Source Characteristics of the Colombian 1999/1/25, Quindio earthquake (Tectonic implications)

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The causative fault of the Quindio earthquake was the Cauca-Almaguer fault, that belongs to the Romeral fault system that is running from the south to the North of Colombia. That fault system is characterized in its south segment by right-lateral strike slip faults, in agreement with the convergence E-W of the Nazca plate. However the Quindio earthquake with a left-lateral mechanism, put in evidence a considerable rotation of the compressive axis compared with the south of Colombia. This rotation is produced by the convergence to the SE of the Panama micro-plate, located in the NW of Colombia. The heavy damage in Armenia city could be explained in part by the directivity effect since the rupture occurred towards the city.

The Quindio earthquake occurred the 25th January of 1999, in the western Colombia. With more than 1000 casualties , and 150.000 people made homeless it is one of the largest disaster of this century in Colombia.

The main characteristics of the Quindio earthquake were: Mb=5.8, Mw=6.1, Mo=2.0e18 Nm, Ms=5.6 , T=3.0 sec. The earthquake was left-lateral (5,63,-19 CMT solution), and the depth was less than 20 km.

The tectonic conditions of Colombia are extremely complex, because of the interaction of three plates: the Nazca plate, the South American plate and the Caribbean plate. The Nazca plate is subducting beneath South America from the west, which has produced several big subduction earthquakes in past (1979, Mw=8.1). Not less commom are the shallow earthquakes produced by the active faults in Colombia, that have a general orientation SW-NE. According to the geological and seismological information, the causative fault of the Quindio earthquake was the Cauca-Almaguer fault , that belongs to the Romeral fault system, has an orientation of N5E, and is dipping to the east (60-80 deg). The romeral fault system that is running from the south to the north of western Colombia, is characterized in its south segment by right-lateral strike slip faults, in agreement with the convergence E-W of the Nazca plate. There was for instance an Mb=6.4 (206,76,170), right-lateral earthquake in June 6 1994 belonging to the Romeral fault system, 150 km south of the Quindio earthquake.

However the Quindio earthquake with a left-lateral mechanism, put in evidence a considerable rotation of the compressive axis compared with the south of Colombia. This rotation is produced by the convergence to the SE of the Panama micro-plate, located in the NW of Colombia, in between the Nazca and Carribbean plates. Another evidence of that SE compression was the 1992/10/18 Murindo earthquake (Mb=6.6) that occurred in the NW of Colombia, with an strike slip mechanism and its compression axis oriented to the SE.

Although no surface break was found, the aftershocks distribution suggest a rupture length of about 15 km. The rupture seems to have started from the southern edge of the fault and to have propagated towards Armenia city, 15 km north of the epicenter. The heavy damage in Armenia city and the surrounding towns, could be explained in part by the directivity effect, which may be understood in detail by the kinematic inversion in process.

In this presentation, we will make an emergent report about a field survey of the Quindio earthquake by a reconnaissance team sent by mombusho to Colombia.