Neotectonics in the margins of the Cauca River valley, Colombia

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As part of the "Microzonificación Seismic de Cali - MZSC" project (INGEOMINAS, 2004) several localities were studied for neotectonic evidences. By means of analysis of aerial photograph and digital elevation models (DEM) several indicative features of tectonic geomorphology were recognized. At outcrop level, striations produced by frictional deformation were measured, geologic columns of quaternary deposits were described and palesoil samples were collected for ^{14}C dating (in process). Several geophysical profiles were used to verify the interpretation of the underground in order to characterize a locality of reference of neotectonic features and to assign seismic magnitudes according to their size and origin.

The Cauca River valley or Cauca Valley (CV) represents the north tract of the Inter-Andean tectonic Cauca-Patía depression (Litherland & Aspden, 1992; James et to the, 1986, Acosta 1978) developed on the Cauca-Romeral terrane (Etayo et al, 1983). It is allochthonous terrane of oceanic likeness that makes part of the lithospheric realm PLOCO of Nivia (1996). The CV is demarcated by the Central Cordillera (CC) to the east and the Western Cordillera (WC) to the west. The western slope of the CC is developed on a pile up of rocks with Paleozoic and Mesozoic ages marking the limit of continental lithospheric against lithospheric of oceanic origin to the westward (Case et al, 1971; Meissner et al, 1977). From latitudes 3° to 4° north the CV presents a plane bottom 38 km wide locally. The city of Cali (3°30' N, and 76°30' W) is in the western margin of this valley. This east facing margin is rectilinear and is defined by the contrast of quaternary filler against lifted and deformed rocks from the Cretaceous and Paleocene periods (Nivia, 2001). Several morphostructural features indicate neotectonic activity (control and displacements of drainages, escarpment ruptures of the land and evident striations in quaternary deposits). The clarity and lineally of this mountainous border, as well as the high energy of the relief have been recognized as indicative of important rates of rising of the Western Cordillera (Barrero, 1979; Padilla, 1981, Page, 1986). This last condition allows high sedimentation rates and any possible ancient morphotectonic features have been misrepresented and they are not manifest.

The eastern margin of the CV and the CC presents a different "incoming and salient" aspect forcing the foothills to snake to between 37 km and 6 km in width, from Cali latitude to 50 km north. The neotectonic features in this margin are more frequent and defined according to tracts of different width of the valley. For example, to the east and south-east of the city of Cali this cordilleran foothills presents a series of rectilinear escarpments that affect several Quaternary-aged cones and fans; pressure ridge extruded and ejected by compression have allowed the trapping of quaternary cones. This deformation is Neocene-Quaternary age. **Figure 1** illustrates the Ruiza sector, a series of coalescence fans trapped by the extrucción of a wedge of Mesozoic oceanic rocks (JKa: Fm. Amaime) overlaid by the Vilela Formation (TPv) of Pliocene age (McCourt & Verdugo, 1985). In one of these fans (Q_2) a rectilinear escarp 6 m high with 35° of inclination facing west is present; its southern end is covered by a torrential alluvial cone of the Holocene-age (Q_0), though not deformed. Paleosol samples were collected for ^{14}C determinations under the deformed fan (Q_2) and inside the non deformed

cone (Q_0). Slickenside lineations were measured in several outcrops inside the Ruiza sector that encompass several deformation styles (reverse and directional right and left lateral faults) leading to (right dihedral and direct inversion methods: Villemin et al, 1993) a stress tensor with compression Sigma-1, North-South (± 25°).

Other registrations of deformation are to be found about 20 kms to the south of the Ruiza sector where a block of metamorphic rock of the Paleozoic-age 2 km wide and more than 4 km long has been expelled toward the SW allowing the formation of an alluvial deposit (Q_0) encased (670m x 250m) in the southwestern slope of Desbaratado river tract that moves. In the lateral limits of this block some clearly directional morphotectonic features are presented, left-lateral in the eastern side and right-lateral in the western side. This has allowed an understanding and documentation of neotectonic evidences of right-lateral and left-lateral directional movements in the same area and in contemporary deposits.

Finally, assuming that the clear features of rupture of the land surface correspond to co-seismic deformation, and that those in the eastern margin of the CV have dimensions between 3,3 and 10 km and using the empirical relationship of Wells and Coppersmith 1994 (Yeats et al, 1997) we have determined the possible seismic magnitude (Mw) associated with the deformations to oscillate between 5,7 and 6,2.

