TECTONIC STRESSES IN THE NORTH-WEST OF ARGENTINA AND THEIR RELATIONSHIP WITH MAIN SHALLOW EARTHQUAKES

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ABSTRACT

The principal Seismogenic Sources in the north-west of Argentina have been studied. Due to these sources this region is the second in the country as regards seismic hazard.
Main shallow earthquakes in this zone have produced many casualties and building damages delimited into one zone with direction SSW-NNE. In this area, the orientation of the maximum horizontal stress, produced by the collision of the Nazca Plate and the South American Plate, has been modified due to local stresses.
One of the reasons of this modification might be that the high Andes are in a distensional process transmited to the east in the South American Plate.

KEY WORDS: Seismogenic Sources, tectonic stresses, main earthquakes.

INTRODUCTION

At this time more than 2,000,000 people live in the north-west region of Argentina (NWA). In this area buildings have been constructed, in general, without earthquake resistant provisions.
The NWA main industries are: mining, sugar-cane, tobacco, petroleum, etc. The points mentioned above show the importance to carry out seismogenic sources studies to base future urban planning of the main cities on their results.
This zone classified as the second most hazardous seismic zone in the country has particular tectonic characteristics compare with other zones subjected to tectonic processes.
Generally, in this area the Nazca Plate subduction is similar to that of the southern part of Bolivia (so-called normal subduction) from latitude 21.5° to 23.5° South. To the South of this zone, between 23.5° and 27.5° S, the subducted plate makes a contortion without changes until 28.5° S where it becomes horizontal. In the NWA region most of the events are intermediate earthquakes and some deep and shallow ones.
The occurrence of shallow earthquakes is not as frequent as the intermediate ones, however, many of them have caused several casualties and injuries and severe damage to buildings.

Main Earthquakes in the region

Event	Year	Province and Locality	Intensity MM
1	1692	Salta (Talavera de Esteco)	VIII
2	1826	Tucumán (Trancas)	VIII
3	1844	Salta (Palomitas)	VIII
4	1863	Jujuy (San Salvador de Jujuy)	VII
5	1871	Salta (Orán)	VII
6	1874	Salta (Orán)	VIII
7	1892	Catamarca (Pomán)	VIII
8	1899	Yacuiba (Límite Argentino - Boliviano)	VII
9	1906	Tucumán (Tafí del Valle)	VII
10	1930	Salta (La Poma)	VIII
11	1931	Tucumán (El Naranjo)	VII
12	1948	Salta (Palomitas)	IX
13	1959	Salta (San Andrés)	VIII
14	1966	Catamarca (Belén)	VII
15	1973	Salta (Santa Clara)	VII
16	1974	Salta (Santa Victoria)	VII
17	1974	Salta (Orán)	VII

THE SEISMOTECTONIC SETTING

The region under study is located in a tectonic setting resulting from the ongoing subduction of the Nazca Plate eastward beneath the South American Plate. This process has created major structural features as complex faulting, the Puna Plateau and to the east, the Subandean Rangers.
Considering the existing megastructures in the region, it has been observed that these structures constitute barriers limiting shallows from intermediate earthquakes.

