NEOGENE DEXTRAL TRANSPRESSION AT THE SOUTHERN EDGE OF THE ALTIPLANO-PUNA (N-W ARGENTINA).

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RESUME: Le haut-plateau andin (Altiplano-Puna) constitue la manifestation topographique majeure de la chaîne des Andes centrales associée à la convergence Est-Ouest entre la plaque pacifique Nazca et l'Amérique du Sud. Dans le NW de l'Argentine (27°S), la limite Sud-Est de la Puna est une zone de transfert majeure entre deux domaines crustaux, l'un au nord fortement raccourci et épaissi, l'autre au sud plus modérement déformé. L'étude d'un Modèle Numérique de Terrain, d'images satellitaires (SPOT), nos observations de terrain, et l'analyse cinématique des populations de failles, permettent d'interprêter cette zone comme une zone transpressive et dextre, accommodant une augmentation du taux de raccourcissement Est-Ouest, depuis le Sud vers le Nord.

KEY WORDS: Andes, Altiplano-Puna, Transpression, Digital Mapping, Fault kinematics.

INTRODUCTION AND GEOLOGICAL SETTING

The main topographic feature of the Central Andes is the Altiplano-Puna (grey area, Fig.1). In northwestern Argentina (27°S), the Andean cordillera narrows abruptly and the foreland Pampean province contains alternating basins and ranges (black, Fig.1). The transition (stipped area, Fig. 1) coincides with two features (Stelzner, 1923): (1) a change in the dip of the subducting Nazca plate, from about 30° easterly dip below the Puna, to subhorizontal below the Pampean province (Cahill & Isacks,1992), and (2) a disappearance of the Neogene andesitic volcanism (Jordan et al.,1983).

The Pampean Ranges strike subparallel to the chain. The ranges consist of Precambrian to Paleozoic plutonic and metamorphic rocks. Basins are filled with Tertiary to Quaternary continental sediments, deposited on a Pre-Miocene erosion surface often well exposed on the ranges. Basins and ranges are generally bounded by high-angle reverse fault zones of dominantly eastward vergence. Sediments show an overall upward coarsening and increase in thickness from the Miocene to the Pliocene (Malizzia,1988), reflecting an increase in tectonic activity.

This paper presents a structural interpretation of the area using digital mapping, satellite images (SPOT), and a kinematic analysis of fault populations.

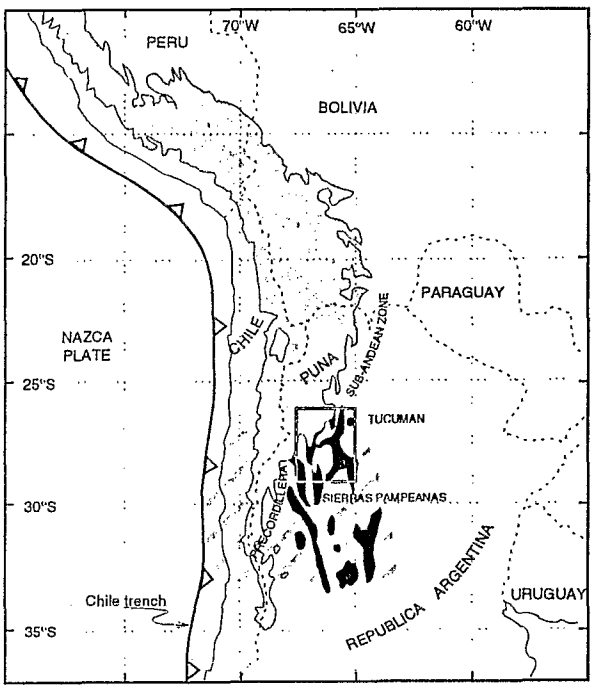

Figure 1.

REGIONAL STRUCTURES

We have produced numerical topographic images of an area covering the northern

Pampean Ranges (Fig.2). From SE to NW, the altitude increases in steps, from the Chaco-Pampean level (230 m) (Fig.2b. SE corner) to the Puna (average altitude >3700 m) (Fig.2b. NW corner). As basins become higher, the sedimentary infill becomes thicker and their surface area decreases. This, we interpret as illustrating an increase of the degree of basin evolution, i.e. an increase in the amount of bulk crustal shortening towards the Altiplano.

