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Structure and neotectonics of the Jaboncillo and Del Peral anticlines: New evidences of Pleistocene to ?Holocene deformation in the Andean piedmont

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INTRODUCTION

The neotectonic features developed in the northern region of Tunuyan Graben (figure 1a) have been previously studied by field works and photo-interpretation (Polanski, 1963; Yrigoyen, 1993, Cortés, 1993, Costa *et al.*, 2000). We integrate surface and subsurface data to develop an original schematic structural section and we analyze detailed topographic profiles and aerial photos to evaluate the structure and neotectonics of the area. This is located at 33°20'SL near the southern end of the central segment of Central Andes, in the Cordón del Plata foothills (figure 1a). The structural units recognized in the region are: Cordillera Frontal, Cerrilladas Pedemontanas and Tunuyán Graben (figure 1a).

The Cordillera Frontal was uplifted as a rigid block during the Plio-Pleistocene and is composed by a Carboniferous sedimentary basement covered with volcanic rocks associated with Choiyoi Group and intruded by Upper Paleozoic and Triassic granitoids (Polanski, 1958). In the study region this mountain belt can be divided in two segments: Cordón del Plata and Cordón del Portillo (figure 1a). The Cordón del Plata thrust-front is represented by La Carrera fault-system which was active until Pleistocene times (Caminos, 1979; Cortés, 1993). Nevertheless, the Cordón del Portillo thrust-front doesn't emerge and is covered by alluvial conglomerates indicating a decrease in neotectonic activity towards the south (Cortés *et al.*, 1999).

In the Cerrilladas Pedemontanas region Miocene to Pleistocene synorogenic deposits crops out in three NNW-trending belts of low altitude hills (figure 1a). These hills are the superficial expression of compressive deformation of Triassic depocenters of Cuyo basin that began in Late Pliocene and is still active (Irigoyen *et al.*, 2000, 2002). Previous researchers have identified both thin- and thick-skinned tectonic styles that coexist in a complex arrangement (Sarewitz, 1988, Kozlowski *et al.*, 1993, Cristallini *et al.*, 2000, Chiaramonte *et al.*, 2000).

The Tunuyán Graben (figure 1a) was defined by Polanski (1963), and comprises a Late Pliocene? to Holocene intermountain basin located between the Cordillera Frontal to the west and the Cerrilladas Pedemontanas to the east. Neogene synorogenic deposits and thin Triassic layers are presents in subsurface. Upper Pliocene to Middle Pleistocene coarse alluvial sediments were accumulated as response to latter orogenic pulses in the Cordillera Frontal. Folds and scarps developed in Pleistocene alluvial deposits are evidences of active tectonics in this zone (Cortés *et al.*, 1999).

STRUCTURE

Integration of seismic lines with new field data made possible the structural modeling of Jaboncillo and Del Peral anticlines (figure 1b). Seismic lines across both folds show that they were formed above an east-vergent very low-angle thrust (García, 2004). Two detachment levels are outlined within the Mariño Fm. and they are linked by a low-angle ramp located below Jaboncillo anticline (figure 1b). Del Peral anticline is compound by Middle Pleistocene sediments and Neogene units (figure 1c). This structure is interpreted as a fault-propagation fold developed by the eastward migration of the shallower thrust, loosing displacement to the south and interfering with the Totoral fault to the north.

Jaboncillo hills are composed by Middle Pleistocene coarse alluvial sediments (La Invernada Fm.) and little Neogene outcrops, that are observed in the bedrock of some cross-cutting creeks near the fold hinge (figure 1c). Jaboncillo anticline is modeled as a fault-bend fold formed above the linking ramp. As it can be interpreted from the structural sections, this structure is a doubly-plunging anticline with a curved fold axis (NNE-trend in the south and NW-trend in the north) (figure 1c). Both folds define a thin-skinned structural style that contrasts with the dominant one in the Cerrilladas Pedemontanas, where basement is involved in the deformation.

NEOTECTONICS

Three scarps developed in Jaboncillo hills were identified. These are regularly spaced and have a sub-parallel map design with a general NNW-trending (figure 1c). Another common feature is that the eastern block is the elevated one, indicating, together with its straight map design, that these are fault-scarps. We interpret that these have been formed by very shallow backthrusts detached within incompetent layers of La Pilona Fm (Late Middle Miocene). In the NE sector, the easternmost fault-scarp affects Upper Pleistocene terraced alluvial deposits (Las Tunas Fm.), allowing us to infer Late Pleistocene tectonic activity. The map design of the scarps respect to the general trend of the fold axis also indicates that dextral strike-slip displacements probably occurred in this region (figure 1c). A local pediment-shaped surface developed above both folds was recognized. This is better preserved in the backlimbs and it was formed during an erosive period near the Middle to Late Pleistocene. The original slope of the pediment was of about 4°-5° to the east, but at the present is nearly horizontal to 1° dipping to the west; therefore a little counter-slope rotation is interpreted. This rotation is linked with folding activity in both anticlines during Late Pleistocene times.

