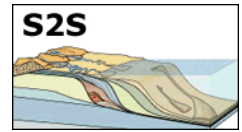


Sediment trapping and bypassing in active continental margin settings: new insight from MARGINS Source-to-Sink studies

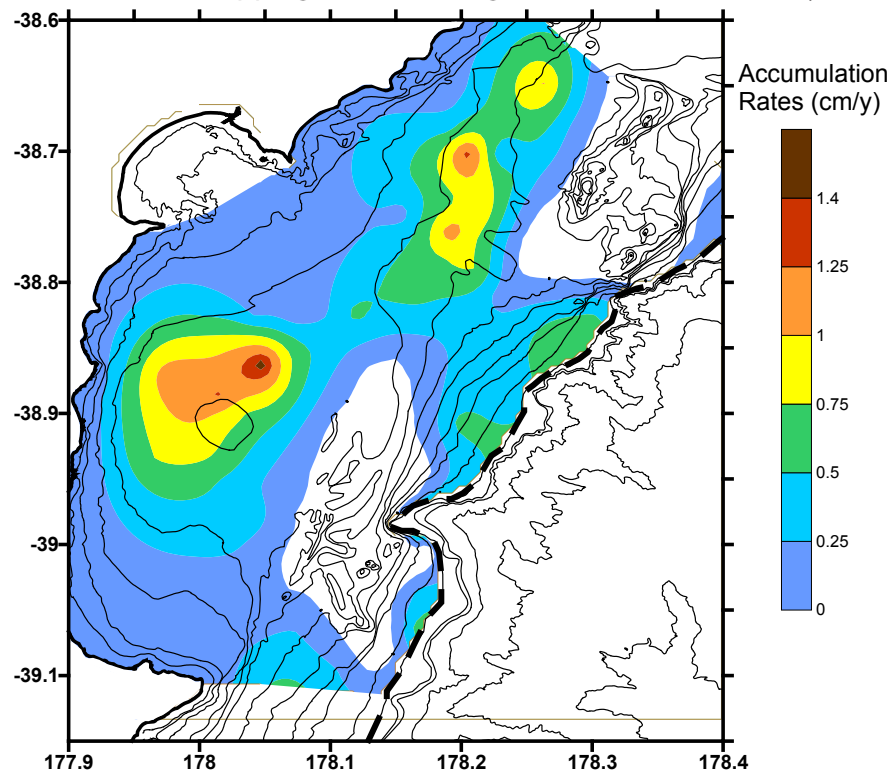


Award: 04-05524, 04-05515 (August 2004), 06-46760 (April 2007)

S. Kuehl¹, A. Miller¹, C. Alexander²

¹Virginia Institute of Marine Sciences, College of William and Mary; ²Skidaway Institute of Oceanography

Continental margin sediments contain a wealth of information on changing climatic, terrestrial and oceanographic conditions over time, but their interpretation depends on our ability to understand the myriad controls on sediment dispersal and accumulation. Traditional models consider sea level to be the primary control on the partitioning of sediments among near shore, shelf and deep sea environments. However, recent studies have highlighted the importance other major factors influencing the ultimate fate of river-derived sediments. The NZ Waipaoa focus area and nearby regions exemplify active margin settings where the fate of riverine inputs during current highstand conditions is strongly modulated by changing sediment yield of the rivers, tectonic accommodation on narrow continental shelves, and energetic oceanographic conditions. Whereas tectonic deformation of active margins such as the NZ North Island east coast creates abundant accommodation in shelf synclines and the potential to preserve a high-resolution stratigraphic record, this accommodation is rapidly depleted by high sediment yields of small mountainous rivers characteristic of these regions. For the Waipaoa focus area, shelf accommodation and sediment input by the rivers was roughly in balance throughout most of the Holocene, resulting in highly efficient shelf sediment trapping. However, huge increases in sediment yield in response to deforestation have resulted in



a situation where roughly 75% of modern sediments dispersed to the shelf by the river escape the Waipaoa shelf. This remarkable result indicates that human disturbance (which may mimic past natural disturbance through catastrophic volcanic eruptions or earthquakes) can radically alter the locus of sediment and organic carbon sequestration on the continental margin having important implications for models of sequence stratigraphy and the global carbon cycle.

Figure: Distribution of sediment accumulation rates on the Waipaoa shelf based on Pb-210 geochronology. A sediment budget for the last 100 years suggest that 75% of the river sediment entering the ocean escapes from the shelf study area.

Gerber, T.P., Pratson, L.F., Kuehl, S.A., Walsh, J.P., Alexander, C., and Palmer, A., In Revision. The influence of sea level and tectonics on Late Pleistocene through Holocene sediment storage along the high-sediment supply Waipaoa continental shelf, Source to Sink Special Volume, Marine Geology.

Kniskern, T.A., Kuehl, S.A., Harris, C.K., and Carter L., In Revision, Sediment accumulation patterns and fine-strata formation on the Waiapu River shelf, New Zealand, Source to Sink Special Volume, Marine Geology.

Kuehl, S.A., Alexander, C., Carter, L., Gerald, L., Gerber, T., Harris, C., McNinch, J., Orpin, L., Pratson, L., Syvitski, J., and Walsh, J.P., 2006. Understanding sediment transfer from land to ocean, Eos Feature Article, 87, (29): 281/286.

Miller, A., and S. Kuehl, Submitted. A sediment budget for recent shelf sedimentation off the Waipaoa River, NZ, Source to Sink Special Volume, Marine Geology.

Orpin, A.R., Alexander, C. Carter, L., Kuehl, S., J.P. Walsh, 2006. Temporal and spatial complexity in post-glacial sedimentation on the tectonically active, Poverty Bay continental margin of New Zealand, Continental Shelf Research, 26: 2205-2224.

Rose, L., and S.A. Kuehl, Submitted. Sediment dispersal and the distribution of sedimentary facies on the continental shelf off the Waipaoa River, Source to Sink Special Volume, Marine Geology.

