

The fire history reconstructed from microscopic charcoal analysis of sediments from Lake Biwa and adjacent areas, central Japan

Jun Inoue*¹, Hikaru Takahara*² and Shusaku Yoshikawa*¹

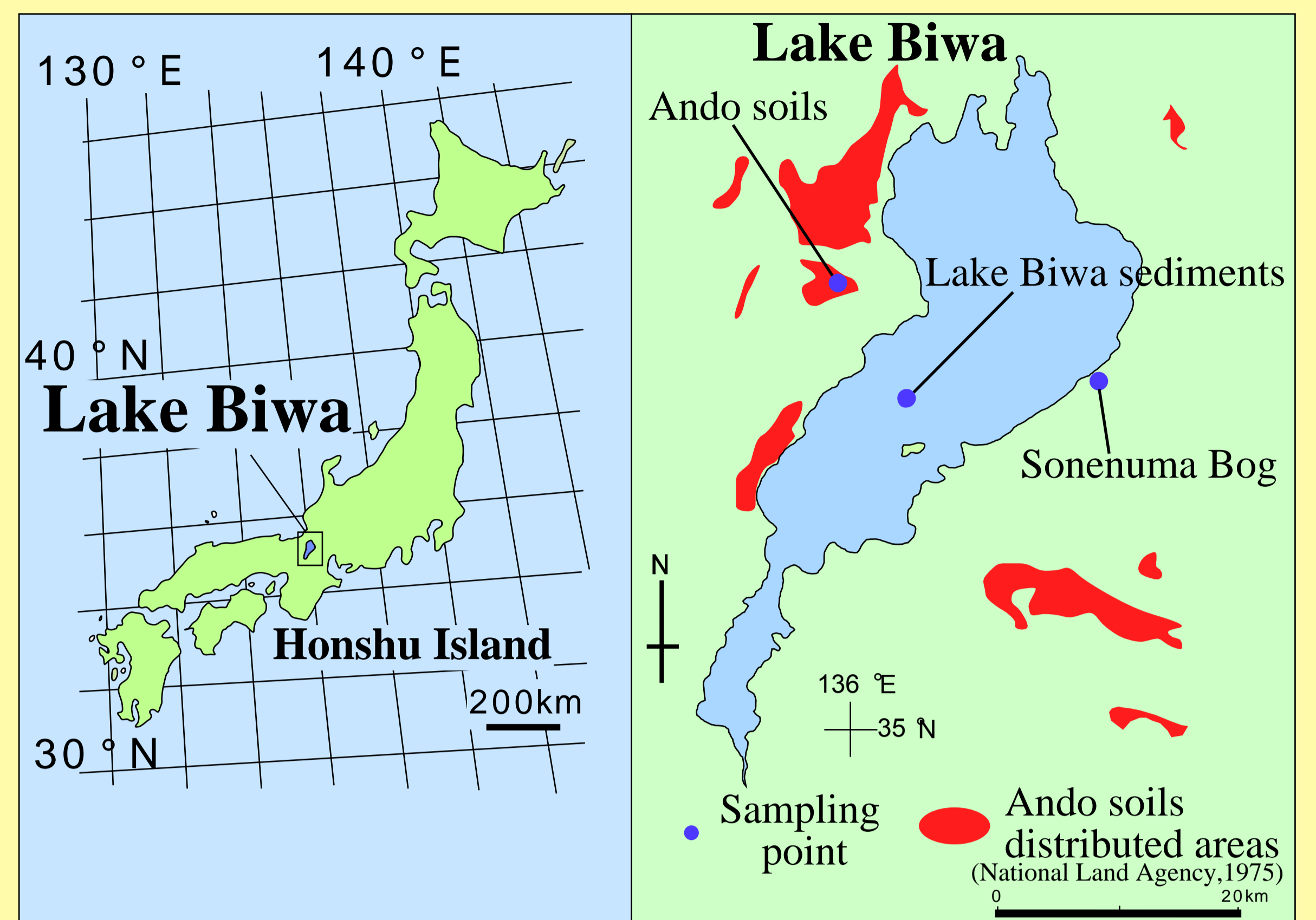
*¹ Osaka City University *² Kyoto Prefectural University

Introduction

Charcoal fragments are generated by natural fires and anthropogenic fires. Because charcoal fragments are preserved in sediments and soils, charcoal analysis of accumulated sediments and soils can be used to reconstruct the fire history. Many studies on charcoal analysis have been carried out on Holocene sediments, however in Japan, fire history has not been proven sufficiently. We reconstructed fire history around Lake Biwa in central Japan from the late Pleistocene to present based on microscopic charcoal concentrations and influxes of sediments from Lake Biwa and adjacent areas. **Lake Biwa sediments, Sonenuma Bog sediments** and deposited soils (**Ando soils**) were used for charcoal analysis.

