Abstract

A set of 59 seismological stations was deployed in the Central Andes region at 21°S (Chile-Bolivia) along a profile ~600 km long and were operated between 2002 and 2004. The teleseismic tomographic images (from P- and S- waves) show low-velocity anomalies that are interpreted as the effects of melting or fluids at both flanks of the Altiplano plateau. Beneath the Central Volcanic Zone (CVZ) a low-velocity anomaly is interpreted to be caused by fluids that are the origin of the volcanic material from the CVZ. A low-velocity anomaly in the upper crust is interpreted as the Altiplano Low-Velocity Zone that appears to extend as far to the east as the Eastern Cordillera. A high-velocity body between 100 km and 150 km depth is interpreted as being part of the old cold lithosphere that detached from the base of the crust. The Brazilian Shield is thought to be responsible for the strong high-velocity anomaly on the eastern side of the Central Andes.

In addition, another set of 19 stations was deployed in the southern Argentine Puna along a profile ~200 km long and were run over the same period of time (2002-2004). The intention was to study the crustal thickness at 25.5°S, where delamination of the lithosphere was proposed to explain the higher elevation of the Puna plateau. Beneath the plateau a negative velocity anomaly is observed and interpreted here as being the location of fluid transfer between the deeper and shallower portions of the crust, that emanate from the Benioff zone at depths of ~200 km. This anomaly clearly divides in two branches: one to the west towards the volcanic arc (CVZ) and the other to the east where the back-arc volcanoes are located. On their way to lower depths, the fluid paths are probably influenced by the presence of nearby isotherms. The bifurcation of the ascending path could be related to the presence of the lithosphere-asthenosphere boundary (LAB) at ~100-130 km. Based on our observations, the type and form of the anomaly, it is possible to propose the presence of a return-flow type model for fluid ascent in contraposition to the assumed corner-flow model usually proposed

for the Andes. The fluids that cause the seismic anomalies beneath the Puna plateau are generated at deeper levels in the asthenosphere and ascend parallel to the oceanic slab in the manner of a return-flow.

In the crust and beneath the Salar de Antofalla (SA), a high-velocity block with seismic activity is interpreted as part of the old and cold Palaeozoic magmatic arc (Faja Eruptiva de la Puna Occidental). The presence of this block is may be responsible for the distribution of volcanic activity localized at both sides of this anomaly. Eastern of the SA, it is possible to recognize a zone with low-velocities beneath the Galan volcano. A sharp limit imposed by high velocities, probably related to metamorphic rocks from the Paleozoic basement (Tacuil and Luracatao ranges) can be detected on the east of the profile.

A high-velocity block with seismic activity is located in the crust beneath the Salar de Antofalla (SA) and interpreted as part of the old and cold Palaeozoic magmatic arc (Faja Eruptiva de la Puna Occidental). This block might be responsible for the distribution of volcanic activity localized at both sides of this anomaly. Beneath the Galan volcano and east of the SA, a zone with low-velocities can be recognized. A sharp limit towards high-velocities can be observed on the east of the profile, probably related to metamorphic rocks from the Palaeozoic basement (Tacuil and Luracatao ranges).