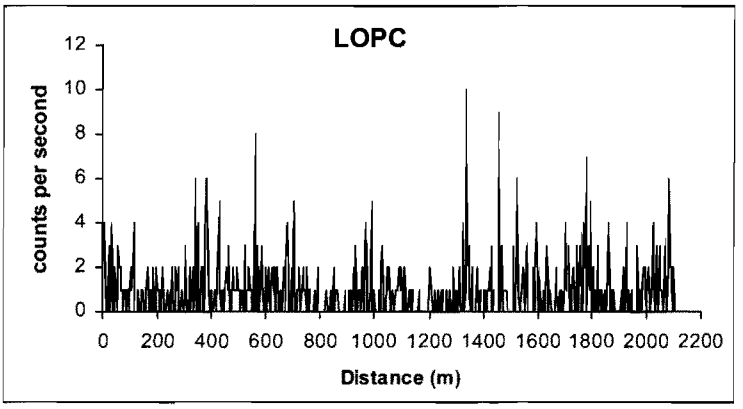

Figure 1: Example of LOPC data generated during a 20-minute subsurface (3 m) horizontal tow along a transect of approximately 2100 m inside Independencia Bay, Peru, in May 30, 2006.

HCS078 - Variations in benthic and planktonic foraminifera from laminated sediments off the coast of Peru

María del Carmen Morales R [1], David Field, Sergio Mayor, Dimitri Gutierrez[2], Abdel Sifeddine[3], Luc Ortlieb[3], Vicente Ferreira, Renato Salvatteci, Federico Velazco.

[1] *INGEMMET- Laboratorio de Paleontología, Av. Canadá 1470, San Borja (mmorales@ingemmet.gob.pe)*
[2] *Instituto del Mar del Perú, IMARPE, Esquina Gamarra y Gral. Valle s/n, Apartado 22, Callao, Lima-Perú tel: +51 1 4297630*
[3] *Institut de Recherche pour le Développement IRD*

Keywords: Dissolution, Foraminiferal record, Laminated sediments, Oxygen minimum zone, Peru margin.

Variations in abundance of foraminifera preserved in marine sediments provide a record of environmental and ecosystem change in the ocean that extends beyond instrumental records. The development of dysoxic environments generally favors the preservation of the calcium carbonate tests of benthic and planktonic foraminifera as well as the temporal sequence of sedimentation in the form of laminated sediments. PALEOPECES is a multidisciplinary group of researchers aiming to reconstruct past changes in ocean and ecosystem structure from sediment cores taken off the coast of Peru. We present results of variations in abundance of foraminifera from a box core taken off Pisco, Peru in 2004 (at 299 m. depth) (Fig. 1) and discuss the implications for reconstructing environmental changes.

Foraminifera were quantified from the >125 um fraction of vertical sampling intervals ranging from 0.2-0.7 cm based on the laminated structures of the sediment. The record of foraminiferal abundances is dominated by periods of presence or absence of planktonic and benthic foraminifera for periods of several sampling intervals to sections of the core spanning over a century in duration (Fig. 1).

A major portion of the variability in the abundance of foraminifera can be attributed to effects of dissolution for several reasons: 1) direct observations of dissolution in parts of the tests of benthic and planktonic foraminifera, 2) periods of absence or nearly total absence of all planktonic foraminifera, which are known to be abundant in surface waters off of Peru, 3) periods of absence or nearly total absence of all benthic foraminifera, although several taxa are abundant in dysoxic waters, 4) observations of varied abundances within a sedimentary slump that represents an instantaneous deposit but later had differential exposure to pore waters.

Intervals of foraminifera preservation show noteworthy variations in species composition. There is a trend of increasing relative abundance of *Bolivina seminuda* throughout the period of enhanced preservation since about 1850. Because *B. seminuda* is well adapted to low oxygen concentrations (Bernhard and Gupta, 2000; Paez et al. 2001) this trend suggests a continued decrease in oxygen concentrations throughout the 20th century. Such a trend of decreasing oxygen is consistent with other proxies indicating increasing productivity, such as total organic carbon shown in Fig. 1, and decreasing oxygen since an apparently abrupt change in the mid 19th century. Furthermore, the enhanced preservation after about 1850 is also best explained by reduced oxygen concentrations in bottom waters.

The shift from total dissolution of foraminifera towards preservation, followed by a continued trend of decreasing oxygen concentrations suggests an important shift in the interstitial chemistry of sedimentary pore waters that can vary with water mass and changes in acidity, alkalinity, and oxygen associated with organic carbon flux. This change occurs at the same time as a multitude of other proxies of surface productivity and sedimentary characteristics (Fig. 1). Thus the foraminiferal record provides an additional line of evidence from the PALEOPECES effort indicating that centennial-scale shifts can occur in the biogeochemical environment of the Peruvian coastal upwelling system.

