ACTIVE FAULTING IN THE SOUTHERN VENEZUELAN ANDES AND COLOMBIAN BORDERLAND

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INTRODUCTION

Along the Southern Venezuelan Andes, the Boconó fault shows a progressive displacement to the West of his NE-SW trending active trace with respect to its axial position exhibited North of Mérida (Fig. 1). Such a shifting of the Boconó active trace is produced by the introduction of a sigmoidal releasing bend connection between several NE-SW segments of the fault, which are characterized by a right steppover geometry. This kind of double deflection pattern occurs close to several highly complicated structural sites located along the fault trace, which constitute significant potential barriers to fault rupture propagation, as may be the case for the following neotectonic features: La González-Estanques pull apart, South of Mérida; Bailadores steppover; La Grita double bend; Los Mirtos-Zumbador composite pull apart and Capacho restraining bend, West of San Cristóbal; La Mulera and Cerro Rangel transpressive push-up ridges in the venezuelan margin of the Rio Táchira, and La Huchena right steppover on the colombian side of this river (Fig. 2). At several of these potential barrier sites, the Boconó active fault displays a system of secondary active traces characterized by a dense branching pattern on the east side of the master fault, and by a progressive damping to the South against the NW-SE sinistral reverse Bramón fault system.

Between Mérida and San Cristóbal, we have surveyed the following secondary branch faults (Fig. 2): San José de Bolívar, Queniquea and La Colorada-La Maravilla right lateral faults, and the San Cristóbal right lateral reverse fault. Between the Capacho restraining bend and the Táchira river, the Boconó main active trace displays a left lateral active branch on each side: to the South, the Caña Brava faults cutting across the Rubio basin (MEIER *et al.*, 1987) and to the North, the Llano Grande Fault. Close to the Colombia borderland, the Boconó active trace gets a conspicuous anastomosed pattern along the transpressive push-up structures of the La Mulera and Cerro Rangel ridges.

Such an occurrence of branching and transpressive faulting features, observed along the southern end of the Boconó active fault and the associated Sierra de Cazadero thrusting structures (MEIER, 1984), take place as a consequence of the convergent movement produced by the Boconó and Bramón fault systems into a squeezing zone defined by the geometry of these faults. In the same way, these kinematic conditions explain the occurrence of a significant damping of the strike-slip motion of the Boconó fault and the accommodation of the corresponding decreasing activity through compressional deformations.

As an attempt to estimate the importance of the Boconó fault damping along its southwestern end, we have got evidences of a markedly decrease of its slip-rate activity using a paleomagnetic age controlled Pleistocene offset drainage, located transversally to the Peribeca pull apart (North-South Catarnica-Velandría canyon drainage) and other drainage offsets data obtained near the Dantera canyon cross-site, close to the Colombian border. In this way, the slip-rate of the Boconó fault at the first site is less than 1 mm/yr and at the second site, probably as low or less than 0.5 mm/yr (SINGER *et al.*, 1991).

