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Regional and seasonal variations in magnetic properties of topmost sediments in the Northern Lake Biwa

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Rock-magnetic investigations have been performed on topmost sediments above about 30 cm below sediment surface (bss) cored in summer (June to July) and winter (November to December) at ten sites with different water depth, where dissolved oxygen (DO) content in bottom water and its seasonal variation are different, in the first depression at the North Basin of Lake Biwa in order to reveal early diagenetic effect on magnetic properties of the sediments. We will report results from the following three sites: N4 (91 m in depth), A (90m) and H70 (66m). The DO value becomes lower than 4 mg/L in winter at N4 and A.

Low-temperature magnetometric results indicate that a partially-maghemitized magnetite is a principal magnetic mineral in samples of the three sites. Warning curves from 6 to 300K of isothermal remanence (IRM) imparted at 6K in 1T after zero-field cooling show a remarkable decrease of IRM between 90 and 120K, which is regarded as a suppressed Verway transition of magnetite. The amount of IRM decrease between 90 and 120K increase downcore at all site, implying the dissolution of maghemite skin covering magnetite. The IRM decrease is slightly remarkable in H70 samples above about 18 cm-bss. The degree of maghemitization may be higher in N4 and A samples. The warning curves of N4 and A samples show another IRM decrease between 20 and 30K with the inflection point at about 29K. The IRM drop is detected in samples above about 18 cmbss, and the samples in two zones of 0-3 cm-bss and 6-12 cm-bss shows the IRM drop more clearly. It seems that the IRM drop is slightly remarkable in samples taken in winter and that the depth of the zone showing the IRM drop changes seasonally. The occurrence of the magnetic mineral with the characteristic low-temperature magnetic behavior may be influenced by the DO values and its seasonal change.

The downcore decrease of magnetic coercivity is observed in the uppermost sediments above about 10 cm-bss, and the amount and grain size of magnetic minerals subsequently decreases and increases downcore below 10cm-bss, respectively. These changes are considered to be associated with the dissolution of maghemitized magnetite by the early diagenetic effect. A seasonal change of magnetic coercivity is recognized in the samples above 10 cm-bss of N4: the samples taken in summer show lower magnetic coercivity, possibly implying a smaller contribution of fine magnetic minerals with higher coercivity.

Keywords: magnetic property, sediment, Lake Biwa