Basins and ranges are generally asymmetric, with a spacing of several tens of kilometers.

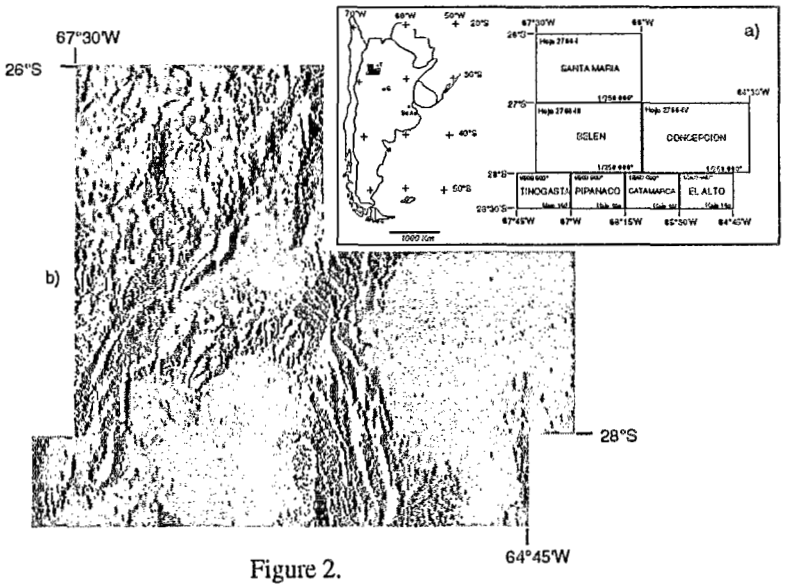

Figure 2.

Unfaulted margins of individual basins are gently dipping and controlled by the pre-Miocene erosion surface; whereas thrusted margins show sharp relief (Fig. 2). More symmetrical depressions, bounded by fault zones of opposite vergence, also occur (Fig. 3).

The overall strike of basins and ranges changes sharply, from a regional NS attitude, to NE-SW orientations within the transition zone between the southern Sierras Pampeanas and the Puna. This zone, previously known as the Tucumán lineament (Mon, 1976), is also marked by (1) en échelon ranges (Figs. 2 and 3), and (2) strong changes in the amount of thrusting along individual basin margins. These features suggest that significant wrenching and block rotations have occurred within this zone.

FAULT KINEMATICS

Striated fault planes were measured at several localities along basin boundaries, within both basement and tertiary sediments (Fig. 4). A statistical analysis of fault populations indicates that (1) the principal direction of bulk shortening is subhorizontal and strikes dominantly EW to ENE-WSW at regional scale, (2) it changes to dominantly NW-SE along the Puna boundary, (3) the principal extension direction is variable, from steeply dipping to subhorizontal, indicating that substantial stretching along strike has locally occurred, and (4) strains are of plane-strain to flattening type. Thus the local kinematics associated with basin development differ significantly from pure thrusting. The principal shortening direction is frequently oblique to basin boundaries (Fig. 4). Hence we infer substantial components of dextral strike-slip along NNE-SSW to NE-SW directions. Conjugate sinistral strike-slip occurred to a lesser extent along NNW-SSE directions.

CONCLUSIONS

For the northern Sierras Pampeanas, we infer substantial dextral wrenching along the southern border of the Puna Plateau during the Neogene. This transpressive basin and range province (the Tucumán Transfer Zone), is interpreted as accommodating a change in the amount of horizontal shortening, between the strongly thickened domain of the Puna to the North and the less deformed Sierras Pampeanas to the South.

REFERENCES

R.W. Allmendinger, 1986, Tectonic development, southeastern border of the Puna Plateau, northwestern Argentina Andes, Geol. Soc. Amer. Bull., 97, 1070-1082.

R.W. Allmendinger, 1989, Neotectonic deformation of the southern Puna Plateau, northwestern Argentina, J. South Amer. Earth Sci., 2, 111-130.

T. Cahill and B.L. Isacks, 1992, Seismicity and shape of the subducted Nazca Plate, Journal of Geophysical Research, 97, 17503-17529.

