



Along strike variations on inverted Tarapacá Basin and its influence in buried western Andean mountain front building

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ABSTRACT

Recent studies focus in the forearc tectonic and structural evolution evidencing the strong control of the pre-orogenic structures in the accommodation of the Andean shortening and deformation. Lateral variations in the structures of mountain fronts can generate relevant changes in the crustal shortening magnitudes and lead to variations in tectonic models. The Western Andean Mountain Front at 21°S represents a unique opportunity to understand the interplay between inherited extensional fabric and thrust belt front structures related to orogenic processes. To assess the structural style, along strike variations and tectonic evolution, we combined regional field observations, 2D seismic interpretation calibrated by well data and rock outcrops, balanced structural cross-sections, aero-magnetic data, structural interpretation and 3D structural modelling. The main results validated and latitudinally extended the structural style characterized by partially inverted graben and half-graben arrays formed by Jurassic to Early Cretaceous extension and subsequently underwent contraction which led to the basin inversion at least since the Upper Cretaceous. This contribution also shows for the first time a complete 3D structural framework showing lateral continuation of main structures and the relationship between orogen-parallel (N-S and NNE-SSW trends) and orogen-oblique structures (ENE-WSW, NW-SE and WNW-ESE orientations), being plausible to propose tip points, polarity changes and accommodation zones. Partially inverted graben and half-graben arrays, accommodation zones, its evolution and along strike variations must be considered in tectonic and generative exploration models to better understand the main Andean structures and mineral deposits distribution, respectively.

1. Introduction

Thick-skin deformation in Andean forearc is classically characterized by development of thrust belt fronts including reactivation of extensional pre-existing structures (Amilibia et al., 2008; Bascuñan et al., 2016; Martínez et al., 2013; Martínez et al., 2017; Bascuñan et al., 2016; Martínez et al., 2017; Fuentes et al., 2018; López et al., 2019, 2020; Martínez et al., 2021; Martínez et al., 2022). Along strike structural variations within thrust belt fronts is typically related to lateral changes in the deforming basin. Variations in main structural trend, horizontal shortening and structural style can be a consequence of pre-existing structures, variations in the mechanical stratigraphy, including

thickness and contrasting facies of the basin fill, and lateral changes in décollement level (O'Brien et al., 1996; Sepehr and Cosgrove, 2004, 2007; Paton and Underhill, 2004; Butler et al., 2006; Turner et al., 2010, 2011; Linkerman et al., 2013; Satolli et al., 2014; Scherrenberg et al., 2014). These along strike changes are usually adjusted by accommodation and/or transfer zones, developing orthogonal or oblique faults to the general structural trend of thrust belt fronts and acting as mechanical limits during inversion tectonics (Rosendahl, 1987; Peacock et al., 2000; Konstantinovskaya et al., 2007).

In the Central Andes, a major geodynamic-scale event controlled the development of extensive basins developed mainly under extensional regimes (Mpodozis and Ramos, 1989, 2008; Ramos, 2010). The

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