

THE INTERDISCIPLINARY RESEARCH PROGRAM "DEFORMATION PROCESSES IN THE ANDES", CONCEPTION AND GOALS

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RESUMEN: El programa de investigación intradisciplinario "Procesos de Deformación en los Andes" ha sido instalado recientemente en Berlín y Potsdam con el apoyo de la Comunidad Alemana de Investigaciones Científicas (DFG). Se llevarán a cabo investigaciones geofísicas, geológicas, geodestas y petrológicas en los Andes Centrales a fin de resolver los problemas claves de la evolución tectónica andina con respecto a la estructura y la reología de la litósfera, la distribución de las tensiones en tiempo y espacio, el transporte del calor, la evolución de cuencas, la isostasia y el consumo de energía durante el proceso orogénico.

KEYWORDS: Central Andes, deformation processes, interdisciplinary research group Berlin and Potsdam SFB 267

INTRODUCTION

An interdisciplinary research program "Deformation Processes in the Andes" (SFB 267) has been established at the Freie Universität Berlin, the Technische Universität Berlin and the new GeoForschungsZentrum Potsdam, which is funded by the German Research Society (DFG). The results and experiences of the previous project "Mobility of Active Continental margins" which was active in the Central Andes from 1984 to 1990 have been used to design this new project, which is planned to run for about 10 years. The Central Andean segment between 20° and 26°S has been chosen for this program because the orogenic deformation processes are distinctly expressed just along this section. The main and outstanding features on this geotraverse can be outlined as follows:

- a convergence rate of about 10 cm/y and high strain rates,
- a vertical uplift rate of about 1mm/y,
- an extreme crustal thickness up to 60-70 km, caused by magmatic underplating and crustal 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,
- a well developed forearc, magmatic arc and back-arc,
- four magmatic arcs which have been evolved succesively by eastwards migrating from Jurassic to recent time,
- variations of the stress regime during the Andean period causing extensional and compressional deformations.

GOALS OF THE PROJECT

Geophysical, geodetic, geological und petrological studies will be carried along the Central Andean traverse aiming to tackle some of the 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 various field projects are under preparation for the first three-year period 1993 - 1995. The main activities will be focussed in the magmatic arc of the Western Cordillera because this zone is seen as key region for the problems of stress transfer from the upper- /lower plate system of the forearc into the strongly deformed back-arc region.

In order to investigate the seismic structure of the magmatic arc and its relations to the adjacent zones a network of seismic refraction profiles are designed in the Western Cordillera. Further 20 mobile seismological stations will be set up in this region under operation for about 3 - 4 month aiming to record and investigate shallow and intermediate earthquakes. The study of seismicity, the determination of focal mechanism and tomographic investigations should reveal the deeper structures and behaviour of a recent magmatic arc. Magnetotelluric deep sounding measurements will contribute additional information. Detailed gravimetric measurements will be carried out aiming to study the deeper structure of intramontaneous basins.

The measurements on the GPS-profile ANSA transversing the Central Andes and being under execution since 1989 will be continued. This study will be remarkably extended within an international co-operation with a profile running along the Pacific coast in N-S direction.

Special geological and petrological investigations are planned in the old and modern 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.

Such a project can be only realised by a close cooperation with geoscientific institutions in Argentina, Bolivia and Chile. In the past a successful cooperation has been developed which should be intensified and extended.

STRUCTURE OF THE COLLABORATIVE RESEARCH CENTER " DEFORMATION PROCESSES IN THE CENTRAL ANDES"

1. Deformation and stress field:

Neotectonic studies, recent kinematics by GPS measurements, modelling of the recent stress and strain field.

2. 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.

3. 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.

4. Evolution of sedimentary basins and isostasy:

Evolution of basins in various crustal environments,
Balancing studies of erosional and sedimentary processes, isostatic studies.