

The last destructive earthquakes occurred in La Rioja (05-28-2002) and Catamarca (09-07-2004), northwestern Pampean ranges, Argentina

Mario A. Araujo, Angel M. Pérez, & Marcelo H. Millán

Instituto Nacional de Prevención Sísmica (INPRES) & Universidad Nacional de San Juan (UNSJ), San Juan, Argentina

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INTRODUCTION

La Rioja and Catamarca provinces are located in the northwest of Argentina. The seismicity of these provinces is moderate and high in the west of the La Rioja province. The main historical destructive earthquakes occurred in 1899, 1957 and 1977 in La Rioja and in 1892, 1898 and 1966 in Catamarca, figure 1. In May 28th of 2002 a $M_l=6.0$ earthquake occurred in the northeast of the La Rioja province and in September 7th of 2004 a $M_l=6.5$ earthquake occurred in the southeast of the Catamarca province, figure1 and figure3. The last two events took place in a region that has a few historical records of destructive earthquakes. Both earthquakes have a compressive style in agreement with the orientation of main horizontal stress in the region.

SEISMOTECTONIC SETTING

The region where these events occurred is located where the Nazca Plate subduces Southamerican Plate subhorizontally from 28°- 30° south latitude, figure 2. The seismotectonic area is the Northoccidental Pampean Ranges and an important shallow seismicity is the main characteristic of this zone.

SEISMICITY AND TECTONIC RELATION

The main seismicity in the Northoccidental Pampean Ranges shows an important reactivation of pre-existent faults, seismogenetic sources, controlled by megatracas oriented NNE-SSW. In this area the Andean stresses are transmitted to the east and the Catamarca-Ambato-La Rioja megatrace crosses the Northoccidental Pampean Ranges oriented NNE-SSW. Then the seimogenetic zones are reactivated and the reverse faults in this region trends NE-SW and NNE-SSW.

The earthquakes of the Sierra de Velasco-Sierra de Mazán (05-28-2002, La Rioja) and the Sierra de Ambato (09-07-2004, Catamarca) occurred in this area. The obtained focal mechanism corresponds to reverse faults that are oriented NE-SW and NNE-SSW, figure3.

The local parameters and focal mechanism for both earthquakes were obtained from the records of the INPRES National Network stations.

Earthquake, 05-28-2002, La Rioja

Origen Time : 04 hr 04 min 22.65 seg
Latitude (S) : 29.106°
Longitude (W) : 66.839°
Depth : 10.9 km
Magnitude MI : 6.0
Intensity MMI(max) : VIII
NP1 - Strike : 45 Dip : 75.0 Slip : 103.1
NP2 - Strike : 183 Dip : 19.8 Slip : 49.7

Earthquake, 09-07-2004, Catamarca

Origen Time : 11 hr 53 min 06.00 seg
Latitude (S) : 28.600°
Longitude (W) : 66.140°
Depth : 27.0 km
Magnitude MI : 6.5
Magnitude Ms : 6.4
Intensity MMI(max) : VII
NP1 - Strike : 143 Dip : 60.0 Slip : 34.0
NP2 - Strike : 85 Dip : 61.0 Slip : 145.0

CONCLUSION

The La Rioja and Catamarca earthquakes are the main destructive events of the last twenty years in Argentina. Both events are crustal earthquakes. The active faults in the area of the Velasco-Mazán and Ambato ranges are compressive and transcurrent which correspond with the stresses in this region crossed by the megatracas. These events are the last evidence of the actual cortical shortening and the uplift of the Velasco-Mazán and Ambato ranges. It is in accordance with the direction of the maximum horizontal stresses obtained from focal mechanism. It is probably that both earthquakes have not presented any rupture surface evidence. This point indicates it is necessary to carry out more complete field studies to obtain a better knowledge of the shallow seismogenetic sources in the Nothoccidental Pampean Ranges.

