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Natural growth rates and reproduction period of *Palaeonummulites venosus*

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Larger benthic Foraminifera (LBF) are single-celled long-living (possibly >1 year) marine organisms building complex calcium carbonate shells. For the investigation of the population dynamics of LBF and influence of environmental change on the growth of them, it is important to study biological factors such as growth rate, longevity and reproduction period of LBF. However, it was expected that growth experiments in laboratory cultures cannot be applied for estimation of natural growth rates although the laboratory conditions were simulated to natural conditions. For that reason, it is necessary to investigate growth of LBF under natural conditions. Therefore, the 'natural laboratory' method was developed to acquire natural growth information. In this study, 'natural laboratory' method was applied for investigations on *Palaeonummulites venosus*.

This method is based on the decomposition of monthly obtained frequency distributions based on chamber number and test diameter into normal-distributed components. Living individuals of LBF were collected at 50m depth in front of Sesoko Island, Okinawa, Japan. Samplings were performed 16 times with monthly intervals by SCUBA diving. Both parameters (chamber number and test diameter) were measured by means of micro X-ray computed tomography. The shift of parameters of means and standard deviations during sampling period were used to estimate the averaged chamber building rate (CBR) and diameter increase rate (DIR) under natural conditions.

The growth rates (CBR and DIR) were calculated by fitting to Michaelis-Menten function. The individual birthdates were estimated by the inverse these rates from each chamber number and test diameter. From frequency distributions of birthdates, *P. venosus* reproduction is occurred continuously through the year, and it has two peaks in May/June (strongly) and November (weakly). In previous research, it was expected that reproduction with one or two peaks is subtropical LBF way, and reproducing lacking peak is characteristic of tropical regions LBF. It would be interesting to study whether the reproduction of *P. venosus* shows similar differences between subtropical and tropical regions. Furthermore, this result explains why small and large *P. venosus* individuals were included in the same sample.