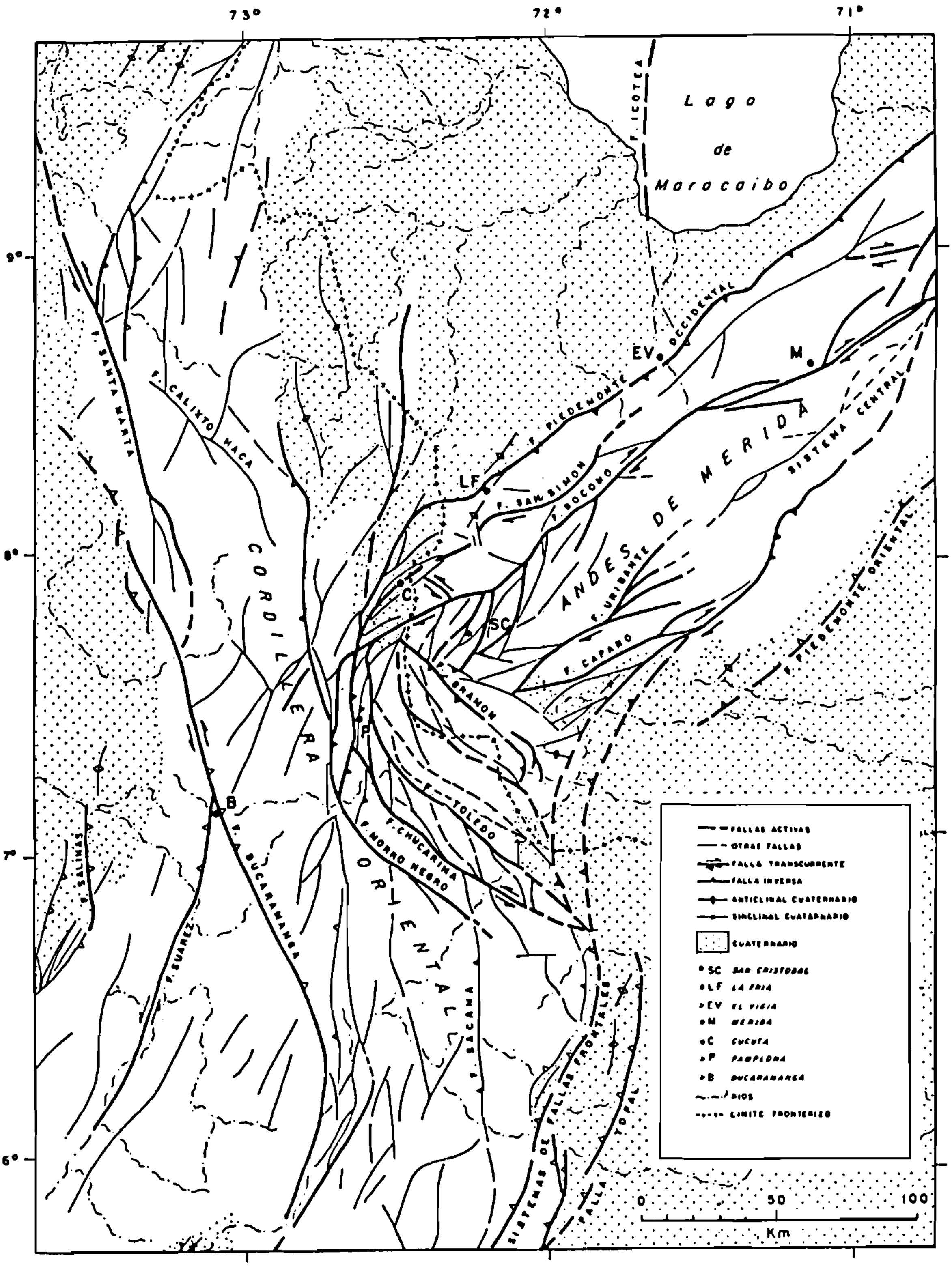

Fig. 1 General tectonic setting of the Southwestern Venezuelan Andes and Colombian borderland.

According to the above slip-rate estimate, it appears that a rate right lateral rate displacement as high as 5 to 7 mm/yr obtained by SCHUBERT *et al.* (1983) South of Mérida along the Plio-Pleistocene La Gonzalez-Estanques pull apart and 5 to 6 mm/yr obtained by AUDEMARD & SOULAS (1995) from paleoseismic trenching assessment at La Grita, cannot be extrapolated to the southern venezuelan segment of the Boconó fault and also along its prolongation beyond the Colombian frontier through the Palo Colorado fault (BOINET, 1985). Additionally, the above mentioned evidences of a decreasing activity of the slip rate along the southern end of the Boconó fault, is consistent with the apparent existence of a kinematic discontinuity introduced by the connection pattern between this right lateral strike-slip fault and the Chinácota and Chucarima left lateral reverse faults, that define part of the geometry of the "Pamplona indenter" in the colombian borderland (BOINET, 1985).

Moreover, the progressive deactivation of the main lateral motion of the Boconó master fault seems to be accommodated by subparallel right lateral active fault system identified on both sides of the main fault (Fig. 2). On the west side, the active traces of the three SW-NE branches of the San Pedro-Aguas Calientes fault cross the Táchira and Pamplonita alluvial valleys through the Cúcuta and Villa de Rosario urban areas, respectively along the Cerro Bogotá (or Libertad) hill and the Lomitas-Hacienda San Javier fault scarps. A good correlation can be observed between these active fault traces and the epicentral area of the 1875 earthquake, which destroyed both cities. However, this earthquake was previously attributed to the Boconó seismogenic source. In fact, it appears that the contribution of the southern end of the Boconó fault as a seismic source, loses importance with respect to the northern segment located between La Grita and Mérida where the 1610 and 1894 earthquake occurred, and also when compared to the faults that define the "Pamplona indenter", probable source for several destructive earthquakes.

