Reductive dissolution of magnetofossils

*Toshitsugu Yamazaki[1]

1. Atmosphere and Ocean Research Institute, The University of Tokyo

Reductive dissolution of magnetite is known to start at or below the Fe-redox boundary in sediment columns. Based on magnetic grain size proxies, previous studies documented that finer grains dissolve earlier. This is probably because finer grains have larger ratios of surface area to volume. Here, I examine how dissolution of biogenic magnetites proceeds. Core GH98-1232 taken from the Japan Sea was used in this purpose. Yamazaki et al. (2003) showed that in this core reductive dissolution started at about 1.3 m in depth and mostly completed within an interval of about 30 cm. FORC measurements and TEM observations were conducted in the present study. The central ridge in FORC diagrams, which is indicative of biogenic magnetite, gradually becomes obscured downcore within the interval of dissolution. TEM observations showed that the sediments include the three morph-types of magnetofossils: octahedra, hexagonal prisms, and bullet-shaped. It is revealed that with the progress of reductive dissolution the proportion of the bullet-shape magnetofossils decreases whereas those of hexagonal prisms increase. This is probably due to that the rate of dissolution of magnetite varies with crystal face: (111) > (100) > (110) (Allen et al., 1988). Bullet-shaped magnetofossils are wrapped mainly with (111) faces, whereas hexagonal prisms elongate in the [111] direction with (110) sides and (111) caps. It was observed that (111) caps of hexagonal prisms are often etched first in the interval of dissolution being underway, which is consistent with the weaker (111) faces. Such changes in dominant morph-type of magnetofossils in diagenesis should not be confused with variations in lineage of inhabiting magnetotactic bacteria.

Keywords: magnetofossil, reductive dissolusion, biogenic magnetite

