ARCHAEOMETRIC AND ARCHAEOMAGNETIC MEASUREMENTS ON GREEK CERAMICS AND BAKED CLAYS: A PROMISING COMBINATION

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Introduction: Systematic mineralogical and petrographic analysis has been performed on ceramic sherds and baked clays derived from nine archaeological sites, situated in N. Greece, Cyclades and NW Peloponesse. The ages of these sites vary, from Early Bronze Age to Roman times, based on the ceramic typology and age-diagnostic objects found in the excavations.

Scope: The main purpose for this study is to deduce information about the firing conditions (i.e. soaking temperature, atmosphere, time) and the post-burial alteration phenomena of the ancient ceramic materials. Such information could be important in order to select suitable materials for the archaeointensity determination. A key point for successful archaeointensity experiments is the firing of the baked material and the atmosphere conditions during heating since the magnetic stability of the samples is directly related to these two factors. The present study constitutes a first attempt to use both sets of data (petrological and archaeomagnetic) in order to cross-check whether or not the information deriving from the former is applicable to the latter. For this reason we used already existing archaeointensity results on samples which are afterwards subjected to the archaeometric examination.

Content: For the majority of archaeological sites, the petrographic and mineralogical results indicate that the firing temperature prevailing in their kilns had a wide range varying from ≈500 up to ≈1100° C. A more narrow range of temperatures, T≈850-1050° C, was applied to the kiln from NW Peloponnese. The preservation of primary clay minerals such as smectite, kaolinite and chlorite, representative of the raw materials of ceramic samples, determines the low firing temperatures in contrast with the presence of newcrystallized high–T mineral phases such as mullite, cristobalite (Ca-poor ceramics) and diopside, gehlenite (Ca-rich ceramics), which establish the high temperatures. Postdepositional alteration phenomena are rarely present. The existence of analcime (zeolite) verify the alteration of ceramic's glassy phase while the secondary calcite formed either from the dissolution of gehlenite or the filtration of calcareous aqueous solutions during burial processes.

The quantity of iron oxides does not exceed 3.0 wt % with a few exception for the samples of Dispilio and Polymylos which was measured ≈ 8.00 wt. The low amount of iron oxides in most of the samples is the result of the neocrystallization of calcium aluminum silicates minerals which permit the entrapment of Fe in their structure contrary to the Si-rich samples (i.e. Dispilio) in which the iron ox-

ides can be preserved even at high temperature ≈1100° C.

An attempt to correlate the above results to successful or failed palaeointensity experiments performed on numerous samples from seven out of nine sites was done. This cross-checking pointed out that the estimation of the firing conditions and the quantification of the neoformed iron oxides may show a good correlation with most archaeointensity results. However a more careful examination of Fe-bearing minerals (i.e. grain-size, the presence of iron oxide solid solutions with the spinel crystal structure or exsolution phenomena) using the electron microscopy analysis is necessary in order to explain the non- systematic correlation observed in some few samples.

The above approach can be very valuable for the archaeointensity measurements provided that more time-extended collections are used, covering recent-Byzantine- and older – neolithic-archaeological periods.