

Chemotaxonomic fingerprints of alkenones and alkenoates in sediments of Lake Naga-ike on the Skarvsnes, Antarctica

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Long chain alkenones and alkenoates are widely distributed in marine sediments and their extent of unsaturation ($U^{K_{37}}$, $U^{K'_{37}}$) is extensively used for reconstruction of paleo sea surface temperature. Alkenones and related compounds have also been detected in various lakes, although there is a wide variation in alkenone compositions and the temperature calibrations between individual settings. These variations probably reflect the difference in alkenone producing species (strains) in lakes. Indeed, recent DNA analysis revealed that multiple lineages of the order Isochrysidales are distributed among alkenone containing lakes, and is considered to be engaged in the alkenone production (2-3). Culture based investigation on temperature calibrations suggested the significant variation of calibrations among Isochrysidaceae species (*Isochrysis galbana* (4), *Pseudoisochrysis paradoxa* (5) and *Chrysothila lamellosa* (6)). Therefore, taxonomic identification of alkenone producers is essential to the proper selection of calibrations and thus lead to better application of alkenone paleothermometer in lakes.

To elucidate chemotaxonomic characteristics of the compositions of alkenone and related compounds, we have been cultured 9 strains covering all 3 genera (*Chrysothila*, *Isochrysis*, *Tisochrysis*) of the family Isochrysidaceae, and proposed that the lack of tetraunsaturated alkenones are common characteristic for genus *Tisochrysis* (7). In this study, cultured Isochrysidaceae strains as well as sediments of antarctic lake Naga-ike were examined further into the compositions of alkenones and alkenoates. We discuss chemotaxonomic feature of triunsaturated alkenone isomers and novel C₃₈ alkenoate which could be identified by a recently-developed method (8) using gas chromatography column with dipole selective stationary phase. Isomer of triunsaturated alkenones have previously identified from high latitude lakes (BrayaSø, Toolik Lake), which are characterized by a significant proportion of triunsaturated isomers ranging C₃₇-C₃₉(8). Meanwhile, triunsaturated alkenone isomer detected from *C. lamellosa* were solely C₃₈. Occurrence of C₃₈ triunsaturated isomers along with novel C₃₈ alkenoate are proposed as characteristics of *C. lamellosa* in the family Isochrysidaceae.

Lake Naga-ike is a freshwater lake on the Skarvsnes, Antarctica, and biomarker analysis has been carried out by (9) revealing ca. 3000 yrs record of alkenone compositions. Examination of the sediment of Lake Naga-ike by a new method (8) revealed that the co-occurrence of C₃₈ triunsaturated alkenone isomers and novel C₃₈ alkenoate, suggesting a possible contribution of *C. lamellosa*. By using a calibration obtained from a culture strain *C. lamellosa* calibration (6), paleotemperature are calculated to be 9.2-15 °C in surface sediments of Lake Naga-ike. The estimated temperatures are concordant with a summer temperature of lake waters observed in Naga-ike, while other known culture based calibrations estimated extremely-low temperatures. This result may afford collateral evidence for the occurrence of alkenone producer closely related to *C. lamellosa*.

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Keywords: alkenone, Haptophytes, chemotaxonomy, lake sediments, paleothermometer