Method

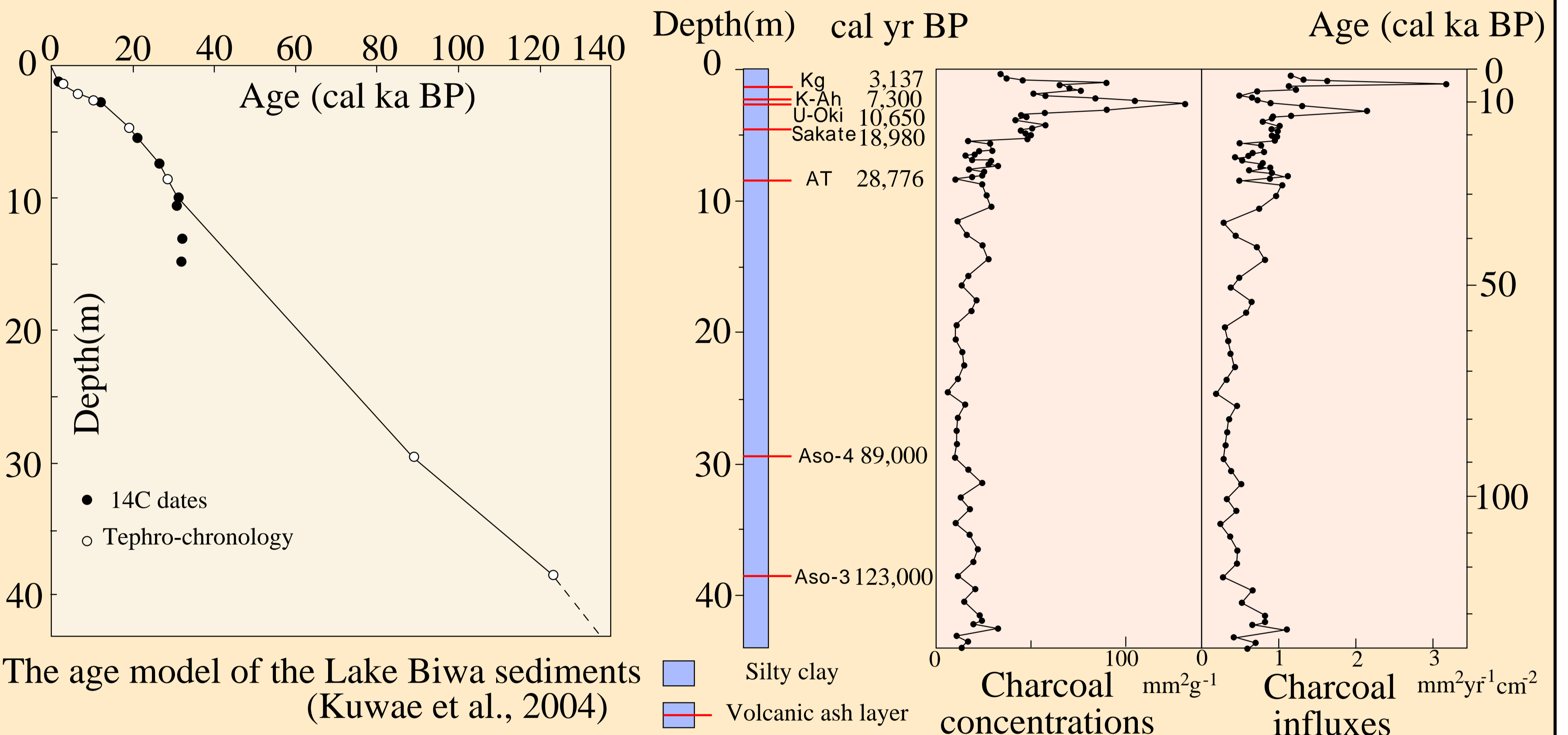
The samples (0.2-0.5g or 1cc) were treated chemically (with KOH and HF, and by acetolysis) and physically (by sieving, 0.25 mm pore size) and then prepared by using the pollen slide method. The area of each slide occupied by charcoal fragments was measured.



