Constraining the Neogene evolution of the Central Andes fold belt between 35°-36°S using top-wedge-growth strata record, Malargüe, Argentina

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Introduction

The Malargüe fold-belt between 35°- 36°S is located at the southern Central Andes of Argentina (Fig. 1). It was first defined by Kozlowski *et al.* (1993) and displays a hybrid thick-thin skinned structural style with well preserved top-wedge foreland basins developed between active structures. The age and geometry of growth strata preserved in these basins allowed us to constrain the main pulses of orogenic wedge encroaching and final fossilization of the fold belt front during the Neogene.

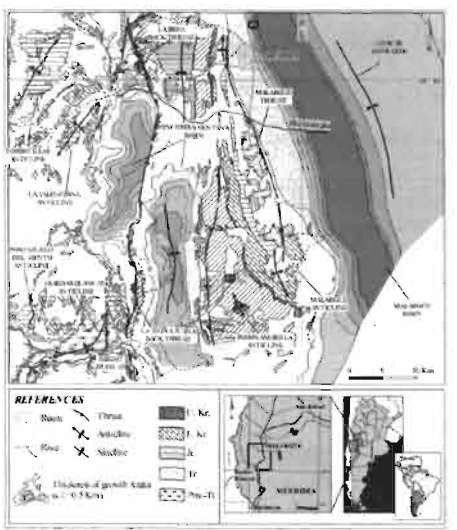

Fig. 1: Location map of the study area.

Structure

Three thick-skinned structural trends bound the top-wedge basins. The Torrecillas, La Valenciana and Bardas Blancas anticlines to the west, the central Malargüe and Pampa Amarilla anticlines and the subsurface Chacay anticline to the east (Fig. 1)

The thickening of Triassic to early Jurassic units measured in surface sections, wells and seismic data along the cores of neogene basement anticlines suggest the inversion of half grabens developed during the rifting stage of the Mesozoic basin. The polarity of early normal faults and geometry of accommodation zones seem to exert a strong influence on the structural vergence of basement anticlines (Manceda and Figueroa, 1995). This basement structures transfer shortening to the cover where at least three main salt/shale décollements favored the development of a complex thin-skinned structural style such as La Brea-Doña Juana (LBDJ) triangular zone along the flank of the western thick-skinned trend.

Syntectonic basins

Closely related to the evolution of the fold-belt two top-wedge foreland basins were developed:

a) *The Pincheira-Ventana basin*, located at the western edge of the study area, is filled by three syntectonic volcanic and volcaniclastic sequences (S1, S2 and S3)(Figs. 1 and 2) Growth strata rests unconformable over upper cretaceous Neuquén Group and thins toward La Valen-ciana and Torre-cillas anticlines to the west and (LBDJ) triangular zone to the east. Progressive un-conformities, strata pinch out and paleocurrents document the activity of the bounding structu-res. To the south-east, S1 and S2 by pass the LBDJ triangular zone to form the eastern Pincheira basin. The basal para-concordance that separates S1 from Paleogene strata suggests a

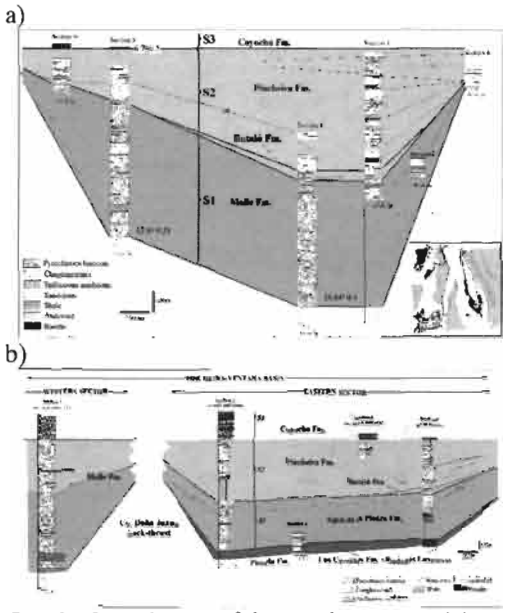

Fig. 2: Correlation of the north-western (a) and south-eastern (b) sector of the Pincheira-Ventana basin.

higher rate of subsidence in this direction. Southwest directed paleocurrents and a coarsening upward trend suggest the structural exhumation and erosion of the Bardas Blancas anticline. Radiometric dating of andesitic lavas at the base of the growth sequence and of basalts at the top, constrain the age of this basin between early mid Miocene and late upper Miocene (15.1 and 6.7 Ma).

b) The *Malargüe basin*, located at the eastern edge of the area, is filled by two syntectonic volcanic and clastic sequences (S3 and S4) covered by a post tectonic clastic sequence (Fig. 3). The seismic analysis of the growth sequences shows a divergent arrangement related to the uplift of the Malargüe anticline to the west and a growth triangle at the flank of Chacay anticline to the east. New radiometric dating of outcropping basal andesitic breccias yielding an age of 5.04 Ma and a quaternary post tectonic sequence at the top, constrain the age of the basin between Late Miocene and Quaternary.