SEISMOGENIC SOURCES

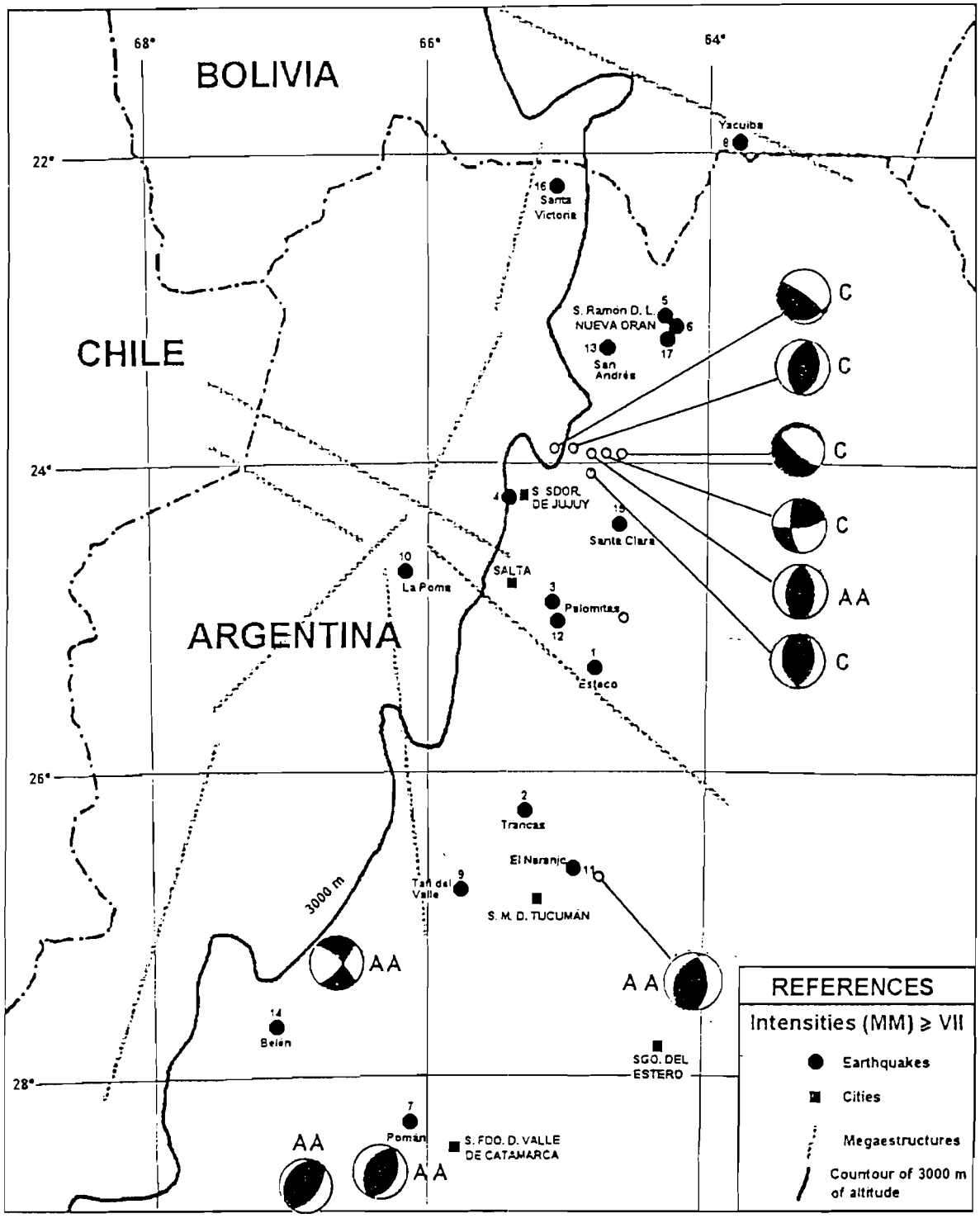
The seismotectonic process is quite complex towards east, especially after the 3,000 m contour. Taking the megastructures into account besides the 3,000 m contour, it is observed that the main earthquakes direction will be SSW to NNE, starting from Catamarca to Yacuiba (at the Argentina-Bolivia border). In this zone the most dangerous earthquakes have occurred.

LOCAL TECTONIC STRESSES

The W-E direction of the maximum horizontal tectonic stresses, which are caused by the collision between both plates, are altered by the local horizontal stresses. Therefore, the final orientation results almost perpendicular to the 3,000 m of the Puna contour.
Some of the focal mechanisms for this zone have been very well determined in previous studies and their representations confirms the above statements. Besides, it is possible to assert that the high Andes are under a tensional process that is transmitted to the puna step by step (e.g. the normal faults near to the 3,000 contour). East of the 3,000 m contour the maximum horizontal tectonic stress caused by the collision between both plates is predominant and therefore the principal stress direction suffers no changes.

CONCLUSIONS

Main shallow earthquakes in this region have occurred close to the 3,000 m contour, which indicates that



MAXIMUM REPORTED INTENSITIES

studies must be focused on the tectonic process close to the 3,000 m Puna contour. On this area very few active fault recognitions have been made mainly due to the weather erosion or to the vegetation which covers the potential surface evidences of faults.

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