NEOTECTONIC OF SUBANDES/BRAZILIAN CRATON BOUNDARIES: DATA FROM THE MARAÑON AND BENI BASINS

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RESUME: L'étude néotectonique des deux bassins de l'avant pays andin montre que la partie distale (coté craton) est déformée par la réactivation des structures du soubassement, alors que la partie proximale subit l'influence des structures andines. On en conclut à la priorité des structures anciennes réactivées sur les structures subandines nouvelles, et à une explication aux anomalies de direction de contrainte observées à la limite entre craton et zone subandine au nord du Pérou.

KEY WORDS: Neotectonics, Subsidence, Foreland basins, Subandes, Peru, Bolivia.

INTRODUCTION

The neotectonic relations between the Andes and the Brazilian craton are poorly documented. The usual model emphasized the subsidence of the foreland basins, which is only true in the case of very large areas and long periods of time. At the scale of the Andean range, the geometry of the subducted oceanic slab is related to the location of subsiding basins over normal Beniof zones, and non-subsiding forelands over flat slab segments (Jordan *et al.* 1983). At a regional scale, subduction in foredeep depends, on the andean side, on the structure of the foothills Piedmont, and on the craton side on reactivated structures in the basement of the basin. The aim of the paper is to focus on the last points, using data from the two main subsiding basins of the Andes, the Marañón basin at the north and the Beni Basin at the South.

GEOLOGICAL SETTING AND STUDY METHODS

The Subandean basins constitute a transition zone between the Brazilian shield to the east and the Subandean Thrust and Fold Belt (Mégard 1984) to the west. They are characterized by extensive floodplains with highly unstable large rivers (Marañón, Ucayali, Beni and Mamore rivers). Neotectonics is studied using geomorphology of the fluvial network, successive shifting of rivers and asymmetrical patterns (Dumont, in press,b), as well as geometric pattern of lakes (Dumont, in press,a). When available, data from surface landforms are combined with structural data from the basement (Laurent and Pardo 1975; Laurent 1985; Sempere 1990) and neotectonic and sismotectonic data from the surrounding regions (Assumpçáo and Suarez 1988; Assumpçáo 1992).

