

1. From the Engdahl catalogue (C1) were selected 2471 earthquakes occurred between 16° -26°S and 62°-79°W, with $m_b \geq 4.0$ and depths between 0 – 200 km. Historical and more recent seismic information is available for temporal distribution of Andean seismic activity.
2. After analyses of seismicity maps and cross sections, two seismogenic sources were determined from C1, the first one Seismogenic Source 1 (SS1) in northern Chile with 96 earthquakes, and the second one Seismogenic Source 2 (SS2) in southern Peru with 261 earthquakes (Fig. 1).
3. Frequency/magnitude relations were obtained for SS1 and SS2. For both seismogenic sources were calculated the parameters for single (GR) and cumulative (GR and ML) distributions, which are shown in Fig. 2.
4. Recurrence intervals were determined for each seismogenic source, especially for earthquakes with the maximum magnitude occurred in each seismogenic source (Fig. 3).
5. Seismic hazard will be estimated considering the social development for some important cities in Peru-Chile Border Region.

Results

Two seismogenic sources were determined in this study based in the earthquake spatial distribution shown in Fig. 1, SS1 in northern Chile with 261 events, and SS2 in southern Peru with 96 events, occurred between 1964-1999. The frequency/magnitude curves for both seismogenic sources are shown in Fig. 2, and their main seismicity parameters are listed in Table 1.

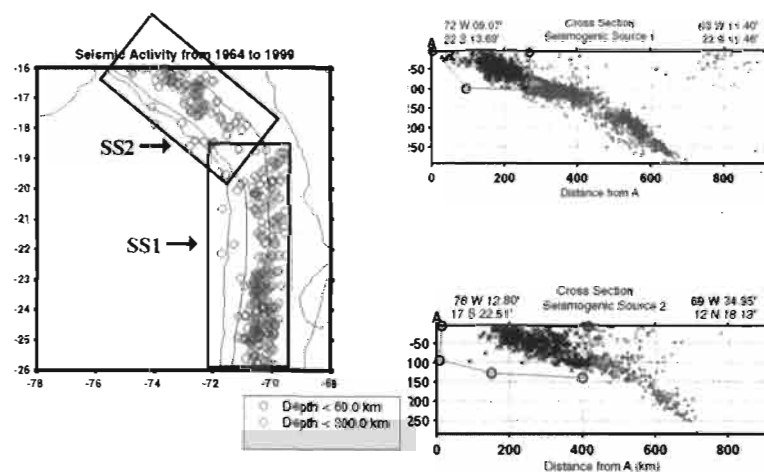


Figure 1. Seismicity map and cross sections in Peru-Chile Border Region showing spatial distribution of earthquakes, and selected horizontal and vertical portions to define SS1 (Northern Chile), and SS2 (Southern Peru)

Considering the relatively short interval of C1 (36 years), it is not possible to obtain realistic curves for cumulative magnitudes relationships (GR and ML) for larger magnitudes earthquakes than those occurred during the interval considered in C1. To calculate reliable frequency/magnitude cumulative curves historical earthquakes have to be considered. In this case we have to use the single magnitude distribution curve for each source and calculate the return period (see Fig. 3) of the maximum magnitude earthquake occurred in each source, assuming this value should be the same than the calculated with the proper cumulative relation, for the maximum magnitude earthquake.

The largest historical earthquake occurred in SS1 was in May 09, 1877 with M_w 8.6, converted to m_b 6.9 using M_w/m_b relationship determined by Zamudio (1998). The return period (RP) for this largest magnitude earthquake in SS1 is 135 years, which means an earthquake like the one of 1877 could occur in northern Chile around the year 2012.

For SS2 the maximum magnitude earthquake (M_w 8,8) occurred in August 13, 1868. That magnitude converted as above, results in $m_b = 7.0$. Its return or recurrence period (RP) is 258 years, consequently an earthquake with magnitude M_w 8.8 could occur in Southern Peru around the year 2126.