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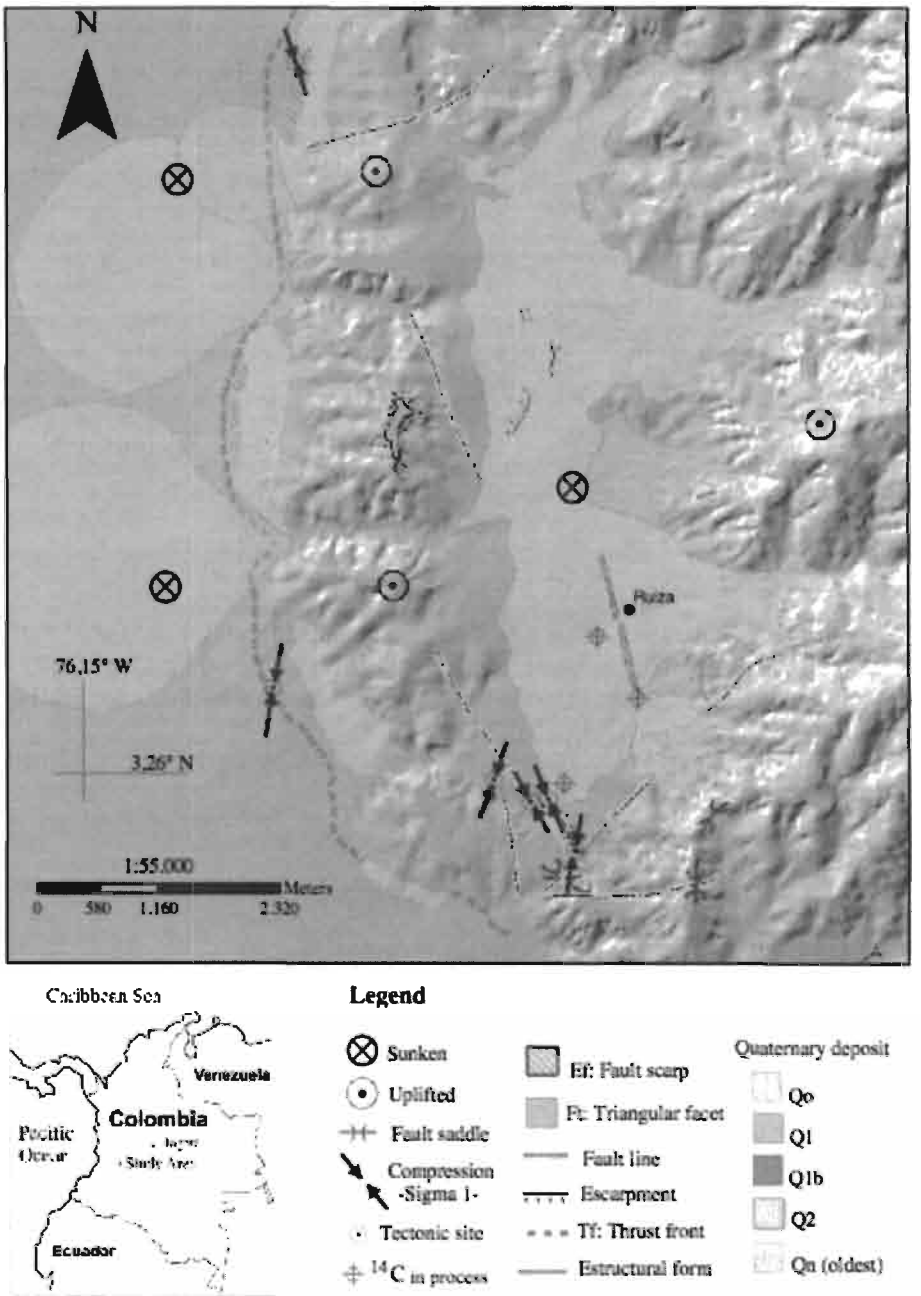

Figure 1. The Ruiza Sector. In the image (DEM) the relief of the eastern side is on the rocks of the Fm. Amaime (JKa. McCourt & Verdugo, 1985); to the center-western one, a lifted longed (N-S) ridge of Fm. Amaime overlaid by the Fm. Vilela (TPv), which traps the Q2. The slope break (Tf) makes the foothills to the west and it would mark the front of the deformation at present.