Geophysical Research Abstracts
Vol. 12, EGU2010-12369-1, 2010
EGU General Assembly 2010

Mass-transport deposits in the northern Ecuador subduction trench: Result from frontal erosion over multiple seismic cycles

Gueorgui Ratzov (1), Jean-Yves Collot (2), Marc Sosson (3), and Sebastien Migeon (1)

(1) Geoazur, Université de Nice Sophia Antipolis, Villefranche sur mer, France (ratzov@geoazur.obs-vlfr.fr) , (2) IRD, Geoazur, Université de Nice Sophia Antipolis, Villefranche sur mer, France (collot@geoazur.obs-vlfr.fr), (3) CNRS, Geoazur, Université de Nice Sophia Antipolis, Valbonne, France (sosson@geoazur.unice.fr)

Investigations of Mass Transport Deposits (MTDs) and turbidite depositions in the confined North Ecuador subduction trench provide access to paleo-seismic information and insights into long-term mechanisms for frontal tectonic erosion at a convergent margin. The Ecuadorian margin is located along Northwestern South America, where the Nazca plate underthrusts eastward the South America plate with a 58 mm.yr-1 convergence rate. The studied trench has been the site of four great subduction earthquakes ($7.7 \leq Mw \leq 8.8$) during the 20th century, and is isolated from major continental sediment input, so that investigated MTDs and turbidites are considered of local origin. Swath bathymetry, seismic reflection and Chirp data, together with sedimentary cores and 14C datings revealed that seven MTDs emplaced in distinct trench sub-basins since $\sim$20 kyr, and 27 turbidites deposited in the southernmost trench sub-basin since $\sim$4.7kyr. Our analysis shows that six MTDs derived from the margin, while a single one stemmed from the outer trench wall. Temporal correlations between MTDs emplaced within trench sub-basins separated by a structural saddle, indicate that the seven MTDs emplaced during five main events. Three were triggered locally and tentatively dated 5.2 kyr, 1.4 kyr and sub-actual, whereas four were emplaced in distinct trench sub-basins as a result of two regional events at 20 kyr and 13.7 kyr. None of the MTDs occurred during the fast stage of the last sea level rise ($\sim$14 to 8 kyr). However, dissociation of gas hydrates during the last 8 kyr-stage of slow sea level rise might have contributed to trigger the three youngest MTDs. Synchronous deposits in independent basins however suggest that at least part of the MTDs were likely triggered by earthquakes. Low sedimentation rates on the slope and high recurrence seismicity also support a seismic trigger for the 27 turbidites sampled in the trench. However, the large 1.4-12 kyr MTDs return time strongly contrasts with the 50-250 yr turbidites return time. The later is consistent with the 73 to >103 yr frequency of Mw$\geq$8.2 to $\geq$8.8 earthquakes, implying that turbidites might have been triggered by large earthquakes. The very large MTDs return time is attributed to long-term deformation processes and mechanical weakening of the margin outer wedge, in response to repeated variations in basal friction, pore pressure and margin extensional/contraction strain over multiple earthquake cycles. This process contributes to short-term frontal erosion, which rate is estimated to be 9.7 km3/Myr/km, since at least 13 kyr.