Magnetic mineral distributions in surface sediments taken from the northeastern Japan Sea

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In order to understand how magnetic minerals assemblages are affected by the redox state of overlying bottom waters in the northeastern Japan Sea, rock magnetic and chemical analyses were conducted. Undisturbed surface sediments were taken at six sites with a multiple corer during the R/V Shinsei-maru KS-14-13 cruise in 2014. The sediments consist of silty clay, and water depths of the six sites range between 778 to 2709 m. Dissolved oxygen (DO) of bottom waters were measured directly with a DO meter on board immediately after recovering of the multiple cores. Water samples were taken from the cores using by a plastic syringe and were passed through a filter (pore diameter of 0.45 μm), and water samples 30 mL were stored in Teflon bottles. The water samples were treated with 1 mL of special grade nitric acid (1 mol/L concentration), and pH was adjusted below 1 at room temperature for dissolved iron (DI) analysis. DI was measured with a flameless graphite furnace atomic adsorption spectrometer. Dried and powdered sediment samples of approximately 20 mg were used for total organic carbon (TOC) and total nitrogen (TN) measurements with a CNHS analyzer. Thermal demagnetization of composite IRMs were conducted for determination of magnetic minerals in the samples. The dried powder samples (ca 50 mg) were packed in a small quartz cup (5 mm in diameter and 10 mm in height). A magnetic field of 2.5 T was applied along the vertical direction of the cup, and then fields of 0.3 T and 0.07 T were applied along the two remaining perpendicular axes using a pulse magnetizer. Results show that higher values of TN and TOC contents are recognized at sites which has lower DO in bottom water. Thermal demagnetization results for composite IRMs for samples from all site samples, soft (<0.07 T), and medium (0.07-0.3 T) components are demagnetized completely at around 580 degree which is the Curie point of magnetite. Slight thermal decay of the hard components (<2.5 T) is observed at 675 degree which is the Curie point of hematite in all samples. An inflection in demagnetization curves at around 320-400 degree is recognized in samples from all sites. Authigenic greigite which is not expected to be defined magnetic mineral to form under an oxic water column. The inflection suggests the presence of (titano)maghemite. The remanent magnetization intensities decrease at around 80-120 degree which is the Neel temperature of goethite at a most oxic site. DI concentration of the site show highest value, thus it suggest that suspended solids of iron hydroxides (<0.45 um in diameter) area bundantly present in the relatively oxic bottom waters, and goethite is stable under such condition. Magneto fossils were confirmed by TEM observations, and were classified three major morphologies which are elongate, tear drop, and equant. Morphology ratios varies by the redox state of overlying bottom waters.

Keywords: Magnetic mineralogy, Redox state of overlying bottom water, Magneto fossils

