MULTIPROXY STUDY OF CONTRASTING ENVIRONMENTAL REGIMES IN THE CARIBBEAN AND THE EASTERN TROPICAL PACIFIC

C. Huguet[1], J.-H. Kim[2,] V. Ramírez-Valencia[1], H. H. Tavera[1], K.-H. Shin[3], J.-K. Gal[3], S. Kang[3], C. González-Arango[1]

[1] Universidad de Los Andes, Colombia,
[2]Korea Polar Research Institute, South Korea
[3]Hanyang University, South Korea,

Introduction

Understanding past changes in Earth's climate requires the reconstruction of climatic patterns in both marine and terrestrial settings. However, transitional zones like coastal seas have received limited attention specially when addressing geographical gradients. Here we present results from a multiproxy study of surface sediments from the southern Caribbean and the eastern tropical Pacific (equator–16°N, and 62°W–85°W) in order to understand the terrestrial and marine influence on coastal environments with different physico-chemical characteristics. We used biomarkers of both bacterial and archaeal origin, branched (br) and isoprenoid (iso) glycerol dialkyl glycerol tetraethers (GDGTs), respectively (Schouten et al. 2013), as well as *n*-alkanes to assess terrestrial inputs and marine productivity between the two contrasting study areas. We integrated these biomarker data with geochemical elemental composition and marine and terrestrial palynomorph assemblages' information to provide a more comprehensive understanding of the differences between the two ecosystem dynamics.

Results

Biomarker abundances and distributions allowed for a clear distinction between the Caribbean and Pacific sites. These data are in good agreement with the distribution of major and trace elements (e.g. Ba, Ca, K) and palynomorph assemblages. In general, the Caribbean side has larger river basins (e.g. Magdalena), while the Pacific side is characterized by smaller river basins, dense tropical rain forests, active fault systems, steeper slopes and high precipitation rates (with some areas receiving over 70000 mm annually), all of which result in higher sedimentary loads in that area (Restrepo and Alvarado, 2011). In both the BIT index (Hopmans et al 2004) and the distribution of brGDGTs (Schouten et al. 2013), we not only observe higher terrestrial inputs in the Pacific side but we can also trace riverine plumes. Coupled to a higher sedimentary load and thus a higher nutrient input, the marine production appears to be higher in the Pacific side than in the Caribbean side. Differential productivity between the Caribbean and the Pacific is reflected in the isoGDGT abundance, geochemical elemental composition, and palynomorph abundance. However, the input of terrestrial nutrients is not the only factor to consider since nutrient upwelling occurs in the eastern Pacific area associated with the Humboldt Current. In a recent study, Fietz et al. (2013) used the distribution of hydroxilated GDGTs to trace cold water masses. In agreement with this study, our hydroxilated GDGTs are also more abundant in the Pacific side most likely coupled to the presence of a colder water mass associated with the Humboldt Current.

Conclusions

Clear differences can be observed in terms of terrestrial input, marine productivity and diversity between the two study areas highlighting the potential of the multipxoy approach to trace back hydrological changes and weathering over the continental tropical South America as well as its consequences in coastal environments.

The Caribbean study area presents lower sedimentary load associated with lower nutrient levels, which results in lower productivity and diversity in the area. In addition to higher sedimentary load, the Pacific side is also influenced by the Humbolt Current, which results in further enhancement of productivity due to nutrient upwelling in that setting compared to the Caribbean.

References

Fietz, S., Huguet, C., Rueda, G., Hambach, B., & Rosell-Melé, A., 2013. Hydroxylated isoprenoidal GDGTs in the Nordic Seas. Marine Chemistry, 152, 1-10.

Hopmans, E. C., Weijers, J. W., Schefuß, E., Herfort, L., Damsté, J. S. S., & Schouten, S., 2004. A novel proxy for terrestrial organic matter in sediments based on branched and isoprenoid tetraether lipids. Earth and Planetary Science Letters, 224(1), 107-116.

Restrepo, J.D. & Alvarado, E.M., 2011. Assessing Major Environmental Issues in the Caribbean and Pacific Coasts of Colombia, South America: An Overview of Fluvial Fluxes, Coral Reef Degradation, and Mangrove Ecosystems Impacted by River Diversion. Treatise on Estuarine and Coastal Science, 11: 289-314.

Schouten, S., Hopmans, E. C., & Damsté, J. S. S., 2013. The organic geochemistry of glycerol dialkyl glycerol tetraether lipids: a review. Organic geochemistry, 54, 19-61.