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Seasonal changes of magnetic minerals and their grain sizes in the Hiroshima Bay sediments

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Frequent outbreaks of red tide have been reported since 1970 in the Hiroshima bay, and the red tide is caused by a bloom of dinoflagellates. Iron is an essential element for dinoflagellates, and is supplied as bivalent or trivalent ions and iron compounds from lands to sea. For damage predictions of red tide, it is important to research the distribution of iron in the bay. The acidification of seawater during summer has been also observed in the Hiroshima Bay. Increase of CO_2 concentration and decrease of dissolved oxygen (DO) content in seawater cause an anoxic condition in the bay. It is known that iron oxides are dissolved and sulfides are formed in an anoxic condition. For clarifying variations of the distribution and mode of iron in sediments and bottom water in the Hiroshima Bay, we investigated kinds of iron compounds in the sediments and the amount of dissolved iron in the bottom and interstitial waters. Sediment cores of 5cm in depth were taken at several sites in the Hiroshima Bay by using a multiple corer from June to August in 2010. Data of oceanographic observations at these sites showed that during the sampling period the temperature of the bottom water increased, whereas DO and pH values decreased. The sediment samples were composed of sandy silt with clay at shallower sites and clayey silt at deeper sites. We measured dissolved iron concentration in interstitial and bottom waters filtered above 0.45 um grains, and performed magnetic hysteresis measurements and high temperature magnetometry on the sediment samples. The presence of magnetite (Fe_3O_4) and hematite (Fe_2O_3) were recognized in all analyzed samples, whereas greigite (Fe_3S_4) appeared at the deeper sites with an anoxic condition in the bottom water. At the deeper sites, the magnetic grain size increased from June to August, while iron concentration increased in the interstitial and bottom waters. It is suggested that magnetite and hematite were dissolved and greigite was formed, associated with the proceeding of the anoxic condition in the bottom water, and that the grain-size of magnetic minerals and the iron concentration of the interstitial and bottom waters also changed. Irons moves between sediments and seawater in the brief period, which may occur sensitively in the bottom of the Hiroshima Bay.

Keywords: marine sediments, iron, magnetic properties