Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

APE031-05 会場:104 時間:5 月 25 日 15:15-15:30

Biomarkers and XRF data reveal Holocene changes in runoff and sea level rise
Biomarkers and XRF data reveal Holocene changes in runoff and sea level rise

Els van Soelen[1*], Gregg Brooks[2], Rebekka Larson[2], Jaap S. Sinninghe Damste[3], Gert-Jan Reichart[1]
Els van Soelen[1*], Gregg Brooks[2], Rebekka Larson[2], Jaap S. Sinninghe Damste[3], Gert-Jan Reichart[1]

[1]Utrecht University, the Netherlands, [2]Eckerd College, St Petersburg, USA, [3]NIOZ, Texel, the Netherlands
[1]Utrecht University, the Netherlands, [2]Eckerd College, St Petersburg, USA, [3]NIOZ, Texel, the Netherlands

Climate in Florida is characterized by a strong annual hydrological cycle, with wet summers and dry winters. Precipitation is regulated by, amongst others, annual shifts in the position of the Intertropical Convergence Zone (ITCZ). During the Northern Hemisphere summer, the ITCZ moves North of the equator thereby increasing transport of moist air into the Gulf of Mexico. Currently, also the El Nino Southern Oscillation (ENSO) affects precipitation in Florida, especially by increasing the amount of winter rainfall during an El Nino event. To study long term changes in the hydrological cycle of Florida, a paleoclimate reconstruction was made, of the past ~9000 years using sediments recovered from a shallow marine setting in southwest Florida (Charlotte Harbor). During this period, sea level rise has played a major role on the environmental changes in the estuary. A high resolution multi-proxy approach allows for the distinction between environmental change due to submergence and climate change. Whole core XRF scanning was used to reconstruct variations in quartz and carbonate content, which was used to correlate different sediment cores. Changes in runoff were reconstructed by looking at fluxes of terrestrial biomarkers, while primary productivity is based on aquatic biomarker fluxes. The BIT index (an index of Branched (terrestrial) versus Isoprenoidal (marine) Tetraethers [1]), and C/N ratios were used to estimate the relative input of terrestrial versus marine organic matter.

The lowest part of the sediment core consists of quartz sands and bivalves and was part of a tidal flat. Between 8500 and 7000 year BP, the site completely submerged, resulting in a restricted marine setting which lasted until about 3500 year BP. Between 6000 and 5000 years BP maxima in terrestrial biomarker fluxes indicate a maximum in runoff, likely due to enhanced rainfall. Reconstructions of runoff and precipitation in the Gulf of Mexico and Caribbean also indicate increased moist conditions during the mid Holocene [2] and increased moisture transport into the Gulf of Mexico between 6500 and 4500 years BP [3]. Warmer northern Hemisphere temperatures and, as a consequence of this, a more northward position of the ITCZ might have been responsible for this, because this would enhance easterly winds which are responsible for bringing moist air to the Gulf of Mexico. Up to 3500 year BP, BIT index and C/N ratio indicate a gradual increase in marine organic matter, indicating gradual submergence of Florida during the mid-Holocene.

From 3500 years BP onwards, the terrestrial input strongly decreased and organic proxies indicate a change towards relatively more marine conditions. Sea level rise is unlikely to have caused this change in environment, because submergence curves for Florida indicate decelerating rates towards the late Holocene [4]. Pollen reconstructions in a wetland in southwest Florida show a development from grass vegetation during the mid Holocene to a Cypress swamp forest in the late Holocene [5]. This is thought to be a consequence of an intensification of ENSO activity in the late Holocene, which resulted in more winter precipitation and longer growing seasons during an El Nino event. This development in vegetation would have increased the water retaining capacity of the soils and prevented erosion, which explains the observed decrease in terrestrial biomarkers. Over the last century, runoff increased again due to human activity, like deforestation and wetland drainage.

[1] Hopmans et al., 2004. Earth Planet. Sci. Lett. 224, 107-116
[2] Montero-Serrano et al., 2010. Global Planet. Change. 74, 132?143
[3] Poore et al., 2003. Paleoceanography, 18, 2, 1048
[4] Toscano and Macintyre, 2003. Coral Reefs 22, 257?270
[5] Donders et al., 2005. PNAS 102(31), 10904-10908

キーワード: Precipitation, Holocene, Florida, Biomarkers
Keywords: Precipitation, Holocene, Florida, Biomarkers