STRUCTURE AND KINEMATIC EVOLUTION OF SUBANDEAN THRUST SYSTEM OF BOLIVIA

Gérard Hérail (1), Patrice Baby (2), Marcimio López (3),Jaime Oller (3),Oscar López (3), René Salinas (3), Thierry Sempéré (2),Garry Beccar (3), Humberto Toledo (3)

1 : ORSTOM, CP 9214, La Paz, Bolivia

2 : ORSTOM, CC 4875, Santa Cruz, Bolivia

3 : YPFB-GXG, CC 1659, Santa Cruz, Bolivia

Résumé

La structuration de la zone subandine de Bolivie est décrite à partir d'une série de coupes équilibrées. On montre le rôle des lithologies et géométries sédimentaires antéorogéniques sur la déformation et on décrit les transformations géométriques acquises au cours de la déformation.

Key-words : Sub-andean belt, Bolivia, foreland belt, thrust.

The Subandean belt of Bolivia (13° 30'S - 15 30'S) is a curved fold-thrust belt predominantly verging toward the east and northeast (1,2). The structuration of this belt began in the Late Oligocene and is still developing. The fold thrust belt is bounded on its Andean side by the Main Frontal Thrust (CFP), whereas its structures die out eastwards in the Beni and Chaco plains. The Chapare buttress, which has a poorly known structure, separates the northern Subandean (SAN) from the southern Subandean (SAS) (3). On each side of the Chapare buttress the pre-orogenic sedimentary pile (4) shows distinct geometrical characteristics (fig. 1).

The SAN (fig. 2A) is 60 to 80 km-wide and consists of 2 strips of different structure, separated by the Marimonos-Toregua thrust. In the Southwest, vigorous reliefs are due to thick sheets detached in the Silurian and redeformed by development at depth of Ordovician duplexes. In the northeast, broad synclines are bounded toward the foreland by a discontinuous and complex thrust front produced by Ordivician duplexes evolving to intercutaneous wedges. Shortening estimated by restoratinn is 136 km, i.e 51%.

The SAS (fig. 2B) is 100 to 140 km-wide and also shows 2 strips of different structure, separated by the Mandiyuti thrust. In the west, the structure is essentially due to

sheets detached in the Silurian, within which lift-off, fault propagation and fault-bend folds developed. In the east, development of numerous duplexes generated antiformal stacks. Total shortening increases from the Argentina border (70 km, i.e. 33%) toward the North (136 km, i.e. 47%, at 21° 20'5; 139 km, i.e 53%, at 20° 5).

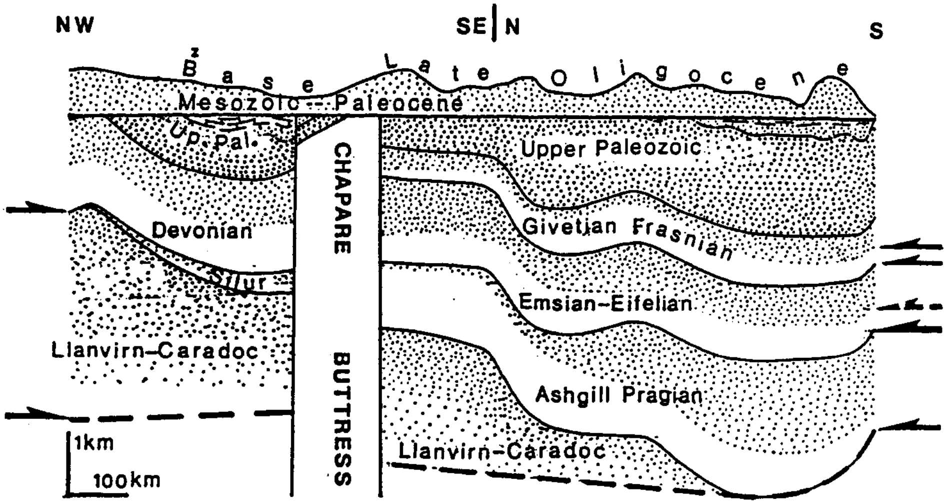

Fig. 1 : The preorogenic sedimentary pile.

In the SAS, the low-angle slope of the basal decollement, the multiplicity and regularity of the overlying decollements, and the low thickness variability of competent levels in E-W directions facilitated the eastward propagation of deformation and the relaying of upper thrusts by deeper and more external thrusts when the first jammed. In the SAN, in the contrary, the high-angle slope of the basal décollement and the NE-tapering of the lithological units affected by the deformation led to frequent jamming of thrust propagation (piling-up of thick sheets, reactivation of structures by more internal thrusts).

