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# Effects of light on the largest extant benthic foraminifer, Cycloclypeus carpenteri

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Cycloclypeus carpenteri is the largest extant benthic foraminifer. This species dwells in deep euphotic depths of warm oligotrophic waters, and is a host to diatom endosymbionts. Fossil Cycloclypeus has been found in tropical shelf carbonates since the Oligocene. Light is supposed to be the primary environmental factor controlling the depth distribution of this species. However, physiological responses of this foraminifer to light are not yet well understood. We investigated short-term and long-term effects of light on Cycloclypeus carpenteri collected from about 70 m depth, west of Okinawa Island (Japan). To determine short-term responses to light, net oxygen production was measured at different light levels and wavelengths using an oxygen microelectrode. Photosynthesis-irradiance curve of this species indicated that net oxygen production increased up to 50 $\mu$E m-2 s-1, was saturated until 100 $\mu$E m-2 s-1, then was photoinhibited over 100 $\mu$E m-2 s-1. Net production was higher when incubated on blue wavelength than on either red or green wavelengths. To determine long-term light effects, asexually reproduced clone individuals were incubated for about 4 months at different light levels ranging from 0 to 100 $\mu$E m-2 s-1. The long-term incubations indicated that growth rates measured by the surface area were optimal at light levels from 5 to 50 $\mu$E m-2 s-1, but were lowered at 0 and 100 $\mu$E m-2 s-1. These results suggest that Cycloclypeus carpenteri can be acclimatized at less than 100 $\mu$E m-2 s-1 of light by changing photopigment (chrolophyll) concentrations of algal symbionts, but this species cannot survive in dark and over 100 $\mu$E m-2 s-1 of light due to the breakdown of algal symbiosis.