

Upper Oligocene Larger Foraminifera from Nosara, Nicoya Peninsula (Costa Rica) and Windward (Carriacou, Lesser Antilles), calibrated by $^{87}\text{Sr}/^{86}\text{Sr}$

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Upper Oligocene shallow water formations unconformably overlie Paleocene-Eocene distal turbidites and siliceous shales in the outcrops between Punta Peladas and the Nosara River mouth, on the W-coast of the Nicoya Peninsula (Costa Rica). The shallow water lithostratigraphy is threefold:

1. nearshore, massive muddy calcareous volcanic sandstones of 10-50 m thickness alternate with
2. up to 40 m thick sandy bioclastic limestones that show high angle cross-bedding typical of nearshore to offshore high-energy carbonate banks. Bioclasts are mainly larger foraminifera, coralline algae, bivalve and echinoderm fragments.
3. The limestones are conformably overlain by an at least 100 m thick section of offshore mudstones alternating with distinct dm-thick volcanoclastic tempestites. This sequence may reach the lowermost Miocene.

The bioclastic limestones of Punta Peladas and Punta Nosara have yielded rich assemblages of larger Foraminifera that could be isolated and have been studied in oriented sections, both SEM for split material and polished rock thin sections for transmitted light and cathodoluminescence (CL) observation.

CL observation was essential for the taxonomic determination of the nepionic stage of miogypsinids which are generally very recrystallised. CL observation revealed also a large number of planktonic foraminifera associated with the shallow water material, confirming the open marine environment indicated by the sedi-

mentology of the carbonates at Punta Peladas.

The association of larger foraminifera are:

Heterostegina antillea Cushman, *Miogypsina tani* Drooger, *Miogypsina gunteri* Cole, *Miogypsina* cf. (*Mirolepidocyclina*) *panamensis* (Cushman), *Miogypsina* sp., *Lepidocyclina (nephrolepidina) vaughani* Cushman, *Lepidocyclina yurnagurensis* Cushman, *Lepidocyclina undosa* Cushman. New species of *Miogypsina* are currently under study. The genus *Miogypsinoides*, known from the middle Oligocene, is absent from the studied assemblages. Associated planktonic foraminifera are in the process of being studied in thin sections.

At Windward, Carriacou (Lesser Antilles), scattered outcrops of the Belvedere Formation contain calciturbidites rich in larger Foraminifera associated with a lower Upper Oligocene nannofossil assemblage (NP24, Speed et al. 1993). Planktonic Foraminifera recovered south of Windward in rocks slightly downsection by Robinson & Jung (1972) indicate a upper Middle Oligocene age.



Figure 1 *Lepidocyclina*, Pta Peladas (Nosara), seen under cathodoluminescence

Larger Foraminifera species collected from a coastal outcrop just north of Windward include *Lepidocyclina undosa* Cushman and *Miogypsina gunteri* Cole.

The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio was measured in 11 specimens of megalosphaeric *Lepidocyclina* spp. mechanically extracted from two rock samples collected at Punta Peladas (Costa Rica), a few m above the angular unconformity with the underlying deep water series. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios range from 0.70809 to 0.70820, which corresponds to a model age of 27.3 to 24.9 Ma according to McArthur et al. (2001). Very similar $^{87}\text{Sr}/^{86}\text{Sr}$ ratios, ranging from 0.70815 to 0.70817 were obtained from two specimens extracted from a sample collected in a coastal outcrop N of Windward Village (Carriacou, Lesser Antilles).

All measured $^{87}\text{Sr}/^{86}\text{Sr}$ ratios fall within a Chattian (Late Oligocene) age according to the Berggren (1995) time scale.

The biochronologic range of the larger foraminifera listed above is currently controversial, and has to be considered as poorly known. In the Caribbean region and Panama some of the species (*Heterostegina antillea* Cushman, *Lepidocyclina (nephrolepidina) vaughani* Cushman) are known from the middle Oligocene *Globorotalia opima* zone to the Lower Miocene *Catapsydrax dissimilis* zone. On the other hand, Butterlin (1981) restricted the range *Miogypsina gunteri* to the lower Aquitanian and *Miogypsina tani* to the upper Aquitanian.

