R004-18
Zoom meeting A ：11/4 PM2 (15:45-18:15)
16:00〜16:15

Preliminary study of high resolution monitoring of paleomagnetic experiments with reef limestones

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Reef limestone has very week remanent magnetization. Previous studies (e.g. Anai et al., 2018) suggest that magnetite seems to be the main carrier of the weak magnetism, and other magnetic minerals crystallized secondarily (e.g. hematite and/or goethite) are also present. The origin of magnetite is considered to be biogenic and/or detrital, which is not clear at the moment. Reef limestones are composed of coral and other fossils with significant heterogeneity in the samples and their magnetizations are weak in general. For this reason, standard magnetization measurement using superconducting magnetometer is quite difficult for some samples. Against this background, reef limestone has been considered to be an unsuitable subject for paleomagnetic studies including magnetostratigraphy. On the other hand, reef limestone is known to be an excellent recorder of paleoenvironment, such as sea-level change and/or climate change. In order to retrieve high sensitivity paleomagnetic and rock magnetic information from reef limestones at sub-millimeter scales, we conducted analyses using a scanning SQUID microscope on a thin section.

Typical characteristic behavior of reef limestones during AF demagnetization is that they are unstable showing inconsistencies among multiple trials at each demagnetization step. We considered the possibility that this could be caused by unstable domain wall movements of MD particles. From the results of SQUID microscopy, the unstable (possible MD) particles seem to be attached to the cavities in the samples. This is consistent with previous studies in which secondary magnetic minerals were removed by flowing a reducing etchant through the cavities of the samples. The high porosity and extremely high permeability of reef limestone suggest that secondary magnetic minerals are crystallized and attached when water containing divalent iron ions passes through the pores. The possible MD particles, which could be responsible for the instability against demagnetization, are also likely to be secondary crystals. The results of an XRF scanner on the thin section also support this prediction. The XRF analysis show that the Fe component is concentrated on the fossil surface and on the walls of the cavities, indicating the presence of secondary magnetic minerals attached to the water channels in the reef limestones. Based on these results, we considered that removing iron oxides and/or iron hydroxides attached to the boundaries between particles and on the surfaces of the cavities can reduce instability against demagnetization and measurement noise. In order to clarify the hypothesis, we plan to conduct chemical demagnetization on a reef limestone sample while monitoring magnetization and chemical composition with the scanning SQUID microscope and the XRF scanner. In the presentation, we will further show experimental results and evaluate the hypothesis.