RECONSTRUCTION OF THE HOLOCENE PALEO-COASTAL ENVIRONMENT OF SRI LANKA

The 2004 Indian Ocean Tsunami devastated Southeast Asia and Sri Lanka in particular. Following the 2004 event, worldwide tsunami scientists recognized the need for identifying stratigraphic signatures of paleo-tsunami events in the area and to develop a regional tsunami chronology. Sediment layers representing extreme climatic events, sea level changes, and regional climatic changes during the Holocene should be preserved in the beautiful, inflated sedimentary profile of the dynamic lagoons of Sri Lanka, but have not as yet been studied. This project carried out detailed, fine resolution sediment profile studies to recognize the signatures of paleo-coastal environmental change, so that they can be differentiated from the regional record of tsunami deposits. This provides valuable information on both coastal hazards and climate change in Sri Lanka as well as in the region.

A variety of methods were employed to ensure the most suitable proxies for paleo-environmental reconstruction using sediment derived from the tropical Precambrian crystalline terrain. Eastern and southeastern Sri Lanka provide ideal locations to study paleo-coastal changes and regional paleo-coastal hazards due to its high rate of progradation leading to inflated sediment sections. Sediment cores (~100 m total sediment) were extracted along landward transects from nine lagoons, two swales, and one back barrier marsh along the prograding coastline. The cores were taken with a custom-made, AMS coring device capable of coring to a maximum penetration of up to 5 m at each site. XRF analysis was carried out with an Innov-X handheld XRF analyzer. Automated grain size analysis was done with a Malvern Mastersizer 2000 to measure fine-grained sediment and a Retsch Camsizer to measure coarse grain samples. Diffuse Spectral Reflectance (DSR) was measured with a Minolta CM-2600D spectrophotometer to quantify sediment mineralogy. Magnetic susceptibility was measured with Barrington magnetic susceptibility meter. Measurements were completed at 1 cm resolution. Light element geochemistry and nIR reflectance was measured in three selected cores from three lagoons to derive the climatic signal. XRD analysis was carried out for selected samples to verify clay composition. Bulk organic matter, wood, mollusk shells, and inorganic carbonate were used for AMS ^{14}C dating.

The results suggest that key periods of transition in the coastal environment occurred in the mid-Holocene between 5200 years ago and 2500 years ago. Results indicate a sea level high-stand between 5200-4900 yrs BP subsequent to a short sea level low-stand. Gradual infilling of Kirinda estuary and Okanda lagoons initiated after 4900 yrs BP. Beach ridge development started after 5000 yrs BP and intensified after around 2500 yrs BP.

Geochemical and clay mineral ratios suggest a weakened monsoon system until ~3500 yrs BP, when monsoon activity gradually increased. Four drought phases around 55,00, 4500-3500, 1500 and 300 yrs BP can be recognized based on the climatic proxies employed. These events correlate with other published accounts of drought recognized in the Indian Ocean region using various proxies (Gupta et al., 2003, Thamban et al., 2007). Significant ~6yr, ~20-25 yr and ~128 yr yrs cycles can be discerned in wavelet power spectra of climatic proxies. The ~6 yr cycle represents the ENSO-related variation of the Indian Monsoon, while ~20-25 yr cycle is governed by

the decadal variability of the Indian Monsoon. The ~128 yrs periodicity likely relates to solar variability.

Grain size variation, stratigraphy and other proxies show three potential tsunami events prior to the 2004 Indian Ocean Tsunami that exhibit stratigraphic and age correlation among the study sites. These events also correlate with historical and regional records of potential tsunami. The most recent pre-2004 tsunami event likely occurred around 1000 yrs BP with the older events around 4000 yrs BP and 5000 yrs BP. The sedimentary record from these estuaries, lagoons, and beach-ridge plains shows clear localized evidence for several additional flood and storm events, and possibly another tsunami event around 7000 yrs BP.

List of Expenses

AMS 14C age dating	$3000.00

Balance of the invoice will be covered with other funding sources.