

STEROLS FROM MOTILE CELLS AND RESTING CYSTS OF AUTOTROPHIC AND HETEROTROPHIC DINOFLAGELLATES

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Dinoflagellate is one of the major primary producers in the ocean since the Mesozoic. These microalgae occur throughout the world's oceans but are often more abundant in coastal areas. About half species of dinoflagellate are autotrophic ones, and others are heterotrophic. Some species are able to force themselves into a dormant or resting stage as part of their relatively complicated life cycle. These dormant stages, called resting cysts, are typically characterized by a thick and highly specialized cell covering. The motile stage of dinoflagellate is difficult to be recorded in sediments since the motile cell of dinoflagellate is labile against bio- and chemical degradation during the settling and the early diagenesis. The resting cysts of some dinoflagellates species are composed of resistant biomacromolecules, which can be preserved in sediments and sedimentary rocks. Geologic record of dinoflagellate evolution, therefore, is based on their resting cyst fossils in sedimentary rocks.

The sterol compositions of dinoflagellates are generally dominated by 4 α -methyl sterols including the C₃₀ sterol called dinosterol (4 α , 23, 24-trimethyl-5 α -cholest-22E-en-3 β -ol). This sterol is rarely found in other algae and hence has been often used as an indicator of dinoflagellate contribution to the marine sediments. However, sedimentary dinosterols do not necessarily provide sufficient information about the motile stage of dinoflagellate and the relative contribution of heterotrophic and autotrophic dinoflagellates. Sterol compositions vary quite considerably between different species of dinoflagellates (Volkman et al., 1999). Some particular sterols can be potential biomarkers for motile cells of dinoflagellates. The objective of the present study is to search for characteristic sterols of motile cell and resting cyst of autotrophic and heterotrophic dinoflagellates.

Four motile cells of autotrophic dinoflagellates, *Peridinium umbonatum* var. *inaequale*, *Akashiwo sanguinea*, *Scrippsiella tinctoria*, and *Prorocentrum micans*, commonly contain 5 major sterols in the free sterol fraction. These major sterols are cholesterol, 4-methylcholestan-3-ol, 4, 24-dimethylcholestan-3-ol, dinosterol, and dinostanol (4, 23, 24-trimethylcholestan-3-ol). A motile cell of heterotrophic dinoflagellate, *Proto-peridinium*

crassipes, contains cholesterol, 4,24-dimethylcholestan-3-ol, dinosterol, dinostanol, and tetramethylcholestan-3-ol as major free sterols. The dinosterol concentration of heterotrophic dinoflagellate is about ten times higher than those of autotrophic species. 4-Methylcholestan-3-ol was commonly detected in autotrophic dinoflagellates, but not in heterotrophic dinoflagellate in the present study. On the contrary, tetramethylcholestan-3-ol was detected in heterotrophic dinoflagellate, but not in autotrophic dinoflagellate.

Resting cyst of *P. inaequale* contains 4 α -methylcholestan-3 β -ol, 4 α , 24-dimethyl-5 α -cholestan-3 β -ol, dinosterol, dinostanol, and unknown C₃₁ sterol as major free sterols. The dinosterol concentration of resting cyst is significantly higher than that of motile cell. Although sterol distribution of resting cyst is nearly similar to that of motile cell, the unknown C₃₁ sterol occurred only in resting cyst. None of motile cell contains this unknown C₃₁ sterol. 4 α -Methylgorgostanol is known as typical C₃₁ sterol produced by dinoflagellate (Alam et al., 1979). However, mass spectral study shows that the unknown C₃₁ sterol in the present study is clearly different from 4 α -methylgorgostanol. The C₃₁ sterol might have been produced during resting stage. Further study on this unknown C₃₁ sterol will provide clues to have potential biomarkers for resting cysts of dinoflagellate.

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