Tectonophysics 859 (2023) 229880

Contents lists available at ScienceDirect

Tectonophysics

journal homepage: www.elsevier.com/locate/tecto

The temporal and spatial relationship between strike-slip and reverse faulting in subduction-related orogenic system: Insights from the Western slope of the Puna Plateau

Diego Jaldín [a,*], Laura Giambiagi [c], Fernando Martínez [d], Carlos Benavente [e], Daniela Espinoza [f], Kyriaki Drymoni [g], Karina Luengo [b], Rodrigo González [b], Juan Rios-Contesse [a]

[a] Universidad Católica del Norte, Programa de Doctorado en Ciencias mención Geología, Avenida Angamos 0610, Antofagasta, Chile
[b] Universidad Católica del Norte, Departamento de Ciencias Geológicas, Avenida Angamos 0610, Antofagasta, Chile
[c] IANIGLA, CCT Mendoza, CONICET, Mendoza, Argentina
[d] Carrera de Geología, Facultad de Ingeniería, Universidad Andres Bello, Campus República, Avenida República 220, Santiago, Chile
[e] Instituto Geológico Minero y Metalúrgico, Av. Canadá 1470, San Borja, Lima, Peru
[f] Institut für Geowissenschaften, Universität Potsdam, Potsdam, Germany
[g] Department of Earth and Environmental Sciences, University of Milan-Bicocca, Milan 20126, Italy

ARTICLE INFO

Keywords:
Volcano-tectonic
Faulting
Strike-slip fault
Central Andes

ABSTRACT

The relationship between parallel and oblique to the orogen faults and the magmatic evolution is key to understanding the evolution of a hot orogen, such as the Central Andes. The Andean orogenesis along the southern Central Andes, during the Neogene is characterized by regional compression and magmatic processes associated with subduction. The outcome of this dynamic interaction between plate tectonics and magmatism has generated reverse, normal and strike-slip faults, both parallel and oblique to the trench. Despite the progress made on studying these fault systems, both their relationship with the stress field and their role in magma propagation into the shallow crust are still enigmatic. In this work, geomorphological observations are coupled with kinematic and dynamic analyses, as well as with kinematic forward modeling, to reconstruct the evolution of two main faults affecting the western slope of the Puna plateau, the Barrancas Blancas fault and the Tocomar fault, during the Neogene. The obtained data reveal that, between 17 and 10 Ma, the Barrancas Blancas fault had reverse activity, while the Tocomar fault had left-lateral strike-slip movement. At 10 Ma, the area was affected by the coeval reactivation of the Volcan de Punta Negra fault and the right-lateral activity of the Tocomar fault. During the last stage, strike-slip movement along the Tocomar fault favored the rise of magma, while the hydrothermal activity evolved along the Barrancas Blancas fault. The study results reveal that the oblique-to-the-orogen faults play a role in the segmentation of the reverse parallel-to-the-trench deformation and control the position of the volcanic centers, while the parallel-to-the-orogen faults control the relief development and the evolution of hydrothermal systems. The proposed model helps in understanding how magma rises to the surface associated with movement along reverse and strike-slip faults during the thickening of the crust.

1. Introduction

The relationship between inherited structures, stress field and magmatism is a key issue to understanding a subduction-related hot orogen (Acocella and Funiciello, 2010; Riller et al., 2012. Ducea et al., 2015). At a convergence orogen, the presence of crustal anisotropies, inherited crustal discontinuities, local variation of the stress field and subduction-generated forces accommodated through strain partitioning may result in heterogeneous orientation and kinematics of fault systems (Sielfeld et al., 2019; Veloso et al., 2020). Therefore, a convergence orogen may be characterized by the synchronicity between orogen-parallel and orogen-oblique faulting (e.g. Mann, 2007).

The interaction between orogen-parallel and orogen-oblique fault systems is characterized by the deflection of the strike of the master

* Corresponding author at: Departamento de Ciencias Geológicas, Universidad Católica del Norte, Avenida Angamos 0610, Antofagasta, Chile.
E-mail addresses: djq001@aumnos.ucn.cl (D. Jaldín), fernando.martinez@unab.cl (F. Martínez), cbenavente@ingemmet.gob.pe (C. Benavente), r_gonzalez@ucn.cl (R. González).

https://doi.org/10.1016/j.tecto.2023.229880
Received 1 September 2022; Received in revised form 26 April 2023; Accepted 27 April 2023
Available online 29 April 2023