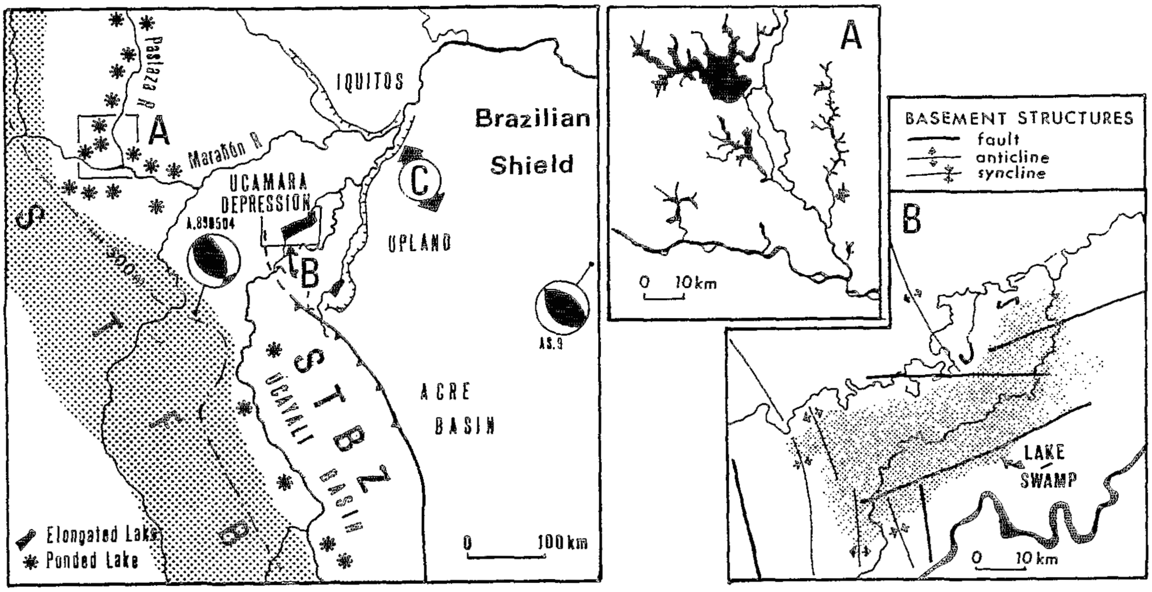

Fig.1. Left: Structural scheme of Peruvian subandes and Brazilian craton border. Right: A: ria lakes; B: elongated lakes. See location on the left figure.

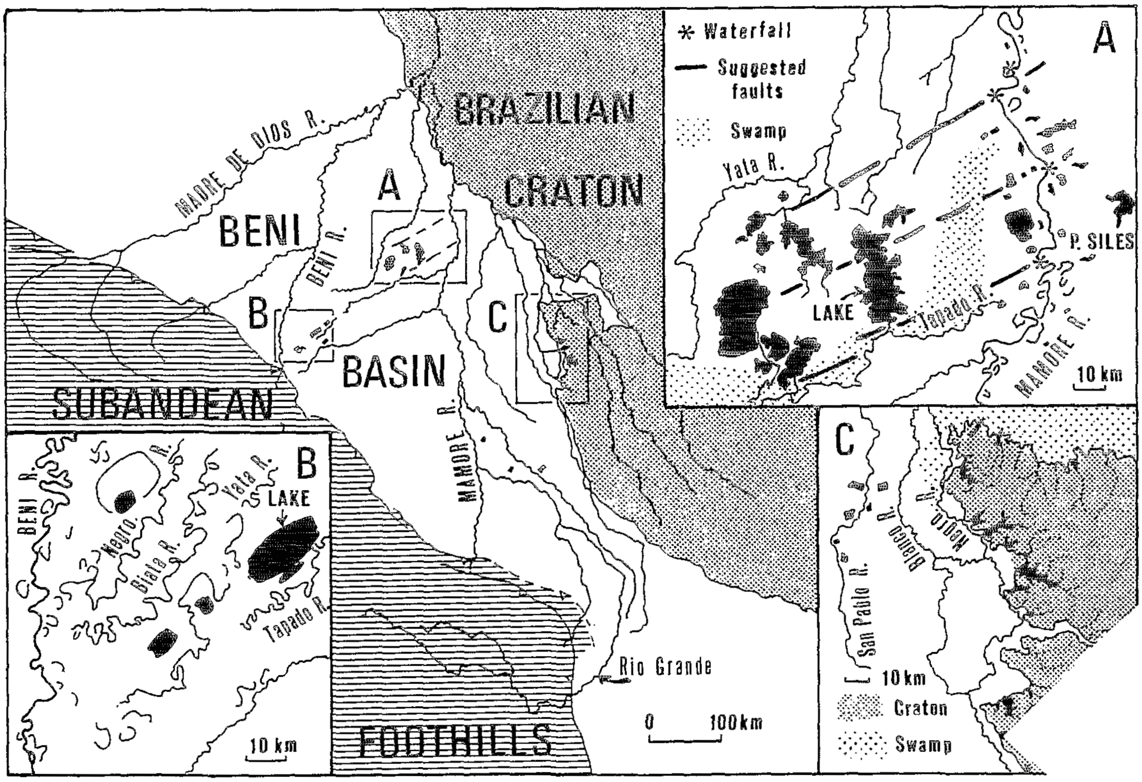

Fig.2. Center: Structural scheme of the Beni Basin and borders, from Sempere (1990), simplified and complemented. A: ria lakes (tilted); B: rectangular lakes; C: ria lakes.

