

## An experimental simulation of the effect of magnetostatic interaction in Thellier paleointensity experiment

# ZHONG ZHENG[1]; Xixi Zhao[2]; Yozo Hamano[3]

[1] Sogokaihatsu Co. Ltd.; [2] Institute of Geophysics and Planetary Geophysics, University of California; [3] Dept. Earth & Planetary Physics, Univ. of Tokyo

Although Neel's theory (1949) satisfactorily explains the magnetic properties of an isolated single-domain (SD) grain, which is an ideal recorder of both direction and intensity of the past geomagnetic field, numerous subsequent paleomagnetic researches showed that only rarely the magnetic carriers in rocks are pure non-interacting SD grains. In most cases, samples contain mixture of SD, pseudo-single domain (PSD), multidomain (MD) particles, and often with strong magnetostatic grain/or domain interactions. Our recent investigations indicate that magnetostatic interactions between magnetic grains can seriously affect the properties of thermal remanent magnetization (TRM) and generate non-ideal behavior for the Thellier-Coe paleointensity experiment. To illustrate these characteristics, an experimental simulation was conducted by using an artificial synthesized magnetite made by Rare Metallic Co. Ltd. Four specimens were prepared. In one specimen (Mt1-1) 22 w.t.% magnetite powder was mixed with an Aron ceramic in clustered grains state, while for other 3 specimens (Mt2-1,-2,-3) the magnetite powder was dispersed in matrix of Seto porcelain clay of very weak magnetization in different magnetite contents (10 w.t.%, 3 w.t.%, 0.35 w.t.%, respectively). Two distinctive groups of magnetite grains can be observed in these samples by backscatter electric image observation: (1) very fine grains (smaller than 1  $\mu\text{m}$ ); and (2) relative coarse grains (2-5  $\mu\text{m}$ ) dispersed in clay matrix. The coarse grains have lower unblocking temperature ( $T_{ub}$ ) (200-550C) and lower coercivity (85%  $h_c$  lower than 15mT). The fine grains, on the other hand, have higher  $T_{ub}$  (550-600C) and higher coercivity (50%  $h_c$  higher than 15mT). The effect of interaction between grains can be observed in the different behavior of these 4 specimens which were prepared with different grain's distance; and the maximum effect of interaction between domains can be estimated by comparing the behavior of mostly dispersed-grain specimen (Mt2-3, 0.35 w.t.%) with that of ideal non-interacting SD grains. Our results clearly show that the interaction between grains has particular disastrous effects on the Thellier-Coe paleointensity experiment. For example, for an expected field 50 uT, differentiated Thellier paleointensity experiments would yield paleointensity estimates that range between 10-70 uT. The effect of interaction between domains, however, could be much smaller compared with those due to grain's interaction. For example, our coarsest grain sample (2-5 $\mu\text{m}$ , containing more domains) caused no more than 10% offset in paleointensity estimates. Detailed results will be presented and discussed at the meeting.