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MICRO-FOCUS X-RAY CT ANALYSIS REVEALS SHELL DENSITY OF MARINE CALCIFIERS AND ITS SEASONAL CHANGES

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The reduction of the oceanic pH—so-called ocean acidification (OA) —is one of the most concerning issues of recent oceanic environmental changes. Recent observation and culture studies of marine calcifying organisms indicate calcification rates sensitively respond to ocean carbonate systems and it may seriously decrease. On the other hand, however, it is difficult to measure individual calcification rate and shell dissociation of marine calcifiers in the nature. It is important for understanding affections of OA and prediction of the future environmental conditions.

We proposed a new method to evaluate shell density of marine calcifiers by using the Micro-focus X-ray Computing tomography (MXCT) technique. The MXCT has great potential to bring a new morphometric analysis of organisms by the innovating data acquisition and it is possible to achieve precise transparent tomographic images of individual specimen with spatial resolution in submicron scales. Furthermore, spatial and quantitative carbonate shell density is also calculated from X-ray attenuation coefficient. Shell density analysis of marine zooplankton measured by MXCT is most accurate and objective compared with any other existing methods (e.g. SEM observations and weight loss etc), therefore MXCT should be an useful tool to evaluate ecological impacts of marine calcifiers by OA. In this study, we applied this method to sediment trap samples which were deployed at the North Pacific and Arctic Ocean where the areas concerning about rapid increasing of OA in the world oceans. We found remarkable seasonal variability on the planktic foraminifera and Pteropod shell density in the North Pacific and Arctic Ocean, respectively. Shell density of planktic foraminifera in the North Pacific had decreased in the winter seasons. On the other hand, shell density of pteropods had decreased in the early winter and summer. It might be coincident with physical and carbonate chemistry in the surface water mass where they were lived. It suggests that calcification of marine calcifiers are strongly affected by surrounding oceanic carbonate systems.