Diagenetic effects on magnetic grain size inferred from geochemical and rock magnetic analyses in the deep-sea sediments

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Rock magnetic properties of marine sediments have been widely used for analyses of sedimentation processes. It is known that the magnetic minerals are dissolved through post-depositional diagenesis, and the dissolution of magnetic minerals masks the primary magnetic condition of marine sediments. However, the dissolution processes and factors of the magnetic minerals have not been fully understood. To clarify the dissolution processes and factors, rock magnetic properties, organic geochemistry of sediments, geochemistry of interstitial water (Eh, pH and dissolved oxygen [DO]), and grain size distribution were examined. The materials were collected from the seven sites in the Ryukyu Trench. The sites are located approximately 300 km east of the Okinawa Island. Two cores are on the seaward trench slope (PS1 and PS2), one is on the trench axis (PS3), and four are on the landward slope (PS4, PS5, PS6, and PS7). The sediment cores above and below 3000 m water depth consist of sandy clay with foraminifera and clay silt without foraminifera, respectively. The sedimentation rate is about 4 cm/kyr, based on the age of ca. 7300 yr BP of the K-Ah layer at the 27-29 cm-bsf in the PS3 core.

Based on the thermomagnetic analyses, magnetite is predominant magnetic mineral throughout all the cores. Rock magnetic parameters for the concentration of magnetic minerals (k, kARM, and SIRM) indicate that the topmost sediments at the seaward slope sites contain a larger amount of magnetic grains than those at the landward slope sites. This can be explained that non-magnetic grains dilute the concentration of magnetic grains in the topmost sediments. Magnetic grain size at the landward sites is relatively finer than that at the seaward sites. It is implied that magnetic grains are derived from different sources between the landward and the seaward sites. In the main section subjacent to the topmost layer, the magnetic hysteresis parameters and the interstitial water of Eh, pH, and DO are changing sympathizingly each other with burial depth. It can be implied that the dissolution of magnetic minerals occurs in the trench axis sediments. It should be noted that the DO is considerably low value in bottom and interstitial waters. This suggests the dissolution of magnetic minerals occurs by low DO.