Young sediments from the Southern Chile Trench: a record of active margin magmatism, tectonics, and paleoseismicity

J.H. Behrmann(1), B. Heberer(2,5), G. Roeser(2,6), M. Rahn(3), A. Kopf (4)

(1) SFB 574, IFM-GEOMAR, Kiel, Germany, (jbehrmann@ifm-geomar.de / Fax: +49-431-6002922)

(2) Geologisches Institut, Universität Freiburg, Freiburg, Germany

(3) Swiss Federal Nuclear Safety Inspectorate, Villigen-HSK, Switzerland

(4) RCOM, Universität Bremen, Bremen, Germany

(5) Present Address: Dept. Geography and Geology, Universitaet Salzburg, Salzburg, Austria

(6) Present Address: Schlumberger D&M, Campo Anadrill, Ciudad Ojeda, Venezuela

Sedimentology, petrography and the provenance of sediments from the Southern Chile Trench (36˚S to 47˚S) that are about to be subducted into the seismogenic zone beneath the South American Plate, were investigated in an integrated approach combining description of a collection of gravity cores, measurement of physical properties, quantitative X-ray petrography and modal analysis. Inferences made from the regional information on sedimentation rates suggest that the cored sediments are of Holocene age. The sediments studied were trench hemipelagics, trench fan deposits, and more distal hemipelagics deposited on the Nazca Plate north of the Chile Triple Junction. The trench is fed from multiple point sources via submarine canyons, extending from the shelf break across the slope, and building submarine fans at the bottom. In the trench, hemipelagic sediment becomes finer northward, reflecting the profound influence of trench architecture on grain size distribution. Modal analyses of turbidites show a southward increase in sediment maturity. While volcanic lithics and plagioclase represent the most dominant fraction in the north, quartz content strongly increases in the southern part of the study area. This reflects the source lithologies, and is also mirrored in the southward decreasing magnetic susceptibility. Further north, active volcanoes in the Main Cordillera almost cause singularities in the provenance signal due to an overwhelming contribution of highly erodible volcanics. Recurrence rates of sandy and silty turbidites in the trench fan sediments indicate a close connection to the paleoseismic record on land. Our study documents the potential usefulness of proximal turbidites to reconstruct paleoseismicity, even at a scale of individual segments of the plate boundary. However, more high-resolution dating of the cores is needed to confirm our conclusions.