Nannofossils, planktonic foraminifera and identical $^{87}\text{Sr}/^{86}\text{Sr}$ ratios

form Punta Peladas and Windward clearly indicate a Chattian (Upper Oligocene) occurrence of *Miogypsina gunteri* and *Miogypsina tani* and confirm this age range for the other larger Foraminifera cited above.

References

Butterlin, J. 1981, Claves para la determinacion de macroforaminiferos de Mexico y del Caribe, del Cretacico Superior al Mioceno Medio: Instituto Mexicano del Petroleo. 217pp.

Berggren, W.A., D.V. Kent, C.C. Swisher & M.P. Aubry. 1995. A revised Cenozoic geochronology and chronostratigraphy. In: Geochronology, time scales and global stratigraphic correlation. SEPM Spec. Publ., vol. 54, pp. 129-212. Tulsa, Okla., Society for Sedimentary Geology.

McArthur, J.M., R.J. Howrath & T.R. Bailey. 2001. Strontium Isotope Stratigraphy: LOWESS Version 3: Best Fit to the Marine Sr-Isotope Curve for 0-509 Ma and Accompanying Look-Up Table for Deriving Numerical Age. The Journal of Geology, vol. 109, pp. 155-170.

Robinson, E and Jung P. 1972, Stratigraphy and Age of Marine Rocks, Carriacou, West Indies: The American Association of Petroleum Geologists Bulletin, vol. 56, no. 1, pp. 114-127.

Speed, R.C., Smith-Horowitz, P.L., Perch-Nielsen, K.v.S.,

Saunders, J.B. and Sanfilippo A.B., 1993, Southern Lesser Antilles Arc Platform: Pre-Late Miocene Stratigraphy, Structure and Tectonic Evolution: The Geological Society of America, Special Paper 277, 98pp.

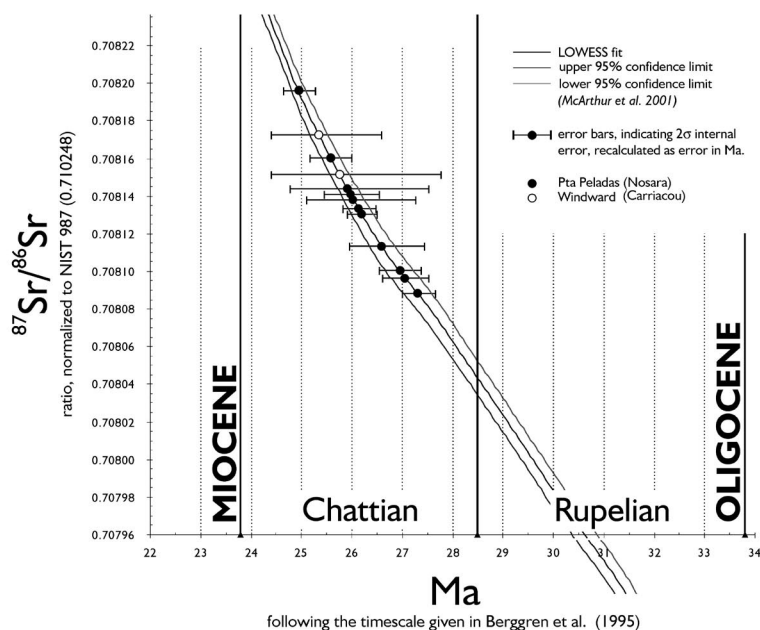


Figure 1 LOWESS Best-fit $^{87}\text{Sr}/^{86}\text{Sr}$ ratio isotope curve of McArthur et al. (2001, who used Berggren et al. 1995 for ages in Ma) for the Oligocene, with $^{87}\text{Sr}/^{86}\text{Sr}$ ratios from Punta Peladas (Nosara, Costa Rica) and Windward (Carriacou, Lesser Antilles).