

THE INTERDISCIPLINARY GEOSCIENTIFIC RESEARCH PROJECT " DEFORMATION PROCESSES IN THE ANDES "

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An interdisciplinary geoscientific research project "Deformations Processes in the Central Andes" has been established at the Freie Universität Berlin, the Technische Universität Berlin, the GeoForschungsZentrum Potsdam and the University Potsdam. This project, started 1993, is funded by these institutions and by the German Research Society (DFG) as a "Sonderforschungsbereich 267" (collaborative research programme 267).

The Central Andean segment between 20° and 25°S has been chosen because along this section the orogenic deformation processes are very well developed.

The main and outstanding features along this geotraverse can be described as follows:

- a high convergence rate of about 10 cm/y and high strain rates,
- a vertical uplift rate of about 1 mm/year
- an extreme crustal thickness up to 60-70 km, caused by magmatic underplating and tectonic stacking,
- zones with extremely high electrical conductivity in various tectonic zones and depths ranges,
- high seismicity in shallow, intermediate and large depth ranges,
- recent and subrecent volcanic activity and high heat flow density,
- a well developed forearc, magmatic arc and back-arc,
- four magmatic arcs which have been evolved successively by eastwards migrating from Jurassic to recent time,
- variations of the stress regime during the Andean period causing extensional and compressional deformations.

Geophysical, geodetic, geological und petrological studies will be carried along the Central Andean traverse aiming to tackle the following key problems:

- the structure of the lithosphere and its rheological state and behaviour,
- the interaction between upper and lower plate,
- the distribution of the stress field and strain in time and space,
- the tectonic and petrological evolution of the upper plate under varying conditions of convergence,
- the geothermal field and heat transfer,
- the evolution of intramontaneous basins and isostasy,
- energy consumption during the orogenic processes.

A number of field projects has been carried out since 1993. In order to investigate the crustal structure of the magmatic arc and the adjacent zones a network of seismic refraction profiles was realized in the Western Cordillera and the Precordillera. In addition 25 mobile seismological stations were set up in

this region operating for about 3 - 4 month aiming to record and investigate shallow and intermediate-deep earthquakes (PISCO 94).

In order to study the lithosphere of the eastern Nazca-plate and the transition to the continental lithosphere was investigated by a joint sea-land project applying airgun seismic reflection and refraction survey, gravimetric, magnetic and heat flow measurements. This project CINCA 95 is planned by the Federal Institute for Geosciences and Natural Resources, Hanover, GEOMAR, Kiel and the SFB 267. Magnetotelluric deep sounding measurements will contribute additional information. Detailed gravimetric measurements will be carried out aiming to study the deeper structure of intramontaneous basins.

A GPS-profile transversing the Central Andes records recent crustal movements. This study will be remarkably extended by the GeForschungsZentrum Potsdam within an international co-operation with a profile running along the Pacific coast in N-S direction.

Special geological and petrological investigations are carried out in the magmatic arcs aiming to reveal the complicated tectonic development of a magmatic arc system. Neotectonic studies are designed aiming to investigate the recent stress and strain field. Geological investigations will take place in the Eastern Cordillera aiming to reconstruct the Andean shortening of the Paleozoic sediments.

Detailed geochemical studies should reveal the nature of the young volcanism.

Petrophysical studies on rock probes under high temperature and pressure conditions should help to interpret the geophysical field data.

Such a project can be only realised by close cooperations with geoscientific institutions in Argentina, Bolivia and Chile.

The research project is structured as followed:

- Deformation and stress field:
Neotectonic studies, recent kinematics by GPS measurements, modelling of the recent stress and strain field.
- Rheological stratification at a convergent plate boundary:
Rock behaviour under high temperature and pressure condition derived from lab and field measurements, temperature field, heat transfer mechanism, rheology and fracturing of the Andean crust. Application of GIS.
- Crustal evolution controlled by varying convergence boundary conditions:
Structure of magmatic arcs by geological and geophysical studies, magmagenesis and crustal evolution, crustal shortening in the back-arc region.
- Evolution of sedimentary basins and isostasy:
Evolution of basins in various crustal environments,
Balancing studies of erosional and sedimentary processes, isostatic studies.