Journal of South American Earth Sciences 129 (2023) 104543

Contents lists available at ScienceDirect

Journal of South American Earth Sciences

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

Kinematic analysis of the mesozoic - Early Cenozoic deformation in the paipote basin (27°10′S)

M. Peña [a,b,*], R. Quiroga [c,d], G. Fuentes [e], M. Arellano [a], J. Norambuena [f], S. Bascuñán [g]

[a] Escuela de Geología, Universidad Mayor, Santiago, Chile
[b] Advanced Mining Technology Center, Universidad de Chile, 8370451, Santiago, Chile
[c] Grupo de Tectónica, IANIGLA, CCT Mendoza, CONICET, Argentina
[d] Institute for Geosciences, University of Potsdam, Potsdam, Germany
[e] Escuela de Geología, Facultad de Ingeniería, Universidad Santo Tomás, Ejército 146, Santiago, Chile
[f] Geológica Servicios S.p.A, Oficina, Av. Providencia 1650, 1707, Santiago, Chile
[g] SQM Salar, S.A., El Trovador, Las Condes, 4285, Santiago, Chile

ARTICLE INFO

Keywords:
Basin evolution
Inversion tectonics
Atacama region
Forward modeling
Strain
Kinematic analysis

ABSTRACT

An integrated structural and kinematic study focused on the characterization of an Andean Mesozoic basin was carried out in the upper stream of the Paipote Creek, in the western limit of the Southern Puna, Fault slip data analysis (n = 80) and structural observations at different scales were collected from Triassic to Upper Cretaceous volcanic and sedimentary units to constrain the structural architecture and the kinematic evolution of the area. Regional observations provide evidence for syntectonic extensional deposition during the Triassic - Jurassic and positive tectonic inversion from at least the Late Jurassic. Extensional features such as growth strata, harpoon structures and roll-over anticlines, helped to infer two main depocenters controlled by west dipping listric faults. E-W extension directions have been recognized in Triassic - Jurassic units, linked to an extensional basin architecture, and mixed contraction directions were related to compressional and strike-slip deformation in the area. A forward model is proposed based on the interpreted architecture in depth of the basin, defining two major depocenters that, together, define the Paipote basin. A shortening estimate of 21% (5,44 km) was calculated for the basin, wich corresponds to the lowest shortening values reported for the Triassic-Jurassic basins in the Atacama region. The strike-slip deformation can be associated previously with recognized NW-SE strike-slip faults, and aids in proposing the Paipote basin as a transitional zone between the Lautaro basin to the south and the Potrerillos basin to the north.

1. Introduction

Fold-and-thrust belts with strike-slip influence correspond to structural architectures that are commonplace in structural geology (Thomas and Coward, 1995; Brun and Nalpas, 1996; Panien et al., 2005; Quintana et al., 2006). The influence of differential deformation, inherited heterogeneities, and obliquity of the compression can generate contrasting differences in structural styles (Yamada and McClay, 2004; Mora et al., 2009; Bonini et al., 2012; Martínez et al., 2012; Martínez et al., 2013, 2022; Tesón et al., 2013; Bonini et al., 2014). The presence of strike-slip as a secondary feature in compressional deformation can be observed in special transpressional architectures, in along strike variations in deformation magnitude (Yamada and McClay, 2004; Rotevatn and Peacock, 2018; Shinn, Y.J., 2015), or the presence of strain kinematic indicators (Ellero et al., 2020; Quiroga et al., 2021). When multiple basins are subjected to positive tectonic inversion, there can be a series of accommodation or transfer zones where faults link the basins in an oblique array (Morley, 2010). The importance of these zones is displayed in the presence of mixture of architectures between strike-slip and positive tectonic inversion structures (Gawthorpe and Hurst, 1993), which comprise zones with a multifactorial tectonic history to understand.

The South American western margin presents an active and continuous subduction since the Carboniferous (Coloma et al., 2017; Del Rey et al., 2016, 2019; Oliveros et al., 2020). This continuous record of its tectonic history has generated a latitudinal and longitudinal variation in the structural architecture observed in the present day (Mpodozis and Ramos, 1990; Cobbold et al., 2007; Giambiagi et al., 2022). One of the

* Corresponding author. Escuela de Geología, Universidad Mayor, Santiago, Chile.
E-mail address: geodeckard@gmail.com (M. Peña).

https://doi.org/10.1016/j.jsames.2023.104543
Received 28 February 2023; Received in revised form 14 August 2023; Accepted 17 August 2023
Available online 19 August 2023