

Sedimentation rate and relative lake-level change during last 300 ky in Lake Biwa, Japan

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The changes of sedimentation rate and relative lake-level during last 300 ky in Lake Biwa were investigated based on sedimentological and tephrochronological study of two borehole cores.

Subsurface structure of Lake Biwa was revealed by many previous studies since 1960s. Lacustrine clay has been deposited from 1 Ma. The purpose of this study is reconstruction of paleoenvironmental changes around east Asia by analysis of the lacustrine deposits below in Biwa. This is a preliminary report about lithology and depositional age of the borehole cores drilled in Lake Biwa.

Two borehole cores (BIW08-A and BIW08-B) were drilled in north of Okinoshima Island, central part of Lake Biwa from April to May 2008. BIW08-A and BIW08-B were drilled at 48 m and 53 m in water depth and are 71.75 m and 100.30 m in length, respectively. Site BIW08-B is located about 500 m northwest from Site BIW08-A and further away from the island and the lake shore.

These cores mainly consist of massive clay with vivianite deposited in central part of lake, so called lacustrine clay except for the lowermost parts. In the lowermost part of BIW08-A core (up to 63 m in depth), alternation of fine to medium sand with cross bedding and mud clasts, and clayey silt with plant fragments and organic matters were found. This alternation shows upward-coarsening pattern and is overlain by the massive clay with erosional contact. In the uppermost part of the alternation, rootlets were found. In the lowermost part of BIW08-B core (up to 89 m in depth), alternation of the fine to medium sand and the clayey silt with upward-coarsening pattern were found, analogously. Based on the cross bedding which indicates unidirectional currents and upward-coarsening pattern and so on, sedimentary environment of these sandy deposits are delta front. The upper surfaces of these deltaic deposits can be correlated to buried terraces reported by previous studies. According to sequence stratigraphy, these deposits are regarded as highstand systems tracts and erosional surfaces between delta front deposits and the lacustrine clay is regarded as sequence boundaries, indicates start of transgression.

Over 20 tephra layer were found from the cores. Most of tephra deposits were identified as widespread tephra deposits. The ages of the oldest tephra layer are 213 ka at 60.55 m in depth of BIW08-A core and 295 ka at 88.50 m in depth of BIW08-B core. Therefore these cores have potential for reconstruction of paleoenvironmental changes during about last 300 ky. Based on the tephra ages, sedimentation rate was estimated. As a result, average sedimentation rate is 0.3 m/ky. Around 220 and 120 ka, sedimentation rate is exceptionally high (0.6 to 1.0 m/ky).

Depositional history of this succession was reconstructed based on these results. Before 300 ka, delta prograded there and deposited both sites. At the time, relative lake-level was about 140 m lower than present. Then relative lake-level rose rapidly, and the massive lacustrine clay started to deposit with an erosional contact. Around 220 ka, relative lake-level was stable at about 110 m lower than present and delta prograded and deposited only around Site BIW08-A. Contrastively, the lacustrine clay continued to deposit around Site BIW08-B. This difference indicates that the delta prograded from east or south. Subsequently, relative lake-level rose rapidly again. After this transgression, paleo water-depth of this area has been deep enough to deposition of the lacustrine clay until present.