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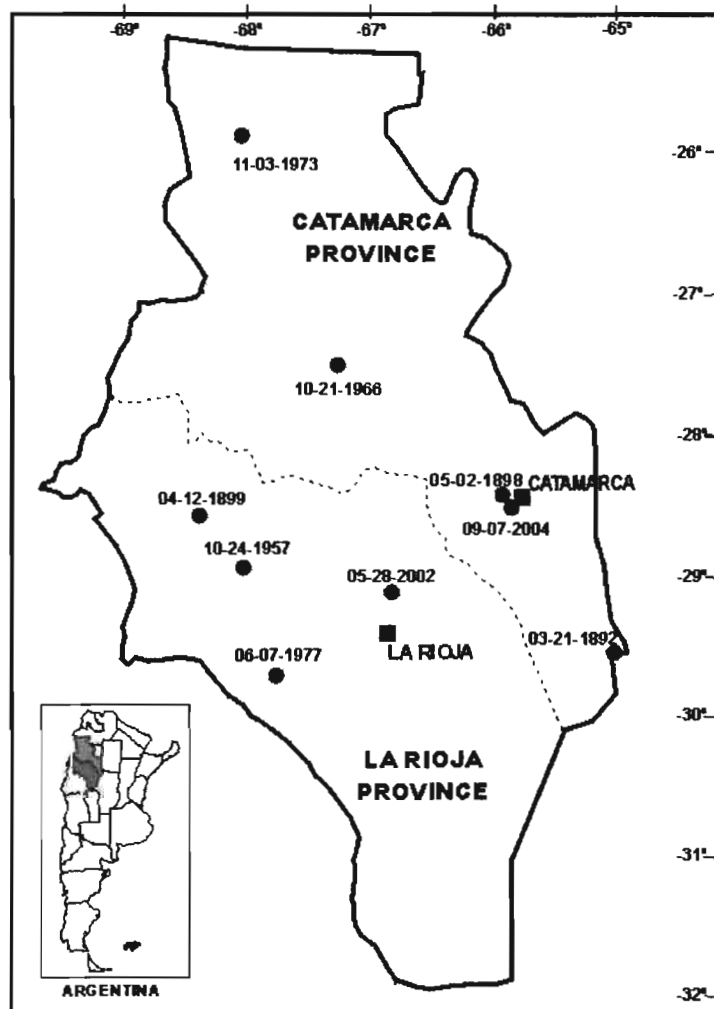


Figure 1: Destructive Earthquakes in Catamarca and La Rioja Provinces.

