

High-temperature magnetic measurements and X-ray diffraction analysis of natural greigite from Taiwan

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Paleomagnetic significance of greigite (Fe_3S_4) has been increasing since the pioneering works (e.g., Snowball and Thompson, 1990; Horng et al., 1992; Roberts and Turner, 1993). Greigite is now found from most of anoxic sediments either of marine or lacustrine environments. Its saturation magnetization is reported as ca. $25 \text{ Am}^2/\text{kg}$ which is about 30% of magnetite, and the Curie temperature (T_c) of 330 degrees C (Spender et al., 1972) is widely accepted (e.g., Hunt et al., 1995). However, natural remanence carried by greigite sometimes found to persist up to 400 degrees C against thermal demagnetization (Horng et al., 1998). Besides, greigite shows thermal instability when heated above ca. 200 degrees C. Torii et al. (1996) showed that the irreversibility of thermomagnetic curve of greigite is caused by its thermal decomposition and thus it is difficult to determine T_c of greigite.

We will demonstrate detailed high-temperature changes in strong-field magnetization (thermomagnetic curve) in sequential and batch modes, and also thermal demagnetization of remanent magnetization (IRM). These thermomagnetic experiments were done under practically non-oxidizing condition with an electric oven installed in MPMS. The sample is a virtually pure greigite nodule obtained from the land-section of marine sediments in the southwestern Taiwan (Erhjen-chi section). Our results clearly show that magnetization of greigite can be persistent close to 380 degrees C whereas the thermomagnetic behaviors are totally irreversible. X-ray diffraction (XRD) patterns of samples before and after heating at various temperatures are precisely analyzed. XRD results revealed that the original greigite is substantially decomposed when heated above 340 degrees C. Pyrrhotite of either monoclinic or hexagonal is formed when heated above 380 degrees C but finally oxidized into hematite above 500 degrees C. These lines of evidence revealed detailed high-temperature magnetic property of greigite as well as mineralogical changes during thermal treatments.