8th International Symposium
on Andean Geodynamics
(ISAG)

Geophysical imaging of the Chilean subduction zone beneath the Antofagasta region

D. Díaz[1], E. Contreras-Reyes[1], A. Maksymowicz[1], B. Potin[1], M. J. Hernández Pozo[1], J. Ruiz[1], S. Ruiz[1], K. Slezak[1]

[1]Departamento de Geofísica, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Blanco Encalada 2002, Santiago, Chile

Subduction zones are plate tectonic boundaries where the incoming/oceanic plate is forced to sink (subduct) beneath the overriding plate. This process results in catastrophic events, such as large earthquakes, tsunamis and volcanic eruptions, affecting millions of people, particularly along the edges of the Pacific Ocean: the so-called Ring of Fire [e.g., Stern, 2002].

In order to improve the knowledge of these processes, it is important to characterize the structure of the overriding continental plate and the interplate contact. In particular, we aim to study the seismic, geoelectric, and density structure of the forearc and volcanic arc of an area of particular interest in Chile, the Antofagasta region. This region is placed in the central Andean arc that is retreated 60 km eastwards from its regional north-south trend, reaching a maximum distance from the Chilean trench of about 400 km. To the west, the Central Andean arc is limited by the Salar de Atacama Basin, a major topographic anomaly located at 2300 m above sea level, bounded to the west by the Cordillera de Domeyko as a subrange of the Precordillera. Crustal thickening that characterizes the backarc in this zone originated in Cenozoic times, particularly during the last 30 Ma (Allmendinger et al., 1997; Lamb, 2000). It coincides with an increase of relative convergence, which became almost orthogonal to the Chilean margin (Pardo-Casas and Molnar, 1987; Somoza, 1998), and with an eastward shift of magmatism (Coira et al., 1982). This was followed by the formation of Miocene–Pliocene stratovolcanoes, and led to the eruption of large-volume ignimbrites between 18° and 24°S. These ignimbrites partly constitute the basement over which several Pleistocene–Holocene volcanoes have been built, such as the Lascar volcano, that has been active since 50 ka, and is historically characterized by continuous fumarolic emissions and occasional sub-plinian eruptions. In April 1993, a sub-plinian eruptions occurred, which generated a column between 5 and 25 km high, collapsed pyroclastic flows, and tephra falling over a large area of Paraguay, Uruguay, Brazil and Argentina.

In this context, we present a joint interpretation of physical parameters in depth and space including Vp and Vp/Vs tomographic inversion and seismicity relocation, electrical resistivity (MT), and magnetic susceptibility models. Preliminary results reveals that the abrupt eastward shift of the active volcanic arc in the Antofagasta region is spatially correlated whit lineaments in the intermediate-depth seismicity and with physical anomalies associated to the presence of the Salar de Atacama Basin and magmatism of the upper crust, showing the interplay between the subduction process and the upper plate structure.