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Archeointensity study on baked clay from the reconstructed kiln: implication for validity of the Tsunakawa-Shaw method

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A reconstruction experiment of a kiln had been done to imitate completely that of an excavated kiln of the 7th century in Japan. Baked clay samples were taken from floor surface and -20 cm level, and they have been stored after determinations of the paleomagnetic directions by partial alternating field demagnetizations. A suite of the rock magnetic experiments and the scanning electron microprobe observations elucidate that dominant magnetic carriers of the floor surface samples are Ti-poor titanomagnetite grains in ˜10 nm size with single-domain and/or super-paramagnetic states, whereas contributions of multi-domain grains seem to be relatively large for the -20 cm level samples. We applied the Tsunakawa-Shaw method to the samples to assess how reliable archeointensity results are obtained from the samples. From the floor surface samples, six out of the eight successful results were discriminated and they give an average of 47.3 microT with a standard deviation of 2.2 microT. This is fairly consistent with the in-situ geomagnetic field of 46.4 microT at the timing of the reconstruction. They are obtained with a built-in anisotropy correction using anhysteretic remanent magnetization, and without any cooling rate corrections. In contrast, only one out of the four successful result was obtained from the -20 cm level samples. It yields an archeointensity of 31.6 microT, which is inconsistent with the in-situ geomagnetic field. Considering from the in-situ temperature record during the firing of the kiln, the floor surface samples acquired full thermoremanent magnetizations (TRMs) as their natural remanent magnetizations whereas the -20 cm level samples only acquired partial TRMs, and these differences probably cause the difference in the archeointensity results between the two sample groups. For archeointensity researches, baked clay samples from a kiln floor are considered to be ideal materials.