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A slow-slipping active fold and thrust system at the southeastern corner of the Atacama Basin, northern Chile

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The western South American offshore is one of the major active convergent plate boundaries in the world, where the Nazca plate is subducting northeastward beneath the South American plate at a rate of about 70-80 mm/yr. Despite of this rapid plate convergence, the forearc region of western Andes does not seem to undergo large deformation at present. In this forearc region, a unique compressional depression, the Atacama Basin, is present. In order to understand the characteristics and mechanisms of active forearc deformation related to the plate convergence, we chose to investigate an area in the southeastern margin of the Atacama Basin, where active structures have been described previously. Since the hyper-aridity of the Atacama Basin results in extremely low erosion and sedimentation rates, we believe the present relief of land surface there is mostly produced by neotectonic activity, and can be used as a deformation marker.

Combining various remote-sensing data sets, such as an SRTM-DEM, Google Earth platform, and higher resolution QuickBird satellite images, we mapped several N-S trending ridges in this area. For further investigating the neotectonic geomorphic features, we performed detailed geomorphic surveys using real-time kinematic (RTK) GPS in the field to obtain high resolution topographic profiles across these features. These ridges are generally several tens of meters high, with their height decreasing northward. We interpret them to be minor duplex fault-bend folds which grew on the backlimb of one larger asymmetric anticline. This major fold, with a steep forelimb facing east, is likely formed as a shear fault-bend fold, and may be associated with an underlying west-dipping thrust fault. We suggest that this fault merge at depth with the major active thrust system of the region.

We also performed 40Ar/39Ar and U-Th dating of deformed strata of the area. The surface ignimbrites mostly have eruption ages of late Pliocene (3.0$\sim$3.2 Ma), and a thin layer of lake deposits covered the northern part of the area at about 440ka. If the structures have been active since the deposition of these deposits, the total deformation would yield a quite low long-term deformation rate of the faults, in the order of 10-1 mm/yr. This result is similar to some other researches in the forearc region of Central Andes, but is distinctly different from results from the Northern and Southern Andes. This very low slip rate of active structures may thus play important roles in the evolution of the forearc deformation belt, as well as the landscape development in this area.