

# Changes in productivity in the Guaymas Basin over the last 22,000 years: Insights from coccolithophores in sediments from IODP Site U1549

## María-Carmen Álvarez

Universidad Nacional Autónoma de México, Instituto de Geofísica; Consejo Nacional de Humanidades, Ciencias y Tecnologías (CONAHCYT), Mexico City, Mexico; malvarez@igeofisica.unam.mx

## Ligia Pérez-Cruz, Jaime Urrutia-Fucugauchi

Universidad Nacional Autónoma de México, Instituto de Geofísica, Mexico City, Mexico; perezcruz@igeofisica.unam.mx; juf@igeofisica.unam.mx

## Alejandro Aldama-Cervantes, Mauricio Velázquez Aguilar

Universidad Nacional Autónoma de México, Posgrado en Ciencias del Mar y Limnología, Mexico City, Mexico; alejandro.aldama.cervantes@ciencias.unam.mx; maps.vlo@ciencias.unam.mx

## Mariem Saavedra-Pellitero

University of Portsmouth, School of the Environment, Geography and Geosciences, Portsmouth, PO1 3QL, UK; mariem.saavedra-pellitero@port.ac.uk

<https://doi.org/10.58998/jnr3200>

The Guaymas Basin in the central Gulf of California is a very productive area with high chlorophyll *a* concentrations in some parts of the basin. Coastal upwelling, which develops yearly on the eastern coast, is strong, and the resulting eddy circulation promotes phytoplankton growth throughout the gulf. These processes are induced by the atmospheric dynamics of the Gulf of California and the prevailing northern winds blowing along the continental coast during spring-winter. Coccolith abundance and net primary productivity (NPP) have been reconstructed for the last 22,000 years, using sediment samples that were retrieved from International Ocean Discovery Program (IODP) Expedition 385 Hole U1549A (27°28.33167'N, 111°28.7844'W). Site U1549 was drilled at a water depth of 1840 m aboard the R/V *JOIDES Resolution*, with Hole U1549A drilled to a total depth of 168.0 m below the seafloor, recovering 166.89 m of core, of which the uppermost 40 m were studied.

The coccolith assemblage from the cores of Hole U1549A is dominated (>50%) by *Gephyrocapsa* >3 μm and the reconstructed NPP is high with values ranging from 944.66 to 1288.25 mg C/m<sup>2</sup>/day. Variations in the coccolith abundance and the NPP allowed us to identify four scenarios.

- (1) Cold and productive: The highest NPP values were recorded during the Last Glacial Maximum and Heinrich Event 1 (H1). The genus *Gephyrocapsa* >3 μm showed its highest abundances and *Coccolithus pelagicus* subsp. *braarudii* was present in relatively high numbers. Both taxa developed well under upwelling conditions with cool water temperatures.
- (2) Intermittent stratification: A stepwise decrease of NPP occurred in the Bølling-Allerød Interstadial (BA) and Younger Dryas (YD). *Coccolithus pelagicus* subsp. *braarudii* showed a decline in abundance, whereas *Florisphaera profunda* showed an increase. Variability and intermittent stratification characterized these intervals. Minimum values in total abundance, NPP, and most of the taxa were reached at 11,707 cal yr BP.
- (3) Warm conditions with occasional stratification: At the beginning of the Holocene Climatic Optimum, *C. pelagicus* subsp. *braarudii* disappeared, and abundant warm-water taxa dominated. After this abundance peak, a decrease in NPP took place, and stratification events are suggested by the presence of *F. profunda*.
- (4) Stratified waters: There was a general progressive decrease in NPP that characterized the modern part of the record, and the variable presence of *F. profunda* revealed stratification in the surface waters.