

Tertiary tectonics of the sub-Andean region of the North Patagonian Andes, southern central Andes of Argentina (41–42°30'S)

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Abstract

The sub-Andean region of the North Patagonian Andes is located between the north Patagonian foreland and the highest elevations of the Andean Cordillera. Its Tertiary contractional structure, active since the upper Late Oligocene and through the upper Late Miocene, corresponds to the external sector of the North Patagonian Andes fold-and-thrust belt, which is characterized by east-vergent thrusts that affect stratified Cenozoic rocks. The units involved in the deformation correspond to El Maitén Oligocene volcanic belt, deformed between east-vergent thrusts and backthrusts, and Oligocene–Miocene sedimentary rocks of the Ñirihuau–Collón Curá Basin. The northern sector of the basin was structured as a thin-skinned fold belt that comprises the Ñirihuau fold belt and a frontal sedimentary wedge. To the south, sedimentary depocenters are confined between medium- to high-angle reverse faults with evidence of basement structural control. In both cases, the general tectonosedimentary framework shows the youngest units toward the east, in agreement with the advance of the orogenic wedge. Most of the Ñirihuau–Collón Curá Basin infill fits a foreland basin system model. Some sectors of the basin show evidence of structural control by normal faults in the initial sedimentation stages. This early extensional regime might be associated with late phases of Oligocene volcanism. Extensional structures probably were partially reactivated during the upper Late Oligocene, as suggested by seismic data.

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Keywords: North Patagonian Andes; Andean tectonics; sub-Andean region; fold-and-thrust belt; Tertiary basins

Resumen

La región subandina de los Andes Nordpatagónicos está situada entre el antepaís nordpatagónico y la región andina principal. Su estructura contraccional terciaria desarrollada a partir del Oligoceno superior tardío y durante el Mioceno superior tardío, corresponde al sector externo de la faja plegada y corrida de los Andes Nordpatagónicos, que se caracteriza por corrimientos de vergencia este en rocas estratificadas cenozoicas. Las rocas estratificadas cenozoicas involucradas en la deformación pertenecen al cinturón volcánico oligoceno de El Maitén, estructurado entre corrimientos de vergencia este y retrocorrimientos y, a las sedimentitas oligoceno–miocenas de la cuenca de Ñirihuau–Collón Curá. El sector norte de la cuenca fue estructurado como una faja plegada y corrida epidérmica y una cuña sedimentaria con poca deformación en el subsuelo, en tanto que al sur, los depocentros sedimentarios se encuentran confinados entre fallas de vergencia opuesta de mediano a alto ángulo, lo que evidencia el control estructural del basamento de la cuenca. En ambos casos, el patrón tectosedimentario general muestra a las unidades más jóvenes hacia el este, en concordancia con el avance en secuencia hacia el antepaís de la cuña orogénica. Si bien, desde el punto de vista tectosedimentario, la mayor parte del relleno ajusta con un modelo de cuenca de antepaís, en algunos sectores de la cuenca, el inicio de la sedimentación habría sido controlado por fallas normales, las que muestran algunas evidencias en el subsuelo de inversión tectónica parcial. Este fallamiento normal estaría relacionado con los estadios finales del régimen extensional asociado al volcanismo Oligoceno.

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Palabras clave: Andes nordpatagónicos; Tectónica Andina; región subandina; faja plegada y corrida; cuencas terciarias

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1. Introduction

The central Andes traditionally have been subdivided into different geologic provinces with distinct stratigraphies and structural features. The North Patagonian Andes, one of these morphostructural domains, is located between 40° and 45°S latitude and comprises more than 500 km of the Andean Cordillera (Fig. 1). The morphology of the region has been highly influenced by aggradational and erosional processes during Plio–Pleistocene glaciations. The highest sector (41–43°S) is characterized by average elevations of 2000–2300 m; Monte Tronador is the main topographic feature (3478 m).

The sub-Andean region (east of 71°W) consists of a 25 km wide N–S to NNW mountain belt with maximum elevations of approximately 2000 m and a 30 km wide area of fluvial plains. Tertiary volcanic and sedimentary rocks represent the predominant stratigraphic units. To the east (Fig. 1(b)), the foreland region encompasses the northern part of the Patagonian Precordillera (part of the Northpatagonian Massif affected by Andean tectonics).