Basin evolution and timing of deformation

The evolution of the foreland basin can be summarised into two main stages involving four syntectonic sequences (Figs. 4 and 5).

During the first stage 1500m of sediments (sequences S1 and S2) were deposited in the Pincheira-Ventana. Radiometric data from volcanic levels at the base of the sequence gives a minimum age of 16 Ma to the onset of Torrecillas, La Valenciana and Bardas Blancas anticlines uplift. During the second stage the locus of subsidence shifted to the eastern Malargüe basin, where more than 2000m of sediments (sequences S3 and S4) were deposited. Radiometric ages give a minimum age of 5.04 Ma to the beginning of the second pulse of activity of the Malargüe anticline and onset of Chacay anticline uplift. This

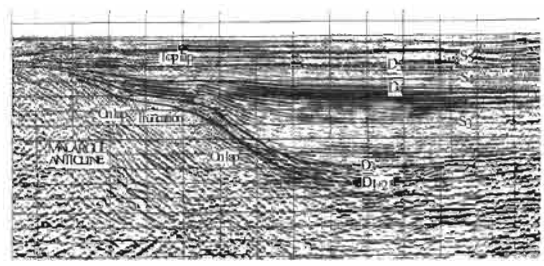

Fig. 3: Seismic interpretation and growth sequences identified in the Malargüe Basin. The basal levels of S3 yield minimum ages of 5,04 Ma and during its deposition relative subsidence rates reach a maximum.

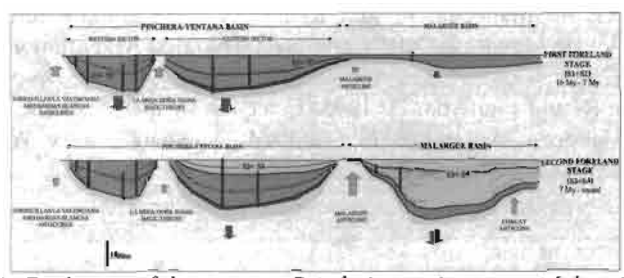

Fig. 4: Evolution of the western Pincheira and eastern Malargüe top-wedge foreland basins.

evidence two in - sequence pulses of foreland fold belt migration diring middle - upper Miocene and Pliocene time respectively. At the end of the second pulse the deformation shifted toward the hinterland area to form the Malargüe out-of-sequence-thrust and post tectonic Pleistocene strata buried the Pliocene deformation front.

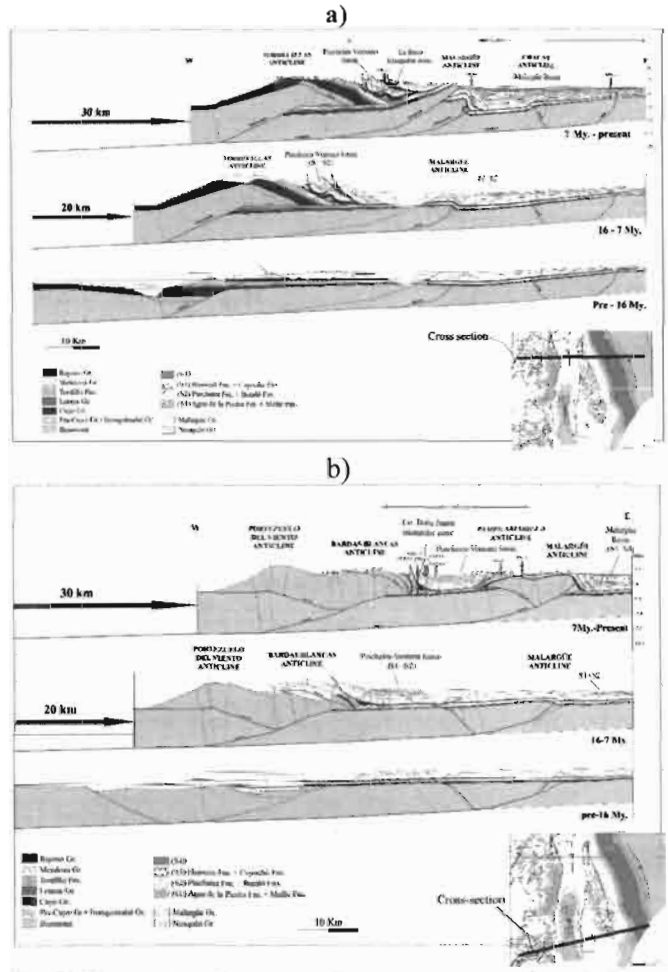

Fig. 5: Three stage incremental reconstruction of two balanced sections showing the preorogenic stage, intermediate Miocene Pincheira basin stage and Pliocene to present Malargue basin stage.

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