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Message from lake sediments on environmental change

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Lake sediments are recognized as good recorders of a variety of temporal and spatial scales such as global climatic change, geological history, biological evolution, watershed disturbance and so on. Techniques on analyzing lake sediments recently have been progressing, and those are carried out from the viewpoint of multi-time scale for multipurpose relating with the environmental change. I introduce the history and present situation of the research on environmental change using the famous lacustrine record from Lake Biwa and Lake Suigetsu in central Japan. Lake Biwa is the largest and oldest lake in Japan. Whereas the neibouring basin Lake Suigetsu has varved sediments of the past 150 kyr. Lake Biwa has continuous sediments of a million year age. Therefore coupling of the two basin works will permit understanding on the Quaternary climate and tectonics in multi time scale. Deep drilling for Lake Biwa commenced in the 1970's, and the drilled core in 1982-1983 (i.e., the 1400 m core) have revealed about 911 m sediments overlying the basement rocks. Recently, the doubt on discontinuity of the sequence in present Lake Biwa was completely cleared. Improvements on fission track timescale have successfully identified the paleomagnetic reversal near the base as Jarammillo rather than Olduvai, determining time coverage of the Lake Biwa sediment as ˜1.3 Ma. A highly linear SAR (Sediment Accumulation Rate) curve is thus given to the 900 m-deep Lake Biwa sediment. This secures the stable sedimentary environment of the basin, and the significance of Lake Biwa sediment as a good recorder for paleoclimate changes. Moreover, progress in the Japanese tephrochronology in recent decades has provided marker tephras in and around the basin. Lake Biwa is, therefore, an ideal terrestrial site to explore paleoclimate and tectonic history during the past 1 Ma of East Asia. Providing examples of paleomonsoon variations will improve our knowledge on the present monsoon drive mechanism by examining the interaction to the Earth's internal forcings. In 2007 and 2008, six piston cores and two long cores newly were obtained, and multidiscipline approaches of pollen, diatom, alkenone, inorganic geochemistry and paleomagnetic analyses realize the above research scopes, for contributing to the loading issues that the Japanese and world societies now highly concerns. Lake Suigetsu has been known to the Quaternary Science community for its annually-laminated (varved) sediment record that spans the last c.70 kyr using the four piston cores and a long core obtained from the center of Lake Suigetsu by Yasuda and co-workers (Takemura et al., 1994, Kitagawa et al., 1995, Yasuda et al., 2004). Kitagawa and van der Plicht (1998a; 1998b; 2000) established a high-precision independent chronology for the core through counting of the annual layers (varves). Nakagawa et al. (2003; 2005; 2006) published high-resolution pollen analysis and pollen-based quantitative climate reconstruction through the deglacial interval to the early Holocene section. In summer 2006, a research team conducted by Prof. Nakagawa obtained a new sediment core reaching the base of the sedimentary profile (73.19 m below the lake bottom). Cores were recovered from four parallel boreholes with fully overlapping core segments, and the precise analysis is now progressing.

Keywords: environmental change, lake sediments, Lake Biwa, Lake Suigetsu