to ignimbrites of Plio-Quaternary age. Scarp heights are from a few metres to 24 m. Despite this area is located along the trace of the COT strike-slip fault system, which is reported as a continuous structure from Chile to Argentina in the literature, no evidence of NW-striking Plio-Quaternary strike-slip structures is present here. A series of numerical models were developed in an elastic half-space with uniform isotropic elastic properties using the Coulomb 3.2 code. We studied the stress changes caused by slip along the various Quaternary COT fault segments, showing that the last motions occurred along the Chorrillos fault might promote in the future further displacement along nearby fault segments located to the northwest. Furthermore, slip along the NW-striking fault segments imparts normal stress changes on the nearby Tuzgle volcano feeding system. Cumulative effects of fault reactivation disadvantage future Tuzgle eruptions.