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Relationship between dissolvable iron in sea water just above sediments and magnetic properties of marine sediments

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Iron is a microelement in seawater, and it is essential for plant planktons. It is known that almost iron ion is supplied from rivers. Iron also exists in suspended particles and marine sediments as iron oxides. Iron oxides are possible to be dissolved in anoxic condition such as coastal and bay sediments. However, the amount of dissolved iron from suspended particles and sediments are not fully understood. Thus we investigate that redox condition and dissolved iron distribution off Chile in the southern Pacific as a case study.
Seven multiple cores covered 187-1389 m in water depth were collected for measurements of rock magnetism and chemical analyses. Dissolved oxygen (DO), oxidation-reduction potential (ORP) and pH of interstitial water were conducted with an isolated membrane electrode on board. The sediment cores were sampled using 6.7-cc plastic cubes at 1-2.2 cm intervals for rock magnetic analysis. Rock magnetic measurements were made on magnetic susceptibility (K), anhysteretic remanent magnetization (ARM) and isothermal remanent magnetization (IRM) while the specimens were in the wet condition. Iron concentration in sea water just above sediments was measured with an atomic absorption spectrometry.
Dissolved iron (DI) concentration in water just above sediments which was filtered above 0.45 um particles were 3.33-5.67 nmol/L. No filtered samples (total dissolvable iron concentration: TDI) showed 4.11-6.22 nmol/L. This suggests that suspended particles can become a supplier of iron in sea water.
Rock magnetic parameters of sediments from 0-2 cm burial depth increase with water depth. According to our core observation, the grain sizes of the sediments become gradually finer with increasing distance from islands, and finer with increasing water depth. The sediments from shallow sites (water depth is 187-685 m) consist of sandy clay with foraminifera. This implies that the concentration of magnetic minerals in the shallow site sediments is diluted by the supply of terrigenous sediments and calcareous microfossils.
We compared rock magnetic parameters (NRM, ARM, IRM, HIRM and S ratio) of surface sediments with TDI. Correlation coefficient (R) showed 0.52-0.72, thus we think that they are interrelated. There was also moderate negative relationship between TDI and DO. Rock magnetic parameters and DO showed decrease with burial depth in all cores. At some sites where DO showed relatively lower values compared to the other sites, the depth of the decrease in rock magnetic parameters is relatively shallow. This suggests that iron in suspended and sedimentary particles is possible to be dissolved in anoxic condition.

Keywords: dissolvable iron, magnetic properties of marine sediments