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Recent tectonic activity in the Precordillera of the North Chilean forearc at the Salar de Punta Negra latitude (24°-25°S)

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Introduction

In the Central Andes, despite most of the continental shortening has concentrated in the back arc region from 10 Ma (e.g. Baby *et al.*, 1997), inner regions as the Chilean forearc also register some moderate active tectonics. In this work we analyse the Neogene tectonic activity in a portion of the Precordillera of the North Chilean forearc, the Salar de Punta Negra area (24-25°S; Fig. 1). During the Eocene-Oligocene a transpressional event occurred there (eg. Maksaev and Zentilli, 1988). In contrast, the recent tectonic activity observed essentially using geomorphological markers does not indicate any strike-slip offset, but repeated and small E-W compressive pulses that reactivate previous structures originated under transpression.

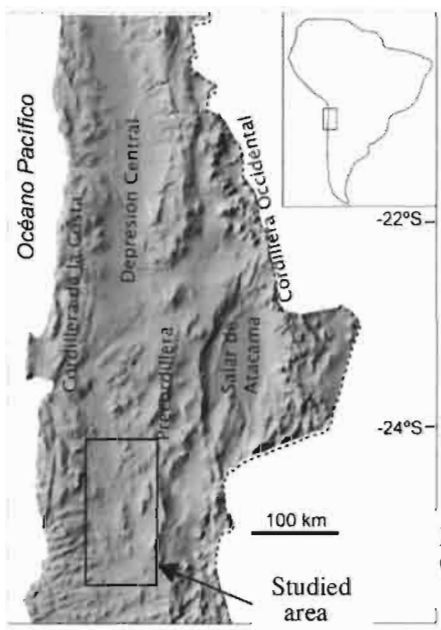

Fig.1. Location of the studied area in the North Chilean forearc.

Deformation history in the Precordillera

The Precordillera in the Northern Chile forearc (also called Cordillera de Domeyko) represents a N-S thick-skinned basement range bounded by a system of reverse faults and blind thrusts with alternanting vergence along-strike (Mpodozis and Ramos, 1989). It results from the inversion since the end of Early Cretaceous of a previous Mesozoic back-arc basin (Mpodozis and Ramos, 1989). A main episode of transpression is described during the Eocene-Oligocene (eg. Maksaev and Zentilli, 1988).

The Neogene tectonic deformation of the Precordillera in Northern Chile, between 20-28°S, varies significantly along-strike. It is characterized by the reactivation of major structures that formed during the previous tectonic episodes, in particular during the Eocene (Kuhn, 2002; Audin *et al.*, 2003) and does not accommodate high tectonic displacements, despite this period corresponds to the mean surrection episode of the Altiplano-Puna plateau (Gregory-Wodzicki, 2000).

Neogene tectonic activity at the Salar Punta Negra latitude (24°-25°S)

The aridity of the studied area, localised in the Atacama Desert, permits to consider alluvial fan deposits, drainage organisation and evolution of intermittent river networks as valid markers to reflect the Neogene tectonics. At the Salar de Punta Negra latitude, aerial photographies, satellite images and fieldwork data indicate the existence of at least three different recent surfaces (two alluvial fan surfaces and the active flood-plain surface) formed after the deposition of a Lower Miocene ignimbrite (Río Frío ignimbrite, K-Ar dates range from 23 to 17 Ma; Naranjo and Cornejo, 1992) that are affected by numerous lineaments linked to fault scarps.

The post-Lower Miocene vertical displacements accommodated by the observed fault scarps are smaller than 100 meters. Therefore the latest deformation episode in the study area corresponds to small tectonic events. Oldest alluvial fan surfaces display higher number of lineaments in comparison with younger surfaces, indicating that structures are related to successive episodes of deformation, and not linked to a single tectonic event.

The plan-view geometry of the lineaments describes a lense with a complex arrangement en échelon, similar to the pattern of strike-slip faults in sinistral transpression scenarios (Mpodozis *et al.*, 1993; Fig. 2). However, geomorphological markers rule out recent strike-slip motions, but E-W compressional tectonics as other authors have proposed for equivalent areas north and southwards (eg. Jordan *et al.*, 2002; Audin *et al.*, 2003). We propose that the lineament geometry marks the reactivation during the Neogene of the major transpressive sinistral faults that formed during the major Eocene-Oligocene tectonic episode. This low intensity reactivation could be associated with the westward tilting of the forearc accompanying the Puna uplift.