The location of sampling points and Lake Biwa

Lake Biwa sediments

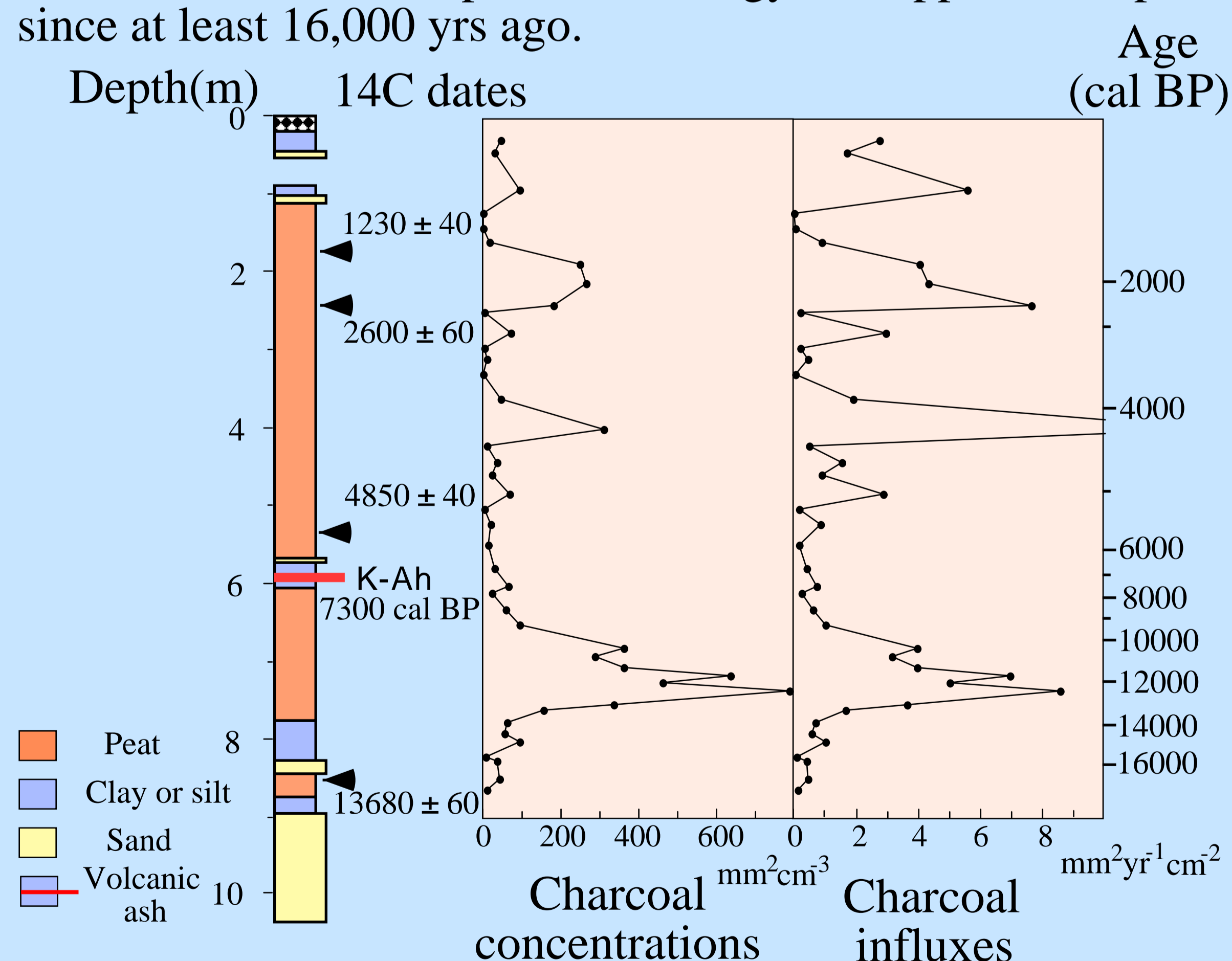
Lake Biwa, the largest lake in Japan, is located in the central part of Honshu Island. The upper core sediments (137.3-m-thick) are composed of homogeneous lacustrine silty clays. The upper 44 m of the core was used for microscopic charcoal analysis. Based on tephro-chronology and AMS ¹⁴C dates (Kuwae et al., 2004), the upper 44m has deposited since ca.136,000 yrs ago and the sedimentation rate was almost constant (ca. 30-40cm/ 1000 yr), except for the uppermost. This is ideal for charcoal analysis to reconstruct fire history.