Field work mainly consisted in the survey of ten detailed topographic profiles across both hills, following creeks and hilltops. The hilltops profiles have been used to verify the presence of the scarps in sectors where these features are poorly preserved. Likewise, an accurate recognition of the pediment surface was possible in these profiles. The creeks equilibrium-profiles were analyzed in detail. Convex-up profiles of Jaboncillo creeks are founded and it was possible to define several segments with different dips. Some changes in the stream-sinuosity are associated with these dip-changes, increasing the sinuosity with dipping. Streams equilibrium-profiles characterize an unbalanced zone associated with Jaboncillo anticline. Using all creek profiles the SL (stream-length) index was calculated (Hack, 1973). The results were represented in a map of SL index values which indicates sectors with perturbations in the equilibrium profiles (high SL values). These perturbations are associated with: fault-scarps activity, modern folding and lithological variations.

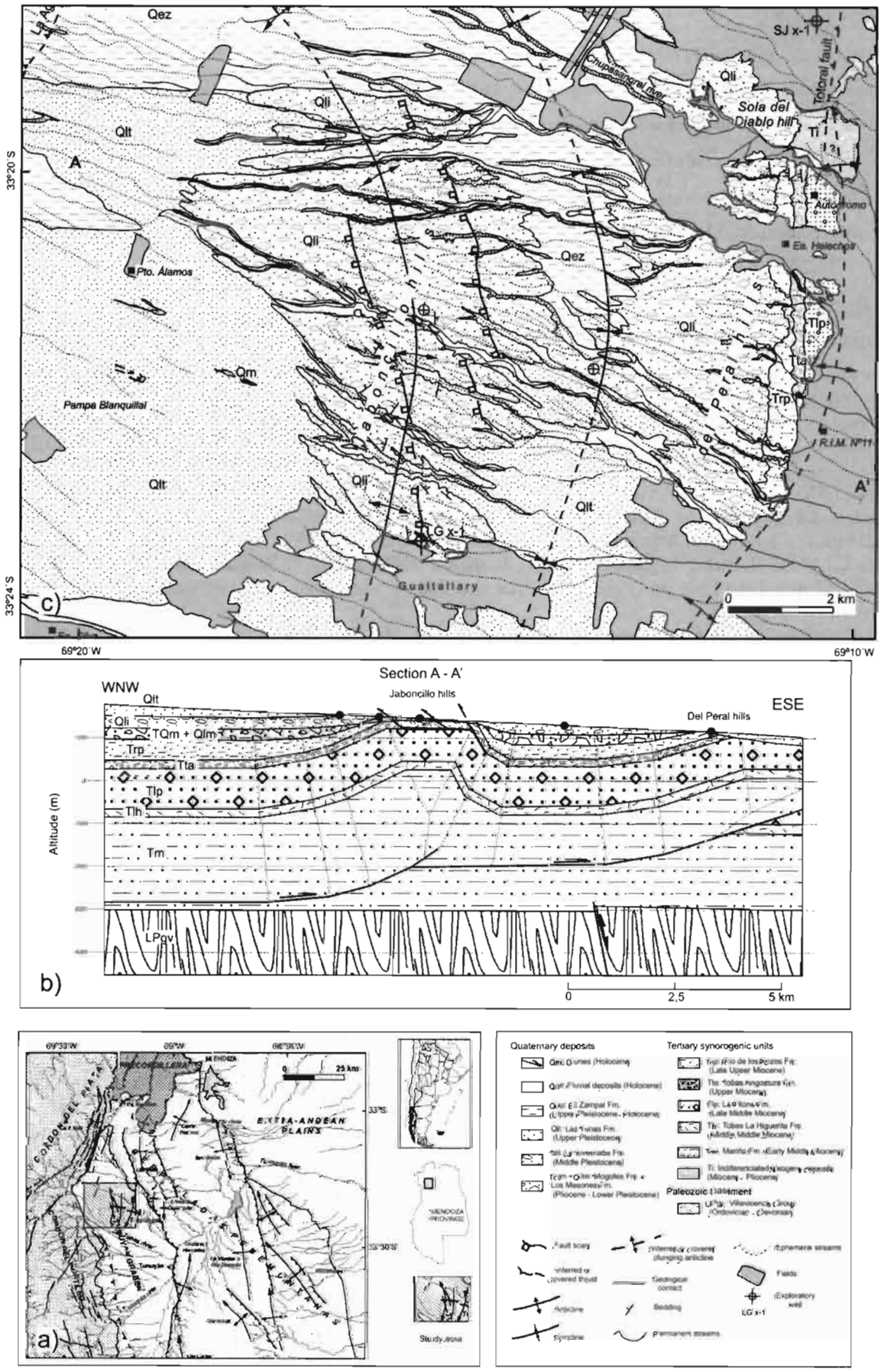

Figure 1: a) Study zone location, b) Schematic structural section, c) Geological map.

CONCLUSIONS

1. Jaboncillo and Del Peral anticlines are fault-related folds developed above a very low-angle thrust with shallow detachment levels within the Mariño Fm. (Middle Miocene) defining a thin-skinned tectonic style.

2. The fault scarps and pediment-shaped surface affects Middle to Late Pleistocene deposits (La Invernada and Las Tunas Formations) indicating tectonic activity in these times.

3. The zone with convex-up creek equilibrium profiles and some perturbations determined by high SL values are strong evidences of Late Pleistocene to Holocene? deformation.

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