T.E. Jordan, B.L. Isacks, V. Ramos and R.W. Allmendinger, 1983, Mountain building in the Central Andes, Episodes, 1983, 20-26.
D.C. Malizzia, 1988, Indicadores litológicos de paleoclima en el Neógeno de Sierras Pampeanas, II reunión Argentina de sedimentología., Actas I, 160-164.
R. Mon, 1976, La tectónica del borde oriental de Los Andes en las provincia de Salta, Tucumán y Catamarca, República Argentina, Rev. Assoc. Geol. Argentina, XXXI, 65-72.
A. Stelzner, 1923, Contribuciones a la geología de la República Argentina, con la parte limítrofe de los Andes Chilenos entre los 32 y 33° S, VIII Actas Acad. Nac. Cienc. (Córdoba).

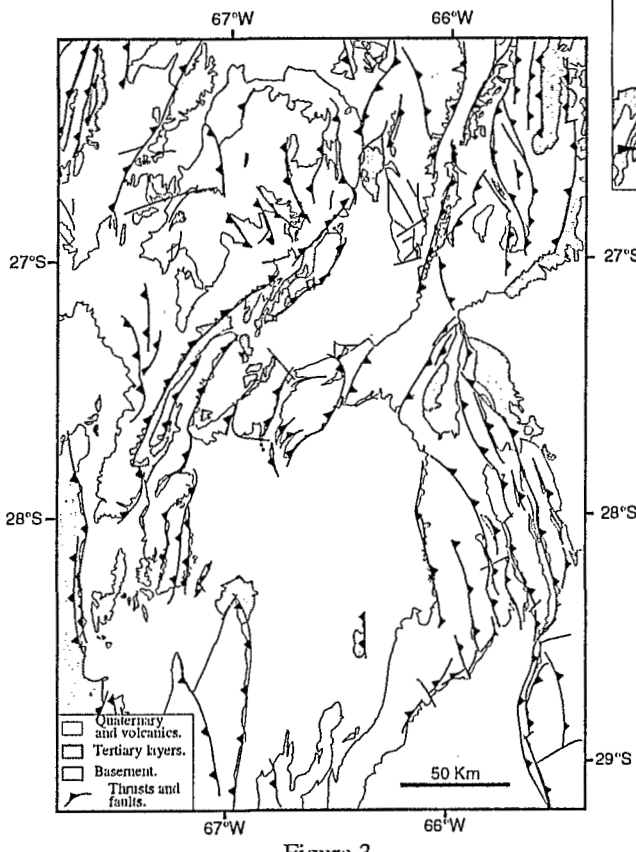

Figure 3.

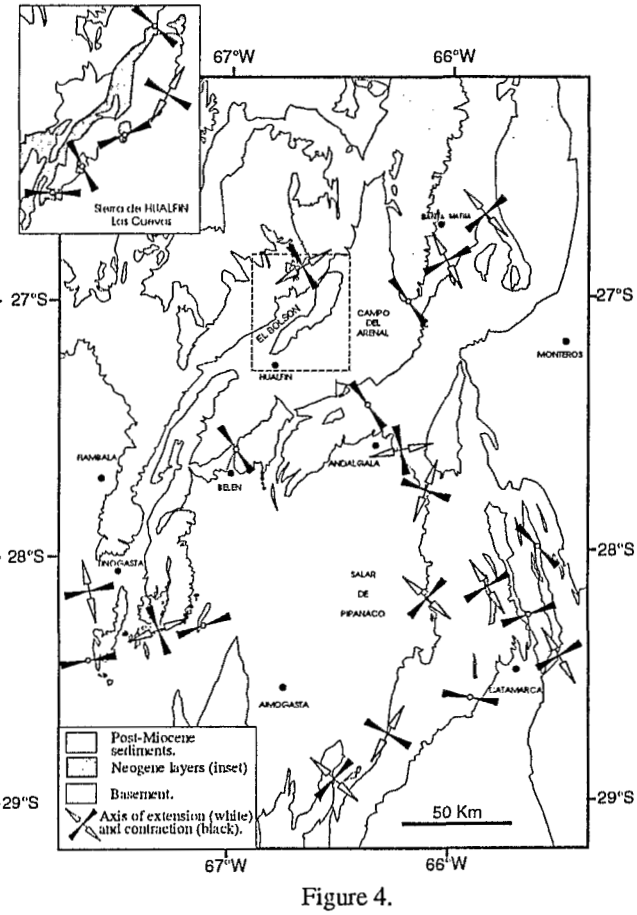

Figure 4.