



Distributed deformation in the Southern Andes: Evidence from DEM analysis and reassessment of fault-kinematic, paleomagnetic and AFT data

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Models of intra-arc deformation in the Southern Andean Volcanic Zone (SAVZ) between 42°S and 47°S commonly focus on the kinematics of the Liquiñe-Ofqui Fault Zone (LOFZ), which cuts the SAVZ along-strike for more than 1000 km. Northward displacement of the Chiloé Block, a detached fore-arc sliver to the west of the LOFZ, points to an overall dextral displacement on the LOFZ. In this tectonic framework, which is based on limited ground truth, the LOFZ is commonly regarded as the main, if not the only, discontinuity accommodating oblique plate convergence. Recent paleomagnetic and fault-kinematic studies, however, challenge this concept as they provide independent evidence for distributed deformation along a number of additional first-order faults resulting in heterogeneous vertical-axis rotation of upper crustal blocks. Following this concept, we highlight the complexity of deformation in the SAVZ and discuss the role of the LOFZ. Our conclusions are based on detailed lineament analysis and reassessment of compiled kinematic, paleomagnetic and apatite fission track (AFT) data.

Morphotectonic lineaments were extracted from shaded relief, drainage and aspect maps derived from ASTER GDEM 2 high-resolution digital elevation models. Published apatite fission track data were interpolated using an inverse distance weighting method and used to calculate exhumation rates. Between 42° S and 47° S, DEM-analysis reveals a network of interconnected and partly curved lineaments trending N-S, NE-SW, and NW-SE. A number of these lineaments display mutual offsets. AFT data indicate enhanced exhumation in the central cordillera, where drastic changes in exhumation rates spatially coincide with the intersection of lineaments. Here, individual fault-bound blocks display uniform exhumation rates.

In contrast to pre-existing, rather crude structural and kinematic interpretations of deformation in the SAVZ and the role of the LOFZ, our lineament analysis and the reassessment of AFT and structural data requires reconsideration of the intra-arc deformation. Most importantly, deformation appears to be distributed across the entire width of the Southern Andes. The fore-arc sliver is displaced on a network of structural discontinuities, rather than merely on the LOFZ. Moreover, variations in exhumation rates of individual fault-bound blocks call for significant vertical displacements during deformation. Collectively, the study indicates rather uniform transpressive deformation of the entire Southern Andes as a result of oblique plate convergence.