

CRUSTAL STRUCTURE OF NORTHERN CHILE AND NW-ARGENTINA

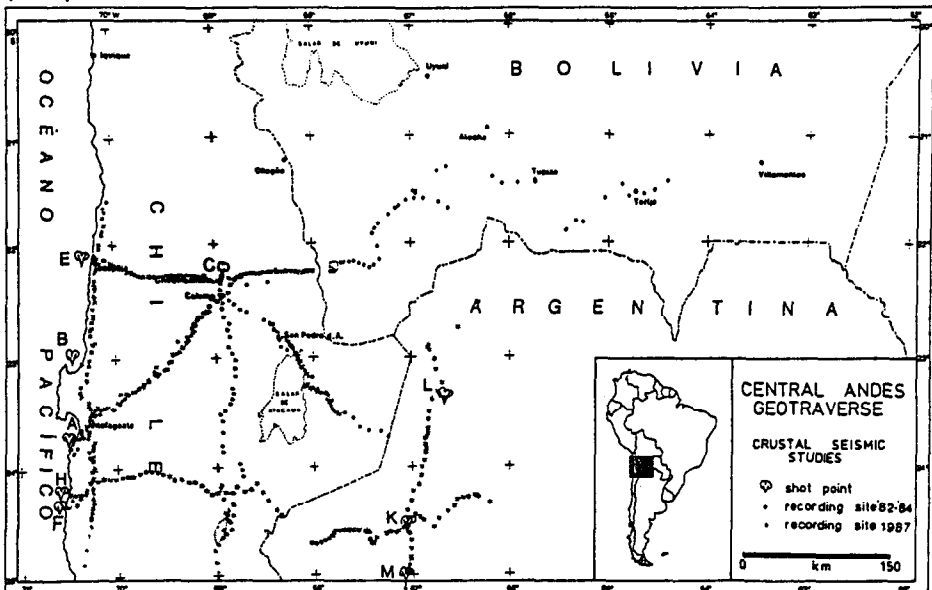
PETER, J.¹, WIGGER¹, MANUEL ARANEDA², PETER GIESE¹, WOLF-DIETER HEINSOHN¹, PETER RÖWER¹, MICHAEL SCHMITZ¹ and JOSE VIRAMONTE³

- 1) Inst. für Geophysikalische Wissenschaften, FUB, Rheinbabenallee 49, D 1000 BERLIN 33
- 2) Depto. de Geofisica, U'de Chile, Casilla 2777, Santiago de Chile
- 3) Universidad Nacional de Salta, Buenos Aires 177, 4400 Salta, R. Argentina

Abstract

Seismic refraction investigations have been carried out in northern Chile and north-western Argentina in several field campaigns during the years 1982, 1984 and 1987. The net of mostly reversed profiles covers the main morpho-structural units of the Central Andes: Coastal Cordillera, Longitudinal Valley, Pre-Cordillera and Pre-Andean Depression, Western Cordillera and Puna up to the Eastern Cordillera (see fig.).

Field work was carried out in a broad Argentine-Chilean-German cooperation, logistically supported by the Chilean Navy (sea blasts) and YPF (drilling for blasts at the Puna) and mainly sponsored by the German Research Organization (DFG).



The field data of analogues and PCM type have been converted to digital data and were processed in Berlin. The presented results obtained by one- and two-dimensional model calculations are based on 17 record sections with recording distances up to 450 km.

Crustal structure of the Andean belts varies strongly in north and south directions expressing the tectonic and magmatic evolution of the convergent continental margin.

The structure beneath the Coastal Cordillera can be described down to 45 km. P-Wave velocities of 5.8-6.0 km/s are observed at the surface and already in 7-10 km a value of 6.7 km/s has to be stated continued by a further positive gradient down to a discontinuity at a depth of 20 km where 7.2 km/s is reached. The mean velocity for this upper 20 km crustal part amounts to 6.6-6.7 km/s. Deeper structure down to 38-43 km displays at least two low velocity zones (LVZ) characterized by velocities between 6.2 - 6.4 km/s interconnected by a high velocity structure (7.6) at about 30 km depth. The velocity increases at the discontinuity at 38-43 km depth to 8.3 km/s and is proved by clear prograde phases.

A rapid change in structure as well as in crustal thickness is evident to eastern direction. The crustal segment of strongest variation belongs to the Longitudinal Valley and Pre-Cordillera where thickness reaches about 60 km. Contrary to the Coastal Cordillera under the Pre- and Western Cordillera P-wave velocity at the southern W-E profile increases slightly and reaches 6.1 km/s at about 30 km depth. The range between 30 and 60 km is characterized by a change of high and low velocities which reach a value of 8.1 km at the Moho. The mean velocity for the total crust as well as for the levels 0-30 km and 30-60 km is 5.9 km/s.

In the area of the geothermal anomaly of El Tatio between Pre-Cordillera and Altiplano there are strong indications for a LVZ at depths greater than 10 km.

Crustal structure of the Puna's crust is similar to the Western Cordillera. The top of the thick lower crust is found in 25-30 km, below there exists a LVZ and the Moho depth is 58-65 km. The mean velocity has a value of 5.9 km/s.

Maximum crustal thickness of more than 70 km is expected under the western Cordillera at latitude of about 23°South.

Crustal thickening of the Central Andes as well as structure and state at the up to 40 km thick lower crust will be discussed in view of accretion and stacking. Different models regarding tectonic and accretional processes for the structure beneath the Coastal Cordillera will be presented.