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Fernando Martínez, Domenico Montanari, Chiara Del Ventisette, Marco Bonini, Giacomo Corti

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Basin inversion and magma migration and emplacement: Insights from basins of northern Chile

Fernando Martínez[a], Domenico Montanari[b], Chiara Del Ventisette[c], Marco Bonini[b], Giacomo Corti[b]

[a] Facultad de Ingeniería y Geología, Departamento de Geología, Universidad Católica del Norte, Angamos 0610, Antofagasta, Chile
[b] Consiglio Nazionale delle Ricerche (CNR), Instituto di Geoscienze e Georisorse, Via G. La Pira 4, Florence 50121, Italy
[c] Earth Sciences Department, University of Florence, Via G. La Pira 4, Florence 50121, Italy
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Abstract

One of the major problems found during the structural modelling of inverted basins influenced by magmatism is the understanding of the geometric and kinematic relationships between inverted structures and intrusive bodies. The Central Andes of northern Chile is a natural laboratory to analyze this situation, since its Cenozoic tectonic evolution was marked by the tectonic inversion of Mesozoic extensional-related back arc basins, which occurred simultaneously with the emplacement of km-scale intrusions. In order to provide some insights on the interplay between basin inversion and magma emplacement, we have completed a comparative analysis based of field data from four inverted Mesozoic basins of northern Chile and a series of previous and new analogue models reproducing the tectonic inversion of half-grabens and simultaneous magma emplacement. The results of the experiments showed a strong correlation with the natural cases analyzed. Magma migration and emplacement during basin inversion was controlled by the initial distribution of normal faults. The magma migration occurred in the same direction of the tectonic transport preferentially along the inverted normal faults. High magma injection rate during basin inversion can cause a major reactivation of the normal faults, favoring a comparatively increase in bulk shortening. The most favorable condition for which the magma reaches the surface during basin inversion is under simultaneous high magma injection and shortening rates. The latter allow the magma to be emplaced along the core of inversion related anticlines such as it is recognized in northern Chile.

1. Introduction

Basin inversion involves the reactivation of pre-existing extensional faults during shortening (Butler, 1989; Cooper and Williams, 1989). This process is controlled by several