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Rock magnetic study on magnetic properties of the topmost sediments from the deepest area of Lake Biwa, Japan

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Magnetic minerals in lake and marine sediments alter with burial in early diagenetic process, which cause the change of primary magnetic properties and the modification of magnetic signals for geomagnetic and environmental variations in the sediments. It is important to understand early diagenetic effects on magnetic properties in the sediments for interpreting paleomagnetic and environmental magnetic records.
A rock-magnetic study was performed on the topmost sediments from the deepest area (91m in depth) of Lake Biwa, the largest lake in Japan. At the deepest area, the amount of dissolved oxygen (DO) in the bottom water shows a seasonal variation: relative high values of DO are observed at February to April, while low DO values below 1 mg/L at October and November. Sediment cores were collected every one or two month from Oct, 2008 to Aug, 2009. The cores were composed of homogeneous clayly silt of black to dark greenish gray color. Analyzed samples were taken from the cores continuously at 1 or 2 cm intervals and freeze-dried.
Based on results from high and low temperature analyses of magnetic properties, magnetic minerals in the sediments were dominantly maghematized magnetite. It was found that the degree for maghematization of magnetite decreases downcore.
Magnetic parameters of the concentration and granulometric proxies for magnetic minerals showed downcore decreases below 10cm in depth of all cores. It is suggested that the amount and grain size of maghematized magnetites decrease and increase with burial, respectively. It is probably related to the dissolution of the magnetic minerals during early diagenesis, accompanying the precedence of the dissolution of finer grains.
At the upper part above 10cm in depth, downcore decrease of magnetic coercivity was observed, which may be associated with the dissolution of the surface of maghematized magnetite. A seasonal change of magnetic coercivity was also recognized: relative high values were observed at November and February, while low value at June. The coercivity variation did not correspond directly to the seasonal variation of DO in the bottom water.
Samples at 0-5cm and 10-15cm in depth showed decrease at 29K in curves of IRM imparted 6K during the heating to 300K. The decrease amount of IRM varied seasonally: large decrease was observed at November, while small decrease at June. Although we have not identified a mineral with these magnetic properties yet, the formation of such a magnetic mineral seems to be sensitive to chemical condition in the bottom water and the topmost sediment.