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浮遊性有孔虫寒帯種の酸素同位体比記録を基にした古環境復元への応用
Implications for paleo-reconstruction based upon oxygen isotopic ratio of different sized polar planktonic foraminifera

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Planktonic foraminifera provide a record of the ocean surface environment through the isotopic and chemical composition of their calcite shells. Shell oxygen isotopic composition ($d^{18}O$) is commonly used to reconstruct the paleo-environment, including temperature, salinity, and water column structure. *Neogloboquadrina pachyderma* is a common polar-subpolar planktonic foraminifer, thus it is an important species for the reconstruction of paleo-oceanography in the high latitude. Foraminifera in sediment trap samples are particularly useful for examining changes in ($d^{18}O$) over time, and for determining which seasons and depths are most represented. In the study, we examined seasonal variation in $d^{18}O$ of different sized *N. pachyderma* (sin.) using sediment trap samples collected over 3.5 years in the northwestern North Pacific Ocean. Shell $d^{18}O$ of small (125-180 um) and large (180-250 um) *N. pachyderma* (sin.) exhibited similar seasonal variation, with minimum values during September-October and maximum values during April-May. In the study, vital offset values were approximately -1 permil for both size classes throughout the study, except during 2000 (-0.8 permil). However, in the reconstruction of paleo-temperature, offset values should be examined from viewpoints of the equation used as oxygen isotope-temperature relationship and the presence of genotypes. $d^{18}O$ differences between size classes of *N. pachyderma* (sin.) in the present study varied seasonally, not a consistent offset; suggesting that the differences were due mainly to oceanographic conditions in the water column rather than to size-specific kinetic/metabolic effects. During summer, when the water column is stratified, large and small individuals appeared to mainly calcify near the pycnocline, at 25-35 m and approximately 45 m, respectively. During winter, when the water column is not stratified or only weakly stratified, both size classes calcified at or slightly above the pycnocline, at 45-65 m. Because the seasonal peaks in flux coincide with minimum and maximum water temperatures and contribution of the flux peaks is approximately equal, flux-weighted values of all (125-250 um) and small (125-180 um) shell size are in good agreement with the mean annual values (no flux-weighted) of small (125-180 um) individuals. Thus, the fossil $d^{18}O$ data of *N. pachyderma* (sin.) most likely record the annual mean oceanographic environment around pycnocline depth, and size-specific differences in $d^{18}O$ reflect water column stratification.

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