Discussion: Low-intensity Neogene tectonics south of the Salar de Atacama

Field data indicate that only moderate shortening, without significant strike-slip motions, occurred in the Precordillera at the Salar de Punta Negra latitude since the Early Miocene. South of the studied area, Audin *et al.* (2003) and Riquelme (2003) also report similar and particularly small tectonic displacements during the Neogene. Northwards, in contrast, authors generally report larger Miocene and Neogene deformations (e.g. Jordan *et al.*, 2002; Victor *et al.*, 2004). Therefore, it seems that there is a change in the tectonic regime intensity in the Precordillera south of the Salar de Atacama. Regionally, the southern boundary of the Salar de Atacama (~24°S) coincides with the limit between the Altiplano and the Puna subdomain. These subdomains present different styles and magnitude of tectonic shortening (e.g. Allmendinger *et al.*, 1997) that can influence on the differences observed in the Precordillera. The Precordillera in the Puna subdomain (i.e. south of the Salar de Atacama) is characterized by the absence of major faults accommodating significant amounts of vertical displacements in the forearc. However, in the Altiplano subdomain, the recent Precordilleran structures accommodate at least 700 m of Pliocene-Quaternary down-to-the-east reverse motion in the Salar de Atacama

area and up to 2000 m of relative uplift between the Western Cordillera and the Central Depresion by Miocene flexures in the Altos de Pica and Iquique latitudes (19-21°S) (Victor *et al.*, 2004; Farías *et al.*, submitted). Despite the amount of uplift in the Altiplano and Puna has been similar, it seems that different mechanisms have acted to accommodate this uplift in the Precordillera as the Puna forearc is characterized, in the Salar de Punta Negra latitude and southwards, by the absence of major Neogene structures accommodating a significant part of the Cordillera uplift.

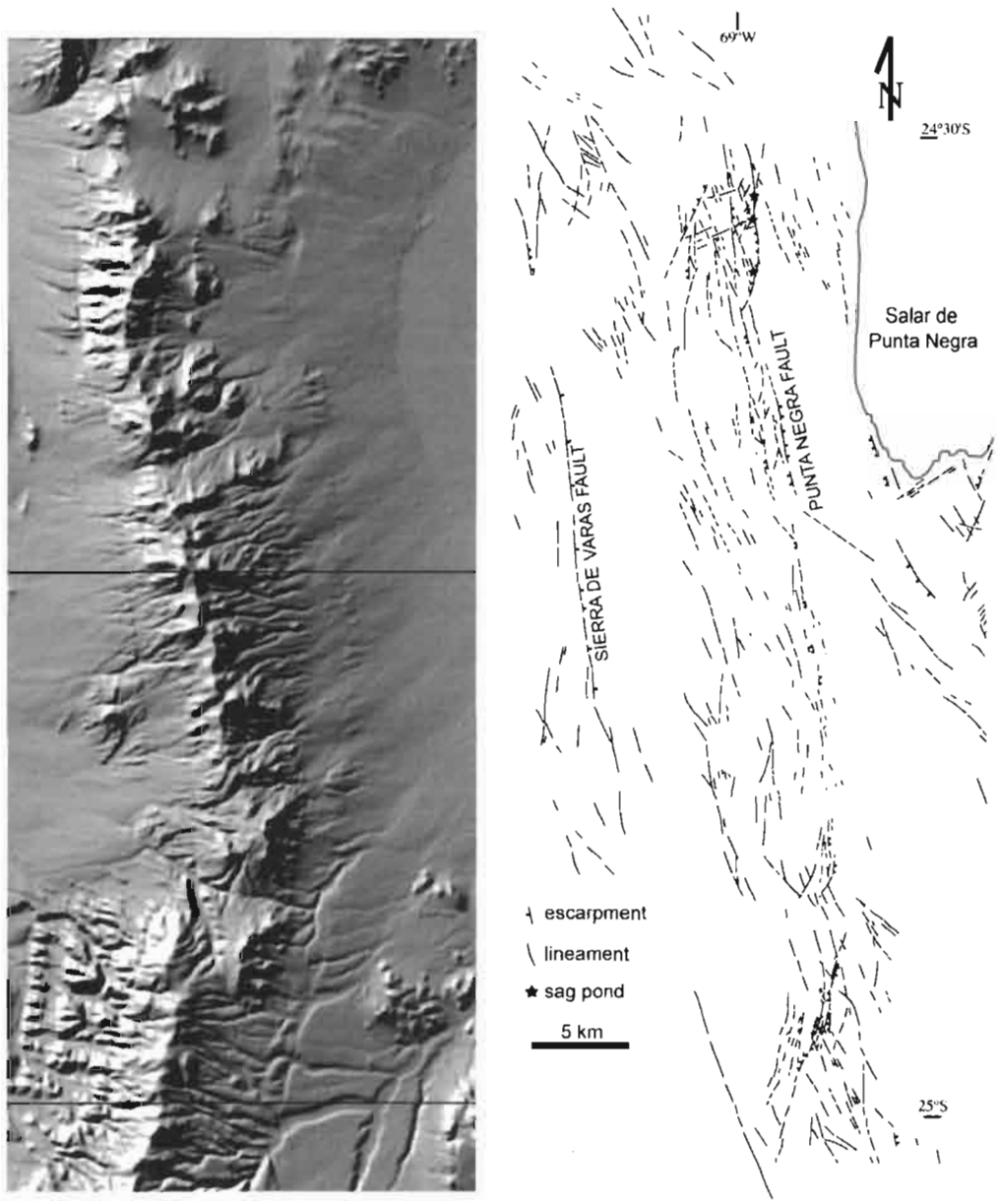

Fig. 2. DEM and photogeological interpretation from aerial photographies and Aster satellite images of lineaments affecting alluvial fan and active floodplain deposits.

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