

## C-14 of humic substances isolated from waters of Lake Biwa

# Seiya Nagao[1]; Takafumi Aramaki[2]; hiroki kodama[3]

[1] Graduate School of Environ. Earth Sci., Hokkaido Univ.; [2] NIES; [3] Bioresource Production and Sci., Kyoto Pref. Univ.

<http://geos.ees.hokudai.ac.jp/>

### Introduction

Humic substances are the largest fraction of dissolved organic matter (DOM) in river and lake waters, and play an important role in both pollutant chemistry and the biogeochemistry of natural waters and soils. These substances are a very complex mixture of organic heterogeneous structures with a wide range of molecular sizes; they have a degree of resistance to microbial degradation and have the ability to form complexes with a variety of polyvalent metals. Investigations on characteristics of humic substances in river and lake waters have yielded insight into the production and turnover of soil organic materials, and their transport behavior within natural watersheds.

A natural isotope, carbon (C-14), is a useful tool for studying the dynamics of dissolved organic carbon in terrestrial environments. The radiocarbon can provide unique information on the source, ages, and residence times of organic materials in aquatic environments. However, very little is known about Delta14C value for DOM and dissolved humic substances in river watersheds and lake waters.

This study is intended to test the utility of a combined Delta14C and delta13C approach to better understand the fate of aquatic humic substances in a lake and its watershed. The Delta14C and delta13C for humic substances dissolved in lake waters from the Lake Biwa in Japan were analyzed by accelerator mass spectrometry (AMS). The Delta14C values were compared to those of other lake humic substances collected from Japan and reference humus samples from the International Humic Substances Society (IHSS).

### Materials and methods

The surface waters were collected at environmental standard sites in north and south part from Lake Biwa, and sampling sites of Zao-Dam and Kawashiro-Dam. The humic substances (humic and fulvic acids) were isolated and purified by the XAD-extraction method.

14C measurements were performed by accelerator mass spectrometry (AMS) at the Marine Research Laboratory of Japan Atomic Energy Research Institute. Humic substances samples were first converted to CO<sub>2</sub> and purified cryogenically. The purified CO<sub>2</sub> was then reduced to graphite with H<sub>2</sub> over Fe and its C-14/C-12 ratio was measured with the AMS system. The C-14 activities are determined with respect to the international standard of oxalic acid. Final C-14 activities are reported in Delta14C. The Delta14C is defined as the deviation in parts per thousand from the modern standard. Delta13C values were determined for sub-samples of the CO<sub>2</sub> gas generated during graphite production, using an isotope ratio mass spectrometer.

### Results and discussion

Figure shows Delta14C values of lake humic substances as a function of delta13C values. The Delta14C values of surface waters from the IHSS reference samples (the Suwannee and Nordic humic substances) in 1986 are greater than 0 permil. On the other hand, the Biwa samples have a Delta14C less than 0 permille. The Delta14C values are ca. 400 permil lower than the IHSS reference samples. These results indicate that surface water humic substances from the Lake Biwa consist mainly of pre-bomb carbon and the IHSS samples must contain a substantial amount of bomb carbon. The amount of fast cycling and the humification for the watersheds of the Lake Biwa may be lower than in the Suwannee River and Nordic lake environments.