THE MARAÑON BASIN

The basin extends over about 375 km WE and 475 km NW-SE. It comprises two parts (Fig.1): the North-trending Pastaza Depression to the north (Laurent and Pardo, 1975) and the triangle shaped Ucayali-Marañón (shortly Ucamara) Depression to the south. Clusters of ria lakes in the lower Pastaza and west Marañón Basin (Fig. 1,A), (Dumont, in press,a) near the foothills border fit with the structural axis of the basin (Sanz 1974; Laurent and Pardo 1975). In the Ucamara Depression we observe NE trending elongated lakes (Dumont, in press,a), which are parallel with the successive positions of the Ucayali River (Dumont, in press,b). This direction is related to the "en échelon" system of the Marañón Fault Zone, reported for the late Paleozoic by Laurent (1985). The main direction of the lakes is interpreted as the surface expression of tension stress, superimposed over reactivated basement structures (Fig. 1,B), (Dumont and Garcia 1991, Dumont, in press,a). This is compatible with faults observed in the Quaternary deposits of the craton border (Fig.1C; Dumont *et al.* 1988). This direction is parallel to P-axis orientation of focal mechanisms observed on both sides of the depression (stereograms on fig. 1, from: Assumpçáo 1992, and: Assumpçáo and Suarez 1988). P-axis orientation in, and around the depression is about 40 degrees away from the usual (WE) P-axis orientation at the Subandes-Craton border (Assumpçáo 1992).

THE BENI BASIN

The Beni Basin is the southern drainage area from the Andean-Amazonian fluvial network. The flat lowlands are about 800 km NS, broader to the north (500 km) than to the south (150 km) (Fig. 2), which fronts the apex of the Bolivian orocline (Sempere 1990).

The Northwestern part of the basin is characterized by the extensive floodplain of the Beni River. The western part of the floodplain, close to the Piedmont of the foothills, expresses active subsidence, evidenced by the flooding of forested areas (Dumont *et al.* 1991,b), and the formation of large lakes of black water, invaded by sedimentary deltas from the silty white water of the Beni River.

River shifting is obvious in several parts of the basin. In the central part, successive stages of river shifting of the Beni River (Tapado, Yata, Biata and Negro rivers) are evidenced by underfit rivers. This shows a counterclockwise displacement of the Beni River from a Northeast trend up to the present Northern direction (Fig. 2,B). The shifting of the Rio Grande towards the west (counter clockwise) may be correlated to that of the Beni River. Numerous ria lakes on the craton border (Fig.2,C) characterize the former floodplain aggradation of the Rio Grande River in this area. Similar trends of river shifting all over the basin possibly resulted due to the onset of a thrusting event along the subandean border of the Beni basin.

The eastern part of the Beni Basin is characterized by a basement structure control (Allenby 1988). There, the present Beni River valley appears to be structurally controlled (Dumont *et al.* 1991,b). North of Puerto Siles (Fig.2,A), a cluster of more or less rounded ria lakes occurs far away from the influence of sediment charged rivers. The Mamore River has a reduced sinuosity across the cluster area, along reaches limited by rapids. This is interpreted as changes of the slope induced by neotectonic deformations (Schumm 1986). Outcrops of hard rocks generating the rapids suggest the effect of block tectonics (Allenby 1988), and tilting, which has resulted in a flooded topography and ria lakes.

CONCLUSION

Distal, or craton side, areas of foreland basins are characterized by block tectonics which generate subsidence (Ucamara Depression), tilting or uplift (Beni Basin) along reactivated basement structures. Most of these structures are rapported to faults of pre-cretaceous age. On the other side, regional subsidence occurs in the proximal areas of the basin, in front of the foothills Piedmont.

It is suggested here that reactivated basement structures may explain the local deviation of sismotectonic constraints at the basin-craton boundaries.

Differences in the style of neotectonics between the proximal and distal parts of foreland basins suggest that in a specific region the reactivation of old basement structures predate the onset of Andean structures. This conclusion may help to understand how the reactivated basement structures may influence the development of Andean foreland structures, and specially the observed anomalies.

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