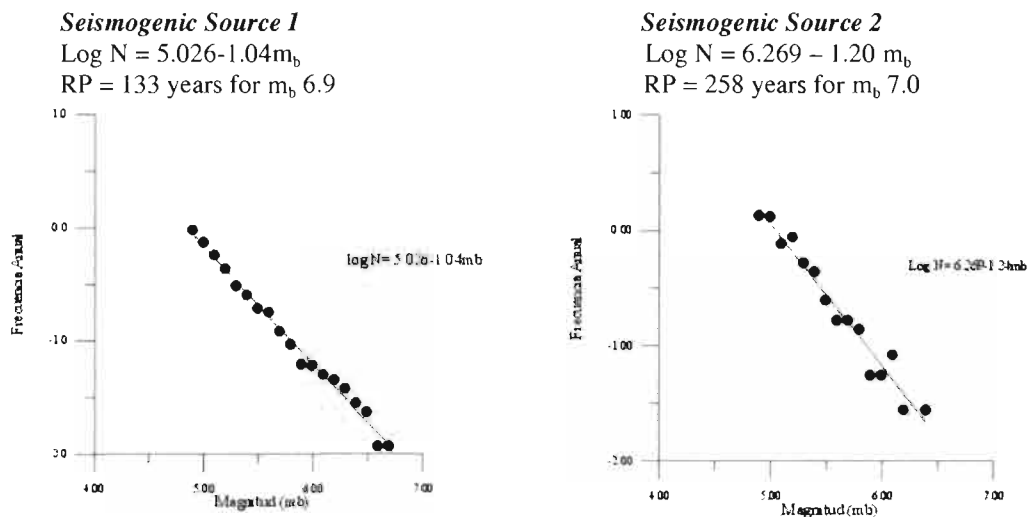


Figure 2. Single frequency/magnitude distribution relations for SS1 and SS2. The data of SS1 has been rearranged passing it 5 times through a Hanning window.

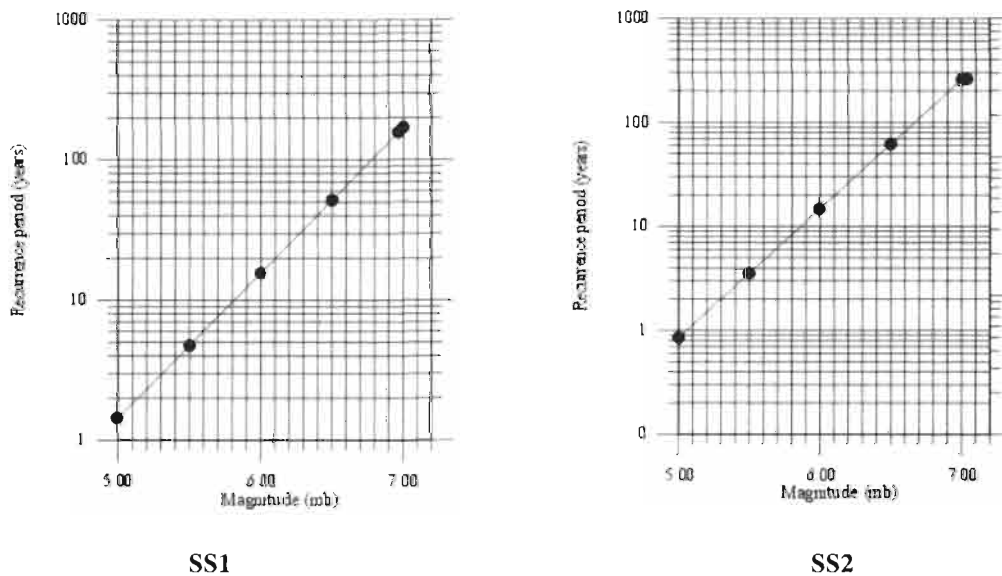


Figure 3. Recurrence period (RP) for SS1 and SS2, using the frequency/magnitude single distribution relation.

Conclusions

Seismic activity is the most important natural phenomena in Peru-Chile Border Region, spatial distribution of that activity shows the existence of two seismogenic superficial sources associated to the subduction process, were occur the more dangerous earthquakes in that region.. Results of this work indicate the probable occurrence of a very large earthquake with Mw 8.6 in the northern Chile portion of Peru-Chile Border Region, around the year 2010, and in the southern Peruvian portion of that region may occur a large earthquake with Mw 8.8, around the year 2126. Considering the 1868 and 1877 earthquakes destroyed several cities next to the epicentral area and caused many deaths, it is probable that similar magnitude earthquakes could provoke a larger quantity of casualties because the great number of inhabitants that live now in cities like Arequipa, Camana, Ilo , Mollendo, in southern Peru, and Arica, Antofagasta, Iquique, in northern Chile.

During the last 128 years two earthquakes with magnitude larger or equal than 6.7? m_b (Mw 8.0) have occurred in Peru-Chile Border Region: July 30, 1995 (Mw 8.0) in Antofagasta SS1, and June 23, 2001 (Mw 8.4) in Ocoña SS2, the last one damaged some Peruvian towns and cities, which were partially destroyed by the seismic event and by a tsunami generated by that earthquake. Those large earthquakes are considered by some authors premonitory events of a larger catastrophic earthquake in the Arica elbow, like Delouis et al. (1996), Spence et al. (1999), and Berrocal et al (2004).

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