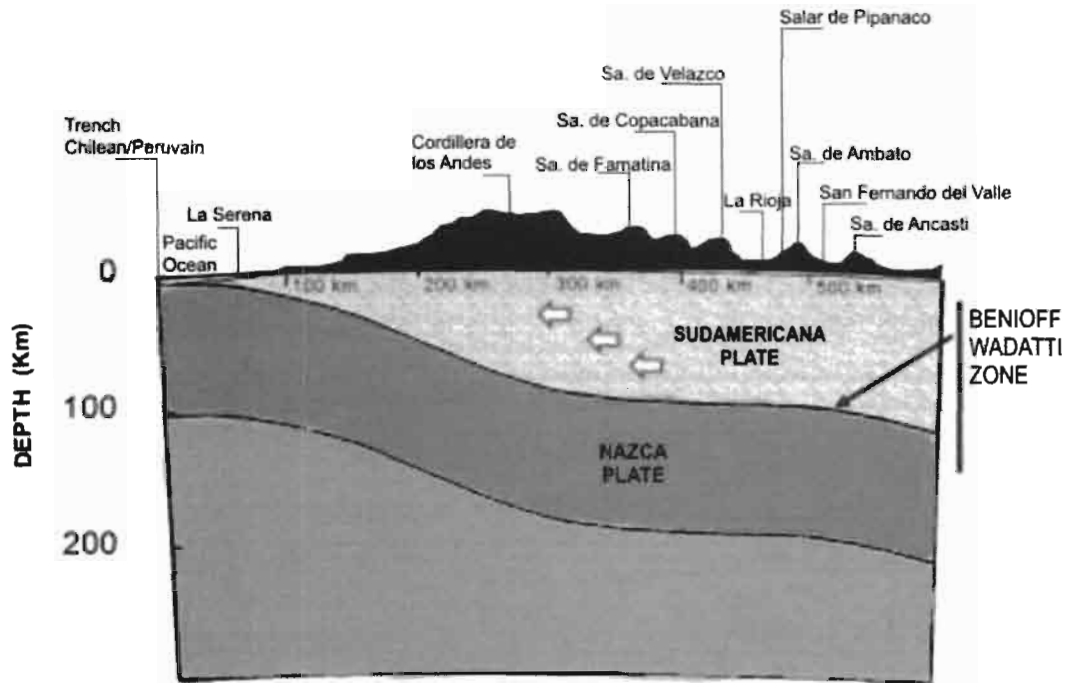


Figure 2. Cross section of the Nazca and South American plates convergence, in the region of study.

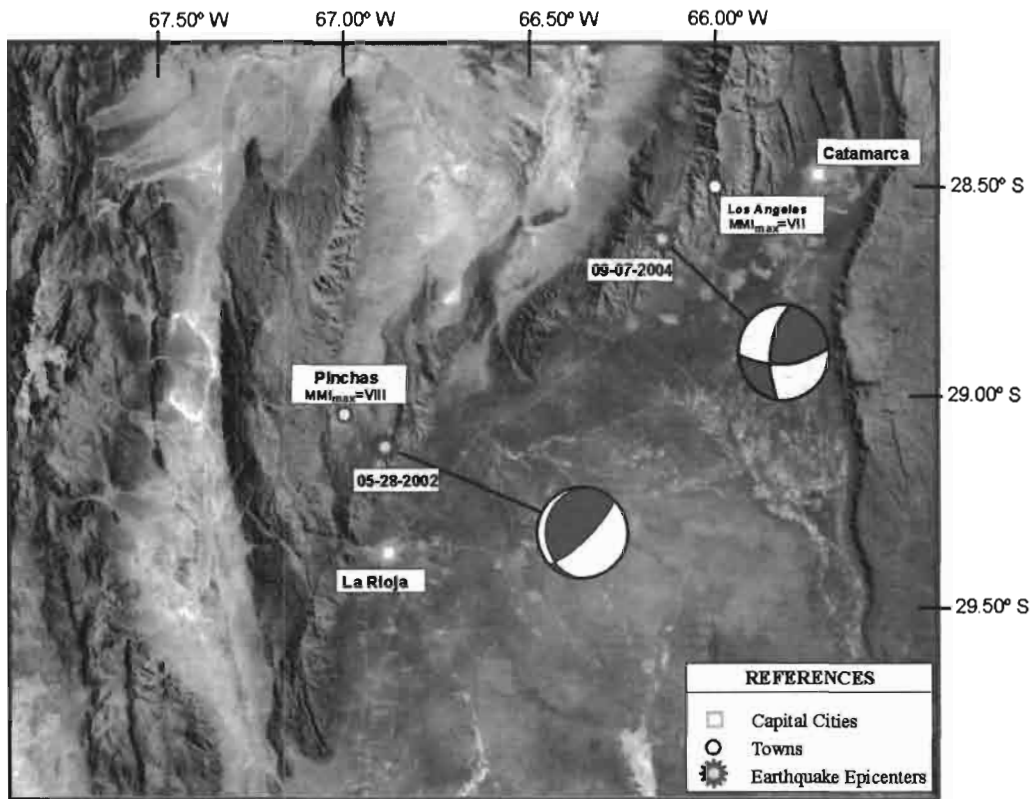


Figure 3. Satelital image with epicenters and focal mechanisms of the earthquakes in Northoccidental Pampean Ranges.