

SOME ASPECTS OF THE ECOLOGY OF SEVERAL LARGE,  
SYMBIONT-BEARING FORAMINIFERA AND THEIR  
CONTRIBUTION TO WARM, SHALLOW-WATER BIOFACIES

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## ABSTRACT

Fifteen species belonging to four families of large, benthic, symbiont-bearing foraminifera were collected in coral reef-associated environments on Palau, Western Caroline Islands, and Oahu, Hawaii. R-mode cluster analysis revealed four species clusters around Palau. One cluster, dominated by Calcarinidae, was characteristic of seaward reef flats. The second cluster, made up of Marginopora vertebralis, Amphistegina lobifera, and Peneroplis pertusus, was characteristic of more protected shoals having water depths of less than 5 m. The third cluster, typified by A. lessonii, characterized reef slopes at 5-20 m. The fourth cluster consisted of more deeply dwelling species, specifically A. radiata and Nummulites ammonoides. In the samples from Oahu, the calcarinid cluster was absent, M. vertebralis was associated with Spirolina arietina, A. lessonii was associated with A. lobifera and P. pertusus, and A. bicirculata and N. ammonoides typified deeper samples.

A. lessonii, A. lobifera, and Calcarina spengleri reached reproductive sizes in Palau in approximately 3 - 4 months. A. lessonii and A. lobifera in Hawaii matured in about 4 months and one year respectively. A. lessonii and A. lobifera growth rates in the laboratory were light limited. A. lessonii also exhibited photoinhibition of  $^{14}\text{C}$  uptake in direct sunlight. A. lobifera, which reproduced at larger sizes and was more fecund than A. lessonii, failed to reproduce at diminished light levels in culture.

Carbonate production rates by selected rotaliine species were up to  $1-6 \text{ kg CaCO}_3 \text{ m}^{-2} \text{ yr}^{-1}$  on seaward reef flats and  $1 \text{ kg CaCO}_3 \text{ m}^{-2} \text{ yr}^{-1}$  on lagoonal reef slopes in Palau. Carbonate turnover rates were about 20 times per year. Production rates in Hawaii were up to  $0.3 \text{ kg CaCO}_3 \text{ m}^{-2} \text{ yr}^{-1}$  on seaward reef slopes, with carbonate turnover rates of about 10 times per year.

Test thickness decreased with habitat depth in the large, symbiont-bearing foraminifera. In rotaliines, change in thickness with diameter ( $\Delta t/\Delta d$ ) was  $>0.5$  in turbulent reef flat species,  $0.4-0.5$  at intermediate depths, and  $<0.4$  in deeper dwelling species. Trends were also evident

in milioline species, although thickness of shallow dwelling miliolines was comparable to deeper dwelling rotaliines. Trochospiral species were thicker than planispiral and discoid forms.

Coiling direction in A. lessonii was predominantly sinistral. A. lobifera was predominantly sinistral in the western Pacific and predominantly dextral in the Hawaiian Islands, with no direction predominant in central Pacific forms. Proportions of minority coiling direction individuals increased in both species in adult size classes. Samples from a 4° C. above ambient thermal effluent were also slightly but significantly enriched in minority coiling individuals of both species. In the laboratory, coiling ratios in clones reflected coiling ratios of the population rather than coiling direction of the individual parent.