INITIAL RESULTS OF COMBINED GEOSCIENTIFIC INVESTIGATIONS OFF- AND ONSHORE THE ACTIVE NORTH-CHILEAN CONTINENTAL MARGIN

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INTRODUCTION

In the summer 1995 a joint geoscientific project was realized incorporating the four German research institutions BGR, GFZ, FUB and GEOMAR in collaboration with Chilean and Spanish institutes: Crustal Investigation Off- and On-shore Nazca Plate/Central Andes (CINCA). Between 18° und 26° South off North-Chile 4,500 km MCS reflection recordings, 1,300 km seismic wide-angle/refraction data using Ocean Bottom Hydrophones and more than 10,000 km gravity, magnetic and bathymetric swathmapping data were collected as well as geological samples and heat flow data during the R/V SONNE cruise SO-104.

Parallel to the offshore seismic measurements onshore seismic observations were made using the signals of the marine seismic airgun array. In opposite direction explosive blasts were recorded by Ocean Bottom Hydrophones.

The aim was a comprehensive study of the geological-tectonical structure of the active North-Chilean continental margin with special focus on the trench, slope and convergence zone proper and to unravel the processes involved.

INITIAL RESULTS

- Almost none or extremely thin sedimentary cover on top of the oceanic basement.

- The oceanic plate approaching the Peru-Chile Trench reveals strong block and normal fault structures with horst and graben features. A zone of crustal bending is recognized extending over some 50 km in front of the trench.

- Particular blocks of oceanic crust are separated with steep flanks of more than 1,000 m offset in the area of the trench and along the outer trench slope.

- Beneath the inner trench slope the seismic reflection signature of the decollement plane can be traced within certain limits.

- Relatively high seismic velocities and a sub-parallel reflection pattern below the sedimentary cover along the inner trench slope characterize large blocks of obviously continental origin sliding into the more than 7,000 m deep Peru-Chile Trench.

- A deep-seated mass of irregular reflection pattern is observed at the front of the continental wedge underlying the downfaulted and tilted continental blocks. This is interpreted as a melange of tectonically eroded and underplated continental crust and oceanic layer 2 material. Obviously it forms the frontal contact and transition between the downgoing oceanic plate and the continental wedge where the major part of tectonic erosion takes place.

- Geological sampling along ridges paralleling the inner trench slope yielded gneiss, amphibolite schists, phyllites, ignimbrites and other magmatic rocks of continental origin. Asymmetric slope basins between the ridges reach thicknesses of up to 2,000 m and are filled with Quaternary and late Tertiary sediments. At the top of one horst approaching the trench from the west pillow basalt and fine crystalline peridodite were dredged.

- Heat flow data indicate relatively high values of 40 - 60 mW/m^2 which probably can be explained by the generation of frictional heat due to the subduction process.

- The magnetic lineations confirm the Eocene age of the subducting oceanic crust at the trench as suggested by Cande & Haxby (1991).

REFERENCES

Cande, S.C., Haxby, W.F. 1991. Eocene Propagating Rifts in the Southwest Pacific and Their Conjugate Features on the Nazca Plate. J.Geophys.Res., 96, B12, 19,609 -19,622.

Hinz, K., von Huene, R., Ranero, C.R. and PACOMAR working group 1996. Tectonic structure of the convergent Pacific margin offshore Costa Rica from multichannel seismic reflection data. Tectonics, 15, no. 1, 54-66.

Huene, R.von, Scholl, D.W. 1991. Observations at convergent margins concerning sediment subduction, subduction erosion, and the growth of continental crust. Reviews of Geophysics, 29, 279-316.

Reutter, K.-J., Scheuber, E., Wigger, P.J. (ed.) 1994. Tectonics of the Southern Central Andes - Structure and Evolution of an Active Continental Margin. Springer-Verlag, Berlin, pp. 333, 3 maps, ISBN 3-540-55232-4.

Scheuber, E., Reutter, K.-J. 1992. Magmatic arc tectonics in the Central Andes between 21° and 25° S. In: Oliver, R.A., Vatin-Pérignon, N., Laubacher, G. (eds.). Andean Geodynamics. Tectonophysics, 205, 127-140.

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