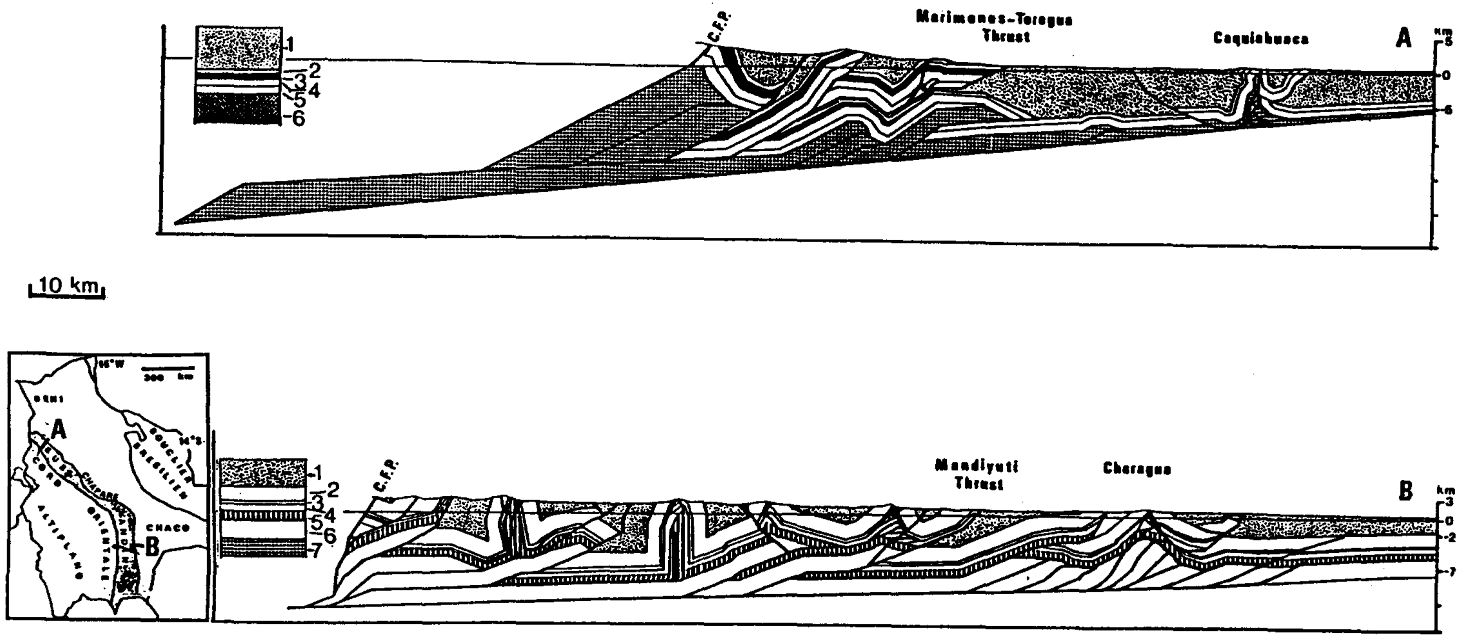

Fig. 2 - Balanced cross-sections in the Subandean thrust fold belt of Bolivia. A: Cross-section (located in the map): 1. Synorogenic sediments (Oligocene to Present); 2. Mesozoic; 3. Permian and Carboniferous; 4. Devonian; 5. Silurian; 6. Ordovician. B: Cross-section (located in the map) : 1. Synorogenic sediments (Oligocene to Present); 2. Mosozoic, Permian and Carboniferous; 3. Iquiri Formation; 4. Los Monos Formation (Givetian to Frasnian; 5. Upper Silurian and lower to middle Devonian; 6. Lower to middle Silurian; 7. Ordovician. C.F.P. Main Frontal Thrust.

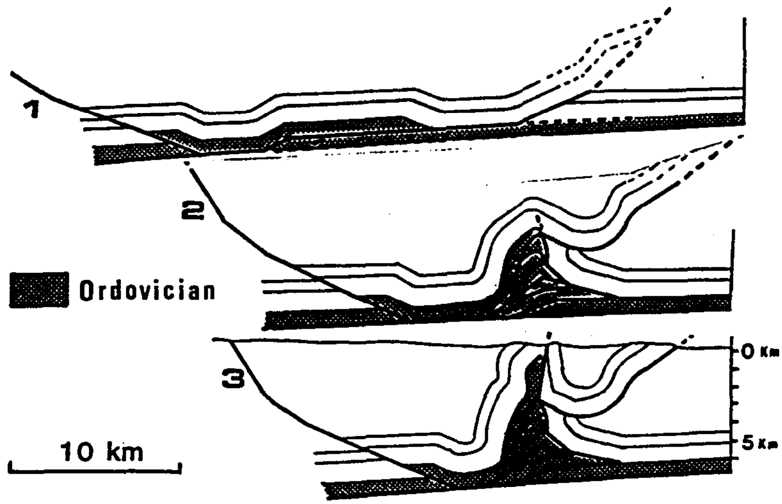

Fig. 3 : Thrust sequence in the Sierra de Caquiahuaca.

Construction of balanced cross-sections gives a regional description of the Subandean structure (fig.2) and permits to reconstitute the evolution of specific structures (fig.3) and to show their lateral variation. In some cases (i.e. in the southermost tip of the belt), development of easternmost anticlines (emerging or not) is due to formation of duplexes in the Silurian where the paleogeographic increase of the slope of the basal decollement jammed the progression of deformation. In other cases (i.e. in the Serrania de Charagua), the easternmost structures follow an increase of the slope of the basal decollement due to flexion by thrust loading.

Geometry and kinematics of deformation in the Subandean fold-thrust belt and foreland basin are controlled by (a) the geometry of the pre-orogenic sedimentary units, which depends on paleogeography of the basins where they were deposited and on their pre-Andean evolution , and (b) modifications of the geometry of the belt during deformation.

References

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