Geoarchaeological analyses of construction materials from the Neolithic site of Asıklı Höyük, Turkey
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Asıklı Höyük is the oldest Aceramic Neolithic tell in the Coppocassos region of Central Anatolia, Turkey, an area of Central Anatolia which has a distinct geologic and geographic structure. The Asıklı project first started in 1989, directed by Prof. Dr. Melis Uzdurum of Istanbul University.

The results of radiocarbon dating show that habitation started in the site in the beginning of the 10th millennium BC and continued until the middle of the 9th millennium BC. The site contains the earliest evidence for sedentism and adoption of a new life style, and has a thick sequence that developed over 1000 years without interruption. Therefore, Asıklı Höyük is possible to observe the Neolithic process in one place. The many changes in human life that happened during this period include the development of new social and economic systems, the creation of the first cities, human bones, and architecture. Asıklı is also the only early Neolithic life in Coppocassos, Asıklı is unique in its age, site, geographic context, and good state of preservation.

RESEARCH AIMS
The main structural material used in the settlement from its first stages of occupation to its abandonment is the mud-brick. Mud-brick can be defined as building material formed from soil made using a mixture of loam and water with various additive and binding materials. Mud-brick is a convenient building material because it can be produced from many kinds of soil using different methods, although it has a disadvantage in that it must be renewed and repaired due to weathering and natural disasters. It has an advantage in that it is a recyclable material. The process of mud-brick production, from preparing the raw material to making and using the bricks provides information about structures and traditions of the culture to which it belongs. For example, the preferred sources, the additives used, and brick shaping methods differ in certain geographies and time periods.

We aim to study: (1) how mud-brick, mortar and plaster were produced, (2) changes in production methods over time, and (3) the relationship between these changes and other aspects of sedentary life that are specific to the Asıklı Höyük Neolithic community. In this context, we propose to analyze the changes in technological and social life by first understanding the use of construction materials in Asıklı.

METHODS
Preliminary analyses of the loose samples are presently limited to CO2, O, and 18O measurements. A few samples of ground powder were reacted with H2O and the δ13C and δ18O of CO2, was calculated from the volume of evolved CO2 gas.

Microarchaeological thin sections were produced from oriented blocks of mud-brick and mortar from Layers 4, 3, and 2, as well as from floor and wall plaster sequences. Measurements of the x-ray isotope and oxygen were conducted on selected samples of mud-brick, mortar, plaster, and compositions that contained abundant carbonate. Several micrograms of each sample were reacted in an oven of 250°C for 3 hours to remove organic material. The isotope ratios were measured relative to internal standards using