INTRAPLATE SEISMICITY IN CENTRAL CHILE

Sergio BARRIENTOS(1), Emilio VERA(1)
and Tony MONFRET(1,2)

(1) Depto. de Geofísica, Universidad de Chile, Casilla 2777, Santiago, Chile
(2) Mission ORSTOM, Chile, Román Díaz 264, Santiago, Chile

KEY WORDS: Seismicity, Central Chile, Intraplate seismicity

SUMMARY

Shallow intraplate seismic activity in Chile is poorly understood. This is mainly the result of lack in association of seismic activity with recognizable fault features at the surface. This work is an attempt to understand the tectonic environment which gives rise to earthquake activity in the occidental flank of the Andes of central Chile. This region, located less that 100 km away from Santiago, has been subjected in the past to earthquakes with magnitudes up to 6.9, and several smaller shocks have taken place in the last few years. Because most of the events lie outside, to the east, of the Central Chile Seismic Network, it is essential to have an adequate knowledge of the velocity structure in the Andean region to produce highest quality epicentral locations. A north-south refraction line using mining blasts of Disputada de Las Condes open pit mine has been acquired. These blasts have been detected as far as 250 km to the south; preliminary interpretation of the travel times indicates a model consisting of 3 layers, 1.5, 5.35 and 8.6 km thick, overlying a halfspace; their associated P wave velocities are 5.2, 5.95, 6.35 and 7.0 km/s respectively.

Hypocentral relocation of earthquakes occurring in the last 10 years, using the newly developed velocity model, reveals several regions of concentration of seismicity. One of them clearly delineates the fault zone, and its extensions, of the strike-slip earthquake that took place in September, 1987. Other pockets of activity are the regions near San José volcano and the birth of the Maipo river. A temporary array of seismographs, installed in the high Maipo region, allowed us to establish the hypocentral location of events with errors less than 1 km. Focal mechanisms of these events were determined using waveform modeling of the records produced by a recently deployed broad-band seismograph at 20 km distance. Focal mechanisms indicate that the region is currently subjected to E-W compression.

INTRODUCTION

In general, seismogenic zones in Chile are basically well established: large shallow (0-50 km) thrust earthquakes along the coast, large deeper (70-100 km) tensional events within the subducting plate, and in few places, like Magellan Strait and the cordilleran region of central Chile, where very shallow seismicity (0-20 km) occurs.

The large thrust earthquakes are located along the coast from Arica (18°S) to Taitao Peninsula (46°S). With magnitudes that can reach values over 8, these events are usually accompanied by tsunamis; their rupture extent is limited to the coupled region between the Nazca and South American plates (Tichelaar

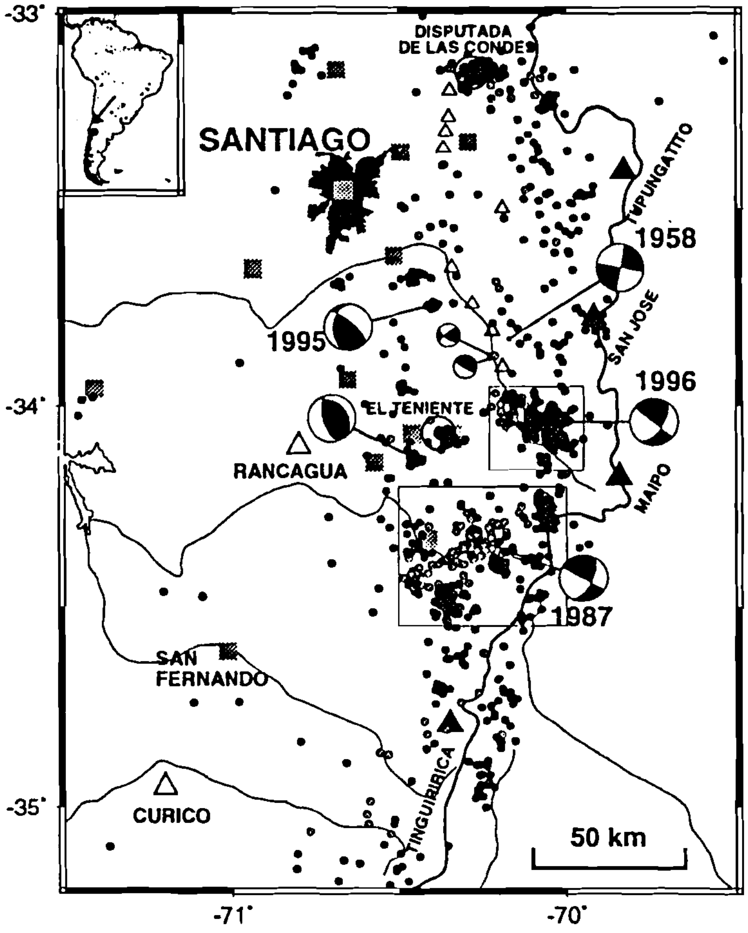

Fig. 1. Epicenters of shallow (< 20 km depth) earthquakes in the Central Chilean Andes during the period 1986-1995 as determined by the Central Chile Seismic Network (squares) of the Dept. of Geophysics of the University of Chile. The two highlighted regions are zones of recent high activity. Portable seismographs deployed for the acquisition of the refraction line (Fig.2) are represented by open triangles.

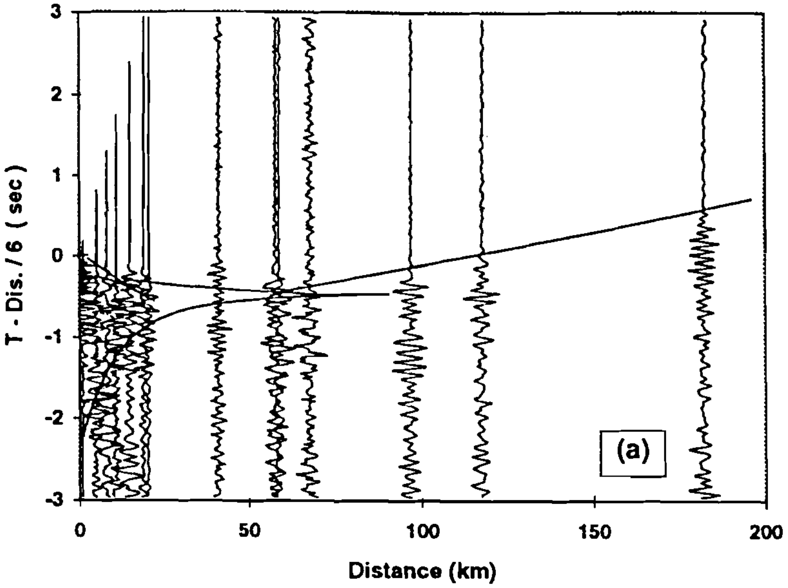

Fig. 2. Refraction profile acquired using the Disputada de Las Condes mining blasts (a). Travel time curves for the P-wave velocity model shown in (b) are superimposed on the traces. The time scale has been reduced using a velocity of 6 km/s. First arrivals are matched within few tenths of a second.