The age model of the Lake Biwa sediments (Kuwae et al., 2004)

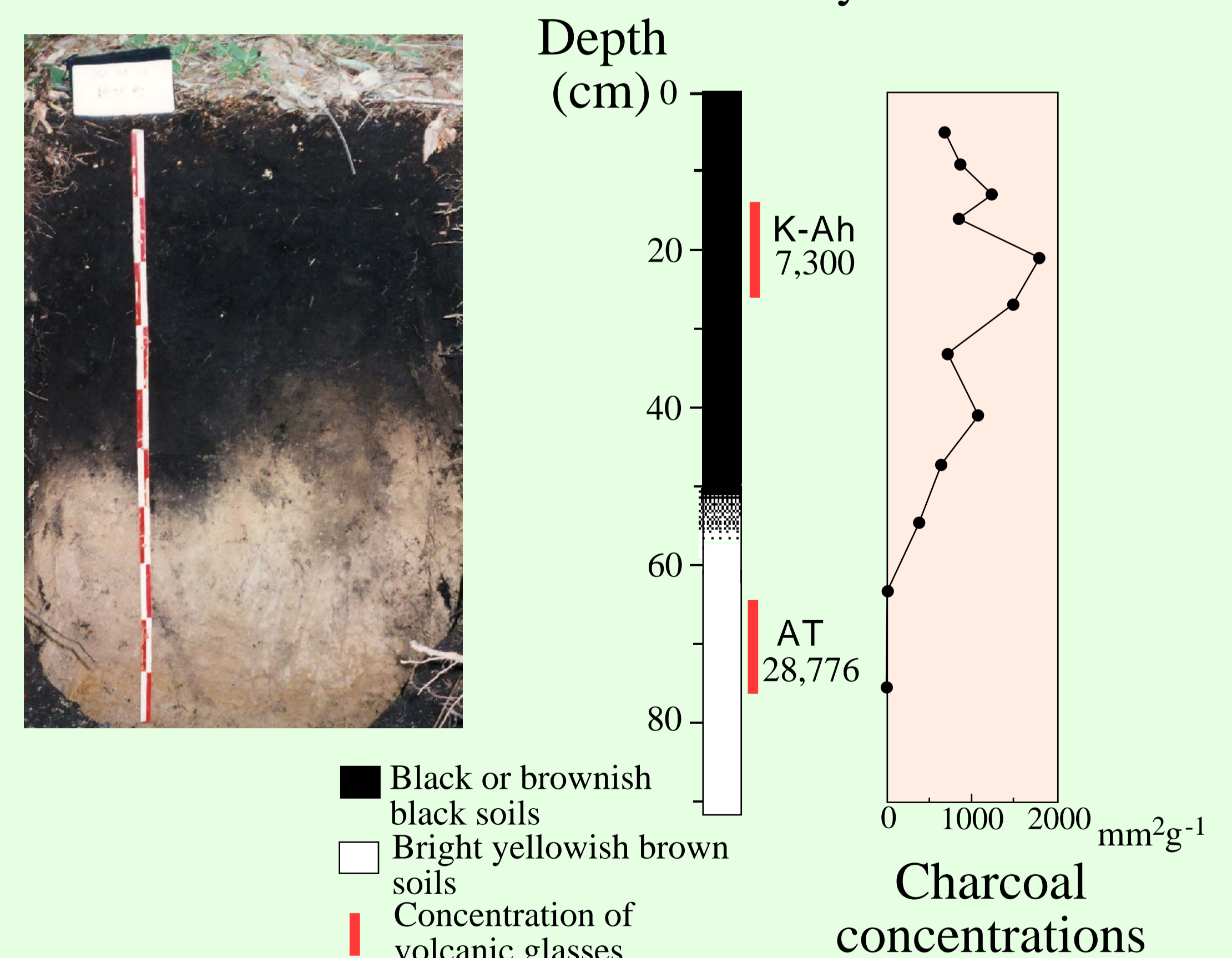
Sonenuma Bog sediments

Now Sonenuma Bog has a surface area of 0.23ha. Based on AMS ¹⁴C dates and tephro-chronology, the upper 9m deposited since at least 16,000 yrs ago.



Ando soils

Ando soils, thick black soils, are widely distributed in Japan. The black soils in this area probably started depositing between the terminal Pleistocene and early Holocene.



Discussion

Charcoal concentrations and influxes of sediments at 3 sites are higher continuously in the terminal Pleistocene and early Holocene. The period of the highest charcoal concentrations in Lake Biwa and Sonenuma sediments are in the early Holocene. On the other hand, in Lake Biwa sediments between 136,000 and 13,000 cal yr BP, charcoal concentrations and influxes are lower (most are less than 50 mm²g⁻¹ or 1 mm²yr⁻¹cm²). These results show that the terminal Pleistocene and Holocene have experienced the highest frequency of fire recorded since 136,000 cal yr BP. We presume that high fire frequency since 12,000 cal yr BP might be caused mainly by anthropogenic fires. Because despite change of climate inferred from previous studies (pollen analysis, diatom analysis and others), charcoal concentrations and influxes prior to 12,000 cal yr BP is continuous low and some early human remains dated back to approximately 10,000 yr BP have been discovered around Lake Biwa. Alternatively, the specific climatic condition in the terminal Pleistocene and Holocene might influence fire frequency.