Archaeointensity data from Japan: current status and future perspectives

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Japan is a country with very rich cultural heritage and with many archaeological sites that can offer precious information about the geomagnetic field secular variation in the past. However, even though archaeomagnetic research in Japan started more than 60 years ago, with numerous studies focused on archaeodirection determinations of in situ archaeological structures, the available up to now archaeointensity data are still scarce. Most of the absolute intensity records come from archaeomagnetic studies carried in 60’s, 70’s and 80’s, mainly obtained with the original Thellier-Thellier method and/or its modifications. In none of these data, cooling rate and anisotropy corrections were applied. During the last 20 years, only two more archaeointensity studies have been published, applying the Tsunakawa-Shaw palaeointensity method on baked clays from Japanese kilns. This current status of archaeointensity studies in Japan makes evident the need of new high-quality reference data in order to reconstruct the geomagnetic intensity secular variation path in Japan. In this perspective, in the frame of the “Be-Archaeo” MSCA-RISE project, we have collected a total of 56 fragments of archaeological artifacts from the archaeological sites of Sada Higashizuka, Sada Nishizuka, Tatezaka, Tenguyama, Tatetskuki and Nima Ohtsuka, situated at the Okayama prefecture. The baked clays studied belong to ancient coffins, haniwa artifacts and pottery and their ages range from 100 AD to 675 AD. Preliminary rock magnetic and archaeomagnetic analysis including magnetic susceptibility, Q-ratio, isothermal remanent magnetization (IRM) curves, thermal demagnetization of a composite IRM component as well as stepwise thermal and alternating field (AF) demagnetizations were performed to investigate the magnetic mineralogy of the samples and their suitability for archaeointensity experiments. The results show the presence of a magnetic mineral with Curie temperature ranging from 480 to 560 °C, most probably magnetite and/or Ti-magnetite. IRM curves and AF demagnetization suggest also the presence of a high coercivity component in some samples, as saturation is not reached at 1 T and samples are not completely demagnetized at 180 mT. Demagnetization diagrams reveal a stable single component of magnetization for most of the samples. However, some samples demonstrate disturbed Zijderveld diagrams and/or two components of magnetization; no correlation between the quality of the results and the material
studied (pottery, haniwa or coffin fragments) was found. These preliminary results were used to select promising samples for archaeointensity experiments, aiming to obtain new high-quality archaeointensity records for the Late Yayoi and Kofun periods.