

Paleointensity study on the Hawaiian 1970 lava: Implications for the reliability of the Thellier method

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We collected five block samples from more than 2m thick flow of the Hawaiian 1970 lava and applied the Coe's version of the Thellier method. The major magnetic phase were identified from thermomagnetic analyses to be titanomagnetites (T_c was higher than 500C). The Day plots showed hysteresis parameters in the PSD region. These rock magnetic properties are similar to those of the Hawaiian 1960 lava, which was already investigated by Yamamoto et al. (submitted). According to their study, some parts of the Hawaiian 1960 lava were characterized by titanomagnetites with intermediate indices of high temperature oxidation (III-V) under reflection light microscope and systematically yielded about 50% high paleointensity. Therefore, the 1970 samples were subjected to the microscopic observation before the paleointensity measurements. The five blocks were classified into two groups with reference to oxidation indices: (A) no titanomagnetites with intermediate oxidation indices (HW7002, HW7003 and HW7005) and (B) some amount of titanomagnetites with intermediate oxidation indices (HW7001 and HW7004). In HW7001 and HW7004 samples, magnetic minerals with intermediate oxidation indices were distributed around small vesicles.

All the samples were stepwise heated in air and the PTRM test were performed at each temperature step. The applied dc field was 30 micro-T because the geomagnetic field in 1970 at the sampling site was calculated from the IGRF1970 to be about 36 micro-T. HW7001, HW7002, HW7003 and HW7005 samples passed the PTRM test and gave good linear portions in the NRM-TRM diagrams while HW7004 did not. The group A (HW7002, HW7003 and HW7005) gave paleointensities of about 39 micro-T, which are consistent with the IGRF 1970 value. However, HW7001 showed about 52 micro-T, that is about 50% higher than the IGRF1970 value. These suggest that the volcanic rocks with intermediate oxidation indices may yield erroneously high paleointensity and thus the microscopic observation should be carried out to examine the reliability of measurement results. We will further apply the LTD-DHT Shaw method to the samples and examine its validity.