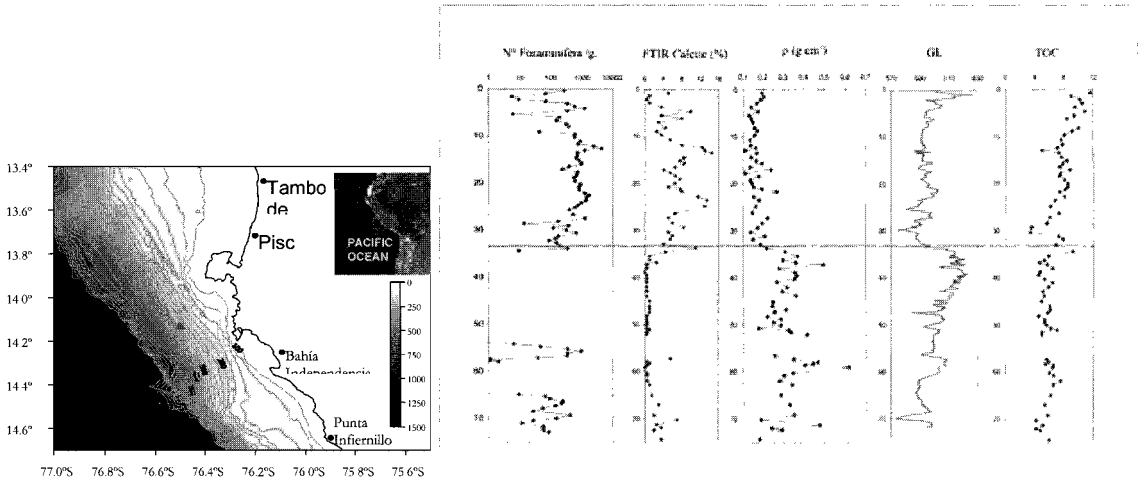

Figure 1. Left, Location of boxcore B0405-06 (red triangle, 14°07.90 S, 76, 30.10W, 299 m depth) off the central-south Peruvian coast. Bathymetric contour lines are in 25m intervals from 100m to 500 m, and in 100m intervals from 500m to 1500m depth (Gutiérrez et al., 2006); right, Downcore time series of total number of foraminifera (benthic and planktonic), % Calcite from FTIR (Fourier Transform Infrared spectrometry), dry bulk density (ρ (g cm^{-3})), grey level (GL), and total organic carbon (TOC), in the boxcore taken off Pisco.

References

Bernhard, J. & Sen Gupta, B. (2000). Foraminifera of oxygen depleted environments. In Modern foraminifera. Kluwer Academic Publisher. Great Britain 1999.

Gutiérrez, D., A. Sifeddine, J. L. Reyss, G. Vargas, F. Velazco, R. Salvatteci, V. Ferreira, L. Ortlieb, D. Field, T. Baumgartner, M. Boussafir, H. Boucher, J. Valdés, L. Marinovic, P. Soler & P. Tapia. (2006). Anoxic sediments off Central Peru record interannual to multidecadal changes of climate and upwelling ecosystem during the last two centuries. Advances in Geosciences, 6, 119–125.

Paez, M., Zúñiga O., Valdéz, J. y Ortliecb, L. (2001). Foraminíferos recientes en sedimentos micróxicos de la Bahía Mejillones del Sur (23°s), Chile. Revista de Biología Marina y Oceanografía 36(2), 129 – 139 diciembre del 2001.

HCS097 - Investigating Internal Variability in the Northern Benguela Current Region – A Modelling Approach

F. Colberg, C. J. C. Reason

Oceanography Department, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa [tel: +27 21 650 5315, fax: +27 21 650 3979, e-mail: colberg@ocean.uct.ac.za].

Keywords: Benguela Current System, Comparable systems, Internal variability, Ocean modelling

This study focuses on the internal variability of the Northern Benguela Current System and the Angola Benguela Front (ABFZ) using a regional model run for 32 years and forced with monthly climatologies of QuikSCAT winds and NCEP/ NCAR reanalysis fluxes. The ABFZ is an important system boundary separating the tropical current system from the Benguela upwelling system. Any changes in the intensity or meridional shifts of the front may potentially affect local fisheries and/ or rainfall variability over the bordering land masses.

Model results suggest that anomalous northward (southward) positions of the Angola Benguela Frontal Zone are connected to anomalous intensities of the front. A mechanism is suggested whereby anomalous northward shifts of the Angola Benguela Frontal Zone are associated with an anticyclonic circulation pattern in the area that shifts the frontal system towards the north. This anomalous circulation also forces changes in coastal upwelling that in turn drive anomalous upper ocean temperatures, which act to enhance the meridional temperature gradient. This mechanism appears to be most effcient during austral spring and summer.

Interannual variability within the front is investigated and is found to be connected to periodic westward propagating anomalies of the large scale sea surface height. It is suggested that oceanic instability processes are mainly responsible for this wave-like motion. A comparison between internal variability near the Angola Benguela FrontalZone and other modes of variability suggests that internal variability could at times account for the same amount of variability induced by El Niño-Southern Oscillation, and for up to 20% of the variability apparent during major warm events in the South East Atlantic such as Benguela Niños.

Morales M.D.C., Fiedl D., Mayor S., Gutierrez D., Sifeddine Abdelfettah, Ortlieb Luc, Ferreira V., Salvatteci R., Velazco F. (2006)

Variations in benthic and planktonic foraminifera from laminated sediments off the coast of Peru

In : *Climate ocean dynamics, ecosystem processes and fisheries : the Humbolt current system : book of extended abstracts*

La Paz (BOL) ; La Paz : IMARPE ; IRD, p. 93-94

International Conference on The Humboldt Current System : Climate, Ocean Dynamics, Ecosystem Processes and Fisheries, Lima (PER), 27/11/2006-01/12/2006.