PRELIMINARY DATA ON THE ORGANIC BIOGEOCHEMISTRY OF REEF INTERSTITIAL WATERS USING THE ORGANIC BIOMARKERS APPROACH. CASE STUDY:TIKEHAU, TAHITI (FRENCH POLYNESIA, SW PACIFIC).

Ioanna Bouloubassi* and Francis Rougerie**

* Laboratoire de Physique et Chimie Marines, Université P. et M. Curie, UA CNRS 353; Tour 25; 4, place Jussieu; 75252 PARIS
** Centre ORSTOM de Tahiti; BP 529; PAPEETE (FRENCH POLYNESIA)

ABSTRACT

Interstitial waters from boreholes in reef flat agglomerate in Tikehau atoll (up to 35 meters depth) and in Tahiti north barrier reef (up to 50 meters depth) contain positively anomalous concentrations of dissolved inorganic nutrients and CO_2, along with low pH and alcalinity. These anomalies are interpreted in the frame of a geothermal endo-upwelling process in which deep oceanic water penetrates the porous reef carbonates and ascends by thermo-convective advection seeping out through the upper carbonate framework (1,2). The record of He-3 anomalies in borehole waters in Tikehau atoll (3) gave a strong evidence for the endo-upwelling mechanism.

This paper deals with the study of reef pore fluids in Tikehau and Tahiti by the biogeochemical markers approach to assess the nature and transformation processes of the organic matter. Two classes of lipids were analyzed, non-aromatic hydrocarbons and fatty acids, using gas chromatography and gas chromatography-mass spectrometry.

Our data pointed out that hydrocarbon and fatty acids imprints in interstitial waters are significantly different from those in the surrounding oceanic surface layer and in lagoonal waters. The hydrocarbons and fatty acids concentrations were high at the top of the boreholes reflecting inputs from the upper living algal-coral system, they decreased at the subsurface and then increased again with increasing sampling depth. This latter feature is not consistent with a downward tranport of organic matter formed in the upper coral veneer of the reef.

Furthermore, various biological markers of algal-planktonic activity were present in the near-surface section of the boreholes along with some markers of land vegetation inputs. The deeper sections were characterized by very important bacterial imprints and quite peculiar n-alkanes distribution profiles. The interstitial waters thus appeared as an environment of intense microbial activity inducing early diagenetic transformations of the organic matter. Several compounds were detected in the hopane series having the stable 17α,21β configuration and showing epimerization at the 22 carbon atom. These compounds are

indicators of thermally mature organic matter. In the case of the studied sites this maturation could not have been possible otherwise than by volcanic and/or geothermal activity. The presence of such compounds in the upper section of the coral reefs strongly indicates an upward migration of reef pore fluids as proposed by the endo-upwelling model.

To our knowledge it is the first time that the organic biomarkers approach is applied in the study of reef pore waters. The preliminary results clearly pointed out that this approach is very promising for the determination of the origin and diagenetic transformation of the organic matter within the pore waters during the migration of the latter through the carbonate framework. Future measurements must include deeper sampling levels in order to provide a better understanding of the organic biogeochemical processes occurring in this environment as well as to better assess the role of the endo-upwelling mechanism.

References

1. ROUGERIE F. and WAUTHY B. (1986). Oceanologica Acta, 9, 133-148.

2. ROUGERIE F. and WAUTHY B. (1990). Coral Reefs (in press).

3. ROUGERIE F., ANDRIE C. and JEAN-BAPTISTE P. (1991). Geophysical Research Letters, 18, 109-112.

International Society for Reef Studies

Annual Meeting, Berkeley, California
13-16 December 1991

Reefs Beyond the Golden Gate

PROGRAM AND ABSTRACTS

Berkeley Marina Marriott Hotel