CONCLUSIONS

A significant decrease of the right-lateral motion of the Boconó fault, considered as plate boundary between the Caribbean and South America plates, may occur in the Venezuelan Southern Andes as a result of a conspicuous branching and damping of the fault activity against the transversal Bramón fault system. Additionally, the progressive deactivation of the main movement of the Boconó fault is consistent with the kinematic connection pattern between this fault and the left lateral reverse faults of the Pamplona indenter, and is also explained by the occurrence of subparallel active faulting on each side of the main fault, which contribute to absorb another significant amount of the relative Caribbean and South America plates displacement occurring along the Venezuelan Andes range. Therefore, the seismogenic sources scenario of the Venezuela-Colombia borderland is much more complex than previously considered.

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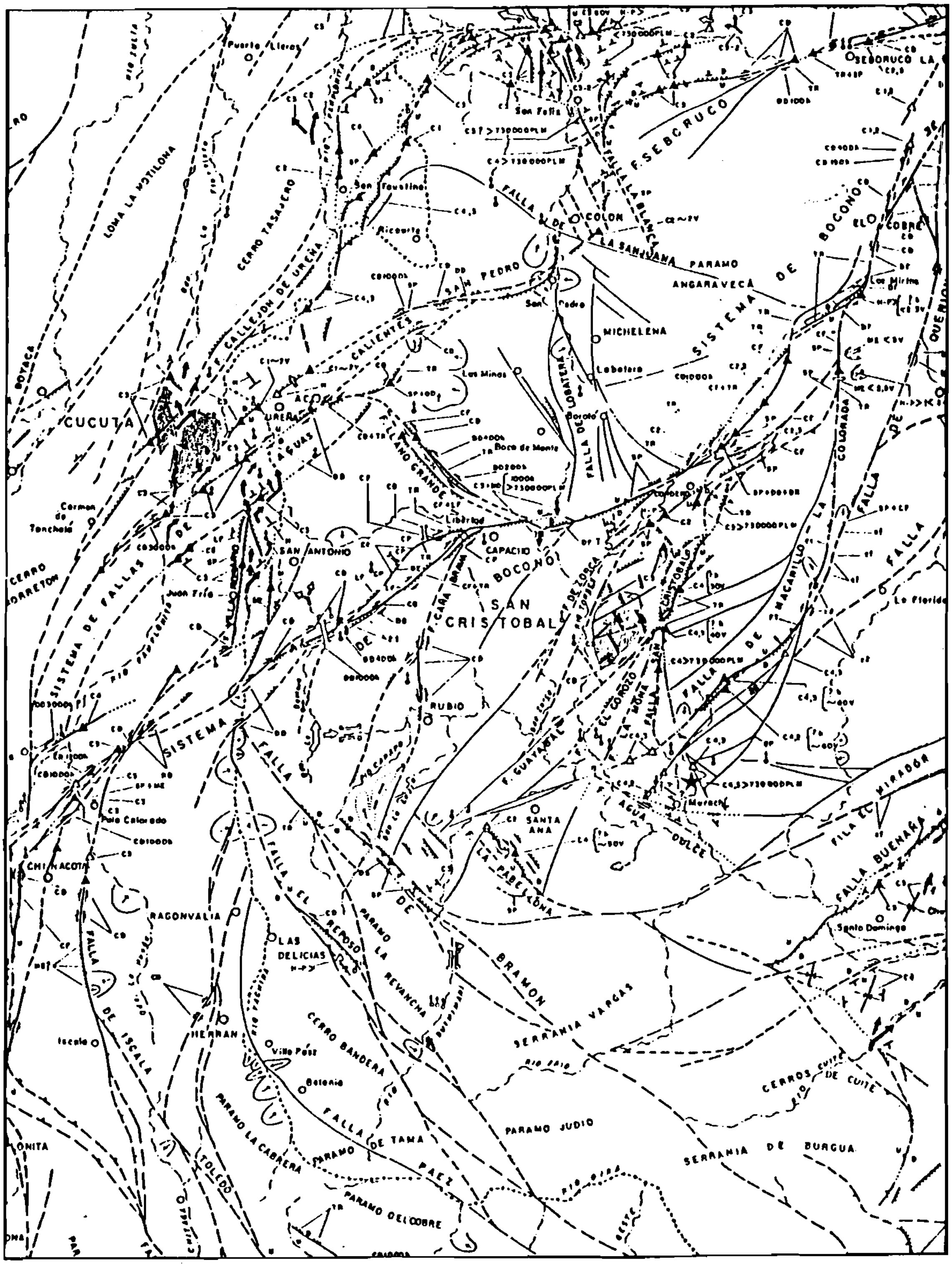

Fig. 2 The Bocono active fault system and other minor active faults in the Venezuelan and Colombian borderland.