

## Paleointensity experiments on baked clay samples taken from the reconstructed ancient kiln

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In 1960-1970s systematic oriented-sample collections were made from baked clay at many archeological sites in Japan. Paleomagnetic directions had been intensively measured from these samples and databases reporting the results have been constructed (e.g. Hirooka et al., 2006). As a next step, we plan paleointensity measurements from these samples. To test how reliable paleointensity results we can obtain, we have conducted paleointensity experiments on baked clay samples taken from the reconstructed ancient kiln, which was completely imitated to that of an excavated kiln of the 7th century (Nakajima et al., 1974).

The reconstruction experiment was conducted on January 1972 (Nakajima et al., 1974). Prior to the reconstruction, in-situ geomagnetic field was measured by a magnetometer:  $D=-5.63$  deg,  $I=46.78$  deg and  $F=46.350$  micro-T. During the experiment, thermocouples were set at several points in the kiln. It was recognized that temperature reached to 1000 C at the floor surface, 630 C at the level 10 cm below the floor, and 350 C at the level 20 cm below the floor. After the experiment, baked clay was taken from (1) the floor surface and (2) the level 20 cm below the floor, with orientation using plaster. Nakajima et al. (1974) conducted partial alternating field (AF) demagnetization up to 20-40 mT on the baked clay samples and reported mean paleomagnetic directions as  $D=-5.03$ ,  $I=43.36$  and  $a95=2.41$  (N=10) for the samples from (1) and  $D=-4.80$ ,  $I=43.52$  and  $a95=3.38$  (N=5) for the samples from (2). These are generally consistent with the in-situ geomagnetic field measured prior to the reconstruction.

Tsunakawa-Shaw paleointensity method (Shaw 1974; Rolph and Shaw 1985; Tsunakawa and Shaw, 1994; Yamamoto et al., 2003) mainly utilizes AF demagnetization and it can be applicable to partially AF demagnetized samples in previous. Mini specimens (about 1.7cm cube) cut from 12 baked clay samples were subjected to the Tsunakawa-Shaw paleointensity experiment. Nine results passed selection criteria and they give mean paleointensity and its standard deviation as  $45.9 \pm 7.4$  micro-T (N=9). The mean paleointensity coincides with the in-situ geomagnetic field measured prior to the reconstruction, but the standard deviation beyond 10 per cent of the mean.

The mini specimens giving nine successful results consist of seven red-colored ones taken from (1) and two gray-colored ones taken from (2). The gray-colored specimens show one order of magnitude smaller anhysteretic remanent magnetization (ARM) intensities than the red-colored ones. If we exclude results from the two gray-colored specimens, mean paleointensity and its standard deviation results in  $46.1 \pm 3.5$  micro-T (N=7). The standard deviation becomes smaller. It implies that archeointensity can be estimated by the accuracy within 10 per cent of the mean using red-colored baked clay specimens taken from a kiln surface, with the application of the Tsunakawa-Shaw method.