# DRM lock-in depth and magnetofossils

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Remanent magnetization acquisition processes of sediments are not fully understood yet despite a long history of research. The flocculation model of Tauxe et al. (2006) succeeded to explain the low efficiency of the remanence acquisition of sediments. The model predicts a ~0 cm DRM lock-in depth. However, the lock-in depth is still controversial; near zero to decimeter-scale lock-in depths were reported so far using the same method, that is, the comparison of the variations of relative paleointensity and cosmogenic nuclide $^{10}$Be flux in a single core. Our recent studies also showed that sediment cores in the western equatorial Pacific, which are adjacent with each other and under similar oceanographic conditions, have various lock-in depths from ~0 to 15 cm (Suganuma et al., 2010; Horiuchi et al., 2016; Sakuramoto et al., 2017).

Recently it has become recognized that biogenic magnetite is a major constituent of magnetic mineral assemblages in global deep-sea sediments (e.g., Roberts et al., 2011; 2012, Yamazaki and Ikehara, 2012). Biogeochemical remanent magnetization carried by magnetofossils may contribute to remanence acquisition processes of sediments, but details are not understood yet. The abundant occurrence of magnetofossils with equant octahedral morphology in oxic red clay indicates that some species of magnetotactic bacteria (MTB) that produce equant octahedral magnetosomes do not avoid oxic conditions and may be aerotorelant (Yamazaki and Shimono, 2013). The population of such MTB may be largest near the sediment-water interface because of the highest availability of nutrients there. On the other hand, it is revealed that MTB that yield bullet-shaped magnetosomes prefer chemical conditions near the oxic-anoxic transition zone (Yamazaki et al., in prep.).

Remanent magnetization of sediments is considered to be a mixture of detrital remanent magnetization and biogeochemical remanent magnetization (BRM). If the floc model is true, the remanence carried by the detrital component does not show delay. The BRM carried by magnetofossils with equant morphology may also have no delay, whereas the BRM of bullet-shaped magnetofossils may contribute to delayed remanence acquisition. Lock-in depth of sediments may be determined by balance of these three components. The delayed component may have higher coercivity due to larger shape anisotropy of bullet-shaped magnetofossils.

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