The geodynamic evolution of the North Patagonian Andes remains obscure because of the scarcity of comprehensive studies on the origin and evolution of its igneous–metamorphic basement and Mesozoic basins. Some recent works have attempted to provide insights (e.g. Jordan et al., 2001; Folguera and Ramos, 2002; Folguera and Iannizzotto, 2004); however,

several topics must still be clarified. Foremost among these include the geometry of the regional structure, which has been attributed to wrench tectonics (Dalla Salda and Franzese, 1987) or a fold-and-thrust belt model (Ramos and Cortés, 1984; Giacosa and Heredia, 2000), and the relative influence of strike-slip (Diraison et al., 1998) and dip-slip components on the main structures (Giacosa and Heredia, 2000). In any case, cartographic evidence is needed to support the strain partitioning indicated by fault slip data (Diraison et al., 1998).

The origin and evolution of the tertiary basins are also controversial. They have been described in terms of a pull-apart model (Spalletti and Dalla Salda, 1996), pure crustal extension in the backarc (Mancini and Serna, 1989; Cazau et al., 1989), or synorogenic deposition in a foreland basin related to different eastward migration episodes of the orogenic front (Ramos and Cortés, 1984; Giacosa and Heredia, 1999, 2000). In this context and without suggesting a specific origin, Diraison et al. (1998) highlight the lack of synextensional seismic fabrics in the basin. However, some evidence suggests that the Ñirihuau–Collón Curá Basin, similar to most retroarc basins, has a complex tectonic evolution and should be regarded as a polyphase basin (Afonso, 2002).

Giacosa and Heredia (1999) identify two different tertiary basins (Fig. 1(c)) that are geographically and temporally separated by the Oligocene El Maitén volcanic belt (Rapela et al., 1988). The western depocenter corresponds to El Bolsón

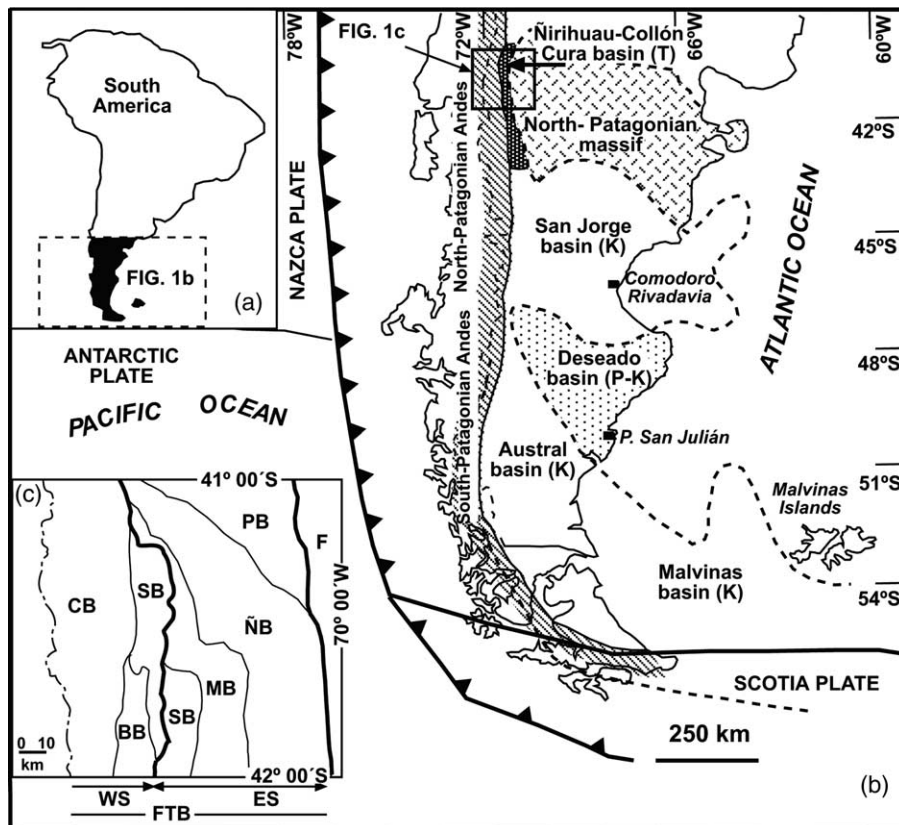


Fig. 1. (a, b) Location of the study area. (c) Map showing the main tectonomagmatic and tectosedimentary division of northwestern Patagonia. Key: CB, Cordilleran Batholith; SB, subcordilleran Batholith; PB, Pilcaniyeu belt; MB, Maitén belt; BB, Bolsón Basin; NB, Nirihuau Basin; F, foreland; FTB, fold-and-thrust belt; WS, western sector; ES, eastern sector.

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