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Holocene coastal landforms reveal earthquake-recurrence intervals on Santa María Island, south-central Chile

B. Bookhagen (1), H.P. Echtler (2), D. Melnick (2), M.R. Strecker (1)

(1) Institut für Geowissenschaften, Universität Potsdam, Germany (2) GeoForschungZentrum Potsdam, Germany

The Chilean coast constitutes one of the most active convergent margins of the Pacific rim, where major earthquakes (M>8) have repeatedly occured, involving vertical offsets of several meters. However, long-term earthquake recurrence intervals extending past historical records are virtually unknown, but would provide critical data on the seismotectonic segmentation of forearc sectors and overall coastal landscape development.

Here, we focus on coastal landforms on the tectonically active Santa María Island (SMI), located 20 km off the Chilean coast at about 37° S and only $\sim$ 70 km east of the trench. The SMI is situated in the transition between the Valdivia and Concepción earthquake rupture segments. We identified tilting axes, quantified uplift, as well as tilting rates by surveying, analyzing, and dating well preserved Holocene strandlines. The strandlines are associated with large subduction earthquakes. We precisely surveyed 15 strandlines with a laser-total station and dated quartz sand in the former shoreline facies using the optical stimulated luminescence method. The strandlines are up to 3 km long and have been constantly tilted to the NNE at a rate of 0.024°/ka. The averaged uplift rate of the island is $\sim$ 2 m/ka.

Based on our age determinations we estimated the mean recurrence interval of strandline-forming earthquakes to be 195 ± 110 years. If seismic activity indeed generated these features the records appear to reflect times with clustered earthquakes, followed by a period of relative quiescence. The mean net gain in strandline elevation after an earthquake is 0.35 m. This value integrates over coseismic deformation that can be up to several meters and aseismic relaxation that has not been previously docu-

mented in this region. This net crustal deformation may ultimately represent the effect of underplated sediment in the seismic coupling zone.