

COMPARATIVE EVOLUTION OF THE EASTERN CORDILLERA (COLOMBIA)
AND THE ANDES OF MERIDA (VENEZUELA) SINCE MIOCENE

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RESUMEN : La historia orogénica de los Andes de Venezuela y de la Cordillera Oriental de Colombia empieza en el Mioceno inferior. Después de este período de inicio común, las dos cordilleras evolucionaron separadamente hasta principios del Cuaternario, cuando adquieren el funcionamiento de conjunto actualmente vigente.

KEY WORDS : Venezuela, Colombia, Neogene, Quaternary, Tectonic evolution.

The Andes Cordillera of Merida forms, over about 450 km long and 100 km wide, a double-sided buckling structure oriented NE-SW. This structure seems to be rootless. Both of its sides are overthrusting extended lowlands in the NW and SE directions, respectively. Both vaults are separated by a strike-slip fault system (Bocono faults), which is running from one end of the chain to the other. The double-sided buckling structure is symmetrical, or not, whether the strike-slip fault system lies along the chain axis, or not.

This mountain belt was generated by the convergence between the Lake of Maracaibo block and the South American shield. This convergence is lasting through the times since Miocene until now, with variable rates and directions. Since early quaternary times the convergence is oblique and one can observe that it is accommodated by the major sub parallel fault systems. The right-lateral component is parallel to the chain axis and is essentially absorbed by the central strike-slip system. The perpendicular component results in overthrusts oriented outward with respect to the chain axis. Such a mechanism implies that the overthrusts extends below the chain like surfaces of décollement, below which both convergent crustal blocks are slipped and quizzed. Moreover this mechanism implies that the main strike-slip fault system is a weak fault. This interpretation is in good agreement with the observed directions of maximum horizontal stress, closely perpendicular to the chain axis.

The Oriental Cordillera of Colombia looks more or less like a triangle extended NNE-SSW, 800 km long, and at most 240 km wide at its northern end. With respect to the classical andean system, which can be followed from the center of Peru, it represents an additional cordillera. These two mountain systems are separated by the depression of the Magdalena river, except at the southern end of the Oriental Cordillera, where both mountain belts join together. When sufficiently wide the Oriental Cordillera of Colombia looks like a locally highly broken highland. It is presently colliding obliquely with the South American shield. The angle between the chain axis and the direction of convergence is

very small southward and opens gradually northward. The most active deformations are concentrated eastward within a 20 to 60 km wide band. Two sub-regions with different tectonic mechanisms and separated by a transition zone must be considered in this strip band.

In the southern sub-region, over about 350 km, the convergence is accommodated by several subparallel systems similar to the Andes of Merida. Some faults are pure thrust. Others form a system of large en-echelon right-lateral strike-slip faults cutting obliquely through the southern part of the chain, from its western flank to the South, to its eastern flank to the North.

The transition zone is centered on Villavicencio. Here, thrust faults are not always parallel to the chain axis, right-lateral strike-slip faults smoothly vanish northeastwards and the frontal underthrusting becomes more and more oblique. Finally, in the northern region, strike-slip faults become minor over the last 250 km and the underthrusting of the shield is accommodated with a large dextral component.

It must be noticed that the underthrusting of the shield is more important northeastward. This explains both the widening of the cordillera and a larger internal shortening, which partly takes place on the great reverse faults by which the cordillera is overthrusting the depression of the Magdalena river.

The active front of the Oriental Cordillera of Colombia is connected with the Venezuelan Andes through an extremely complex deformed zone, oriented NW-SE, about 50 km wide, which is located at the border of both countries. Since early Quaternary both systems have the same pole of rotation and form the main limit between the Caribbean and South American plates.

Both cordilleras started their orogenic history simultaneously, in early Miocene, when the Venezuelan Andes began to be very progressively uplifted, with reverse faulting of its northwestward flank and intense continental flexuration outward from the chain. Meanwhile, the Oriental Cordillera of Colombia also began to be uplifted with almost the same tectonic features as the Venezuelan Andes: continental flexuration and intense reverse faulting. The orogenic initiation of both cordilleras could be the consequence of the collision of the Arc of Panama against the Occidental front of the South American continent.

Nevertheless, between this common early start and the Quaternary times, these two cordilleras develop themselves in different ways. In fact, the collision is already acting in Colombia in the middle Miocene (starting at the upper part of the lower Miocene?), although probably following rates and directions different to the present ones. In the meantime, the convergence remains nearly perpendicular to the Venezuelan Andes except in Pliocene times when its orientation is such that the central strike-slip system becomes left lateral, opposite to the actual one.