

## Lake Baikal, the natural laboratory, and its paleoenvironmental science

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### Introduction

Lake Baikal is placed in Siberia, northeastern part of Eurasian continent, surrounded by thick subarctic forests. In 1996, this lake was selected as a world natural heritage site. We now know that the nature of the lake and its watershed is well kept to offer a world unique research field for the fundamental environmental science concerning the present ecosystem, paleoenvironmental changes, and phylogeny and evolution of various endemic species.

#### 1. Reasons why this lake is called the Natural Laboratory

Lake Baikal has various world records as a natural freshwater lake, as the oldest (30 million years), the deepest (1637m), and the biggest volume (23000 km<sup>3</sup>). Moreover, the surface area is about 50 times of Lake Biwa (31500 km<sup>2</sup>), the area of its watershed is 1.5 times of Japan (556000 km<sup>2</sup>). Length (638 km) and width (av. 40 km) are also big enough for discussion as a regional model of the sea. Here, it shows the most typical inland climate with the greatest average temperature changes between summer and winter, and glacial and interglacial periods. Dry climate of Mongolian steppe and Gobi desert sometimes expanded to cover Baikal region. Rift system has changed its basin, made faults or mountains along the lake. Hydraulic and weathering conditions must be affected to change the water quality. Two thirds of more than 2500 species identified are endemic. Maximum 8 km thick of bottom sediment is known, where several times of longer history than that of human beings has been recorded continuously since the history of the lake started about 30 million years ago. Practically closed system of the lake enables us to discuss about all of the detected historical events with the powerful hypothesis that they occurred in the basin.

These conditions support our best synthetic research of the lake system including present ecosystem, paleoenvironment, and phylogeny and evolution. This is the main reason why we call Lake Baikal the Natural Laboratory.

#### 2. Baikal Paleoenvironmental Analysis

Russian and American scientists initiated the international Baikal Drilling Project (BDP) in 1989 under Siberian Branch, Russian Academy of Sciences. Japanese (1992) and German (1996) groups participated the program to develop it. Steering Committee of the BDP has conducted 5 deep drilling operations and successfully obtained continuous sediment cores. Cores were treated by research groups for dating of the sediment layers, physical and geological studies, inorganic and organic chemical studies including isotopic and pigment analysis, and paleobiological analysis mainly on pollen and diatom. Among many interesting results, following discussions look noteworthy. Fundamental trend of climate was cooling for the last 12 million years, and glacial period in the northern hemisphere started about 2.7 million years ago. More than 56 times of alteration were occurred between forest and dryer (steppe) periods since about 5 million years ago. However, no new vegetable genera have been found despite such a long period as 12 million years and big climatic changes. On the other hand, evolution of diatoms looked much more frequently and their life times were drastically shortened after the glacial period started about 2.7 million years ago. This contrast between vegetation and phytoplankton is very interesting and further discussion about mechanisms of ecological changes must be expectant.

#### 3. To more stable Environmental Sciences

Environmental science is the science for existence. Knowledge of mechanism of climatic and other environmental changes, factors, which control the shape and extent of changes, are essential together with the way in which organisms have overcome or been defeated by these environmental changes. Results of paleoenvironmental analysis are really significant to find the best way for our survival.