ROCK MAGNETIC AND ARCHAEOMAGNETIC STUDY OF AN ANCIENT KILN AT KATO ACAIA, GREECE

E. TEMA

Dipartimento di Scienze della Terra, Università degli Studi di Torino, 10125, Torino, Italy, evdokia.tema@unito.it

Introduction: Dating of archaeological material is a key issue in the archaeological research as it can significantly contribute to determine the age and duration of the human occupation of a site and define the chronology of cultural and economic development of a certain area. A wide variety of established and newly developed archaeometric techniques can offer valuable dating tools. Archaeomagnetic dating is based on the fact that some archaeological artefacts (e.g., kilns, hearths, bricks, pottery) contain magnetic particles that, when heated at high temperatures and cooled in the presence of the Earth’s magnetic field, may acquire a thermal remanent magnetization (TRM) with direction parallel to the direction of the local field and magnitude proportional to the local field intensity. The date of the TRM acquisition can thus be determined by comparing the geomagnetic field elements (Declination, D, Inclination, I and intensity, J) obtained from the remanent magnetization measured on the undisturbed archaeological artefacts with reference secular variation (SV) curves that report the chronological geomagnetic field variations within a certain region. The accuracy of archaeomagnetic dating depends on several factors such as the suitability of the studied materials as recorders of the Earth’s magnetic field, the measurement’s uncertainty, the rate of change of the geomagnetic field in the considered period and the availability of detailed reference SV curves for the given territory.

Content: The results of a systematic rock magnetic and archaeomagnetic study of an ancient circular brick kiln excavated at Kato Achaia are presented here. Hierarchical sampling process has been followed collecting 12 independent brick samples oriented in situ using a magnetic compass and an inclinometer. Several magnetic measurements have been carried out in order to determine the main magnetic carrier of the samples and to check their thermal stability. Isothermal remanent magnetization (IRM) experiments pointed to magnetite and/or Ti-magnetite as the main magnetic minerals in most of the samples. Thermal demagnetization of the three IRM components induced along the three sample axes, applying first the maximum field (1.3 T) along Z-axis, then the intermediate field (0.5 T) along the Y-axis and finally the minimum field (0.1 T) along the X-axis, shows the dominance of the magnetically soft fraction (< 0.1 T) with unblocking temperatures ranging between 440 and 500 °C. Standard archaeomagnetic procedures have been used for the determination of the archaeomagnetic direction registered by the bricks during the kiln’s last firing. Stepwise thermal demagnetization shows a stable characteristic remanent magnetization (ChRM) while negligible secondary components present in some samples are easily removed at low temperatures. The direction of the ChRM has been obtained from principal component analysis and the kiln’s mean direction calculated from 15 specimens (corresponding to 9 independent samples) is $D = 350.1^\circ$, $I = 57.3^\circ$ with $\alpha_{95} = 2.4^\circ$ and $k = 246$. 
The archaeomagnetic age of the kiln has been obtained using the most recent developments in data elaboration and was calculated after comparison of the kiln's archaeomagnetic parameters with the declination and inclination reference curves produced by the SHA.DIF. 3K European regional geomagnetic field model. Two possible dating intervals are obtained calculated at 95% of probability: a first one 401-176 BC, and a second one 73 BC - 42 AD. Taking in consideration the available archaeological evidence from the site, the first dating interval (401-176 BC) seems most probable and suggests that the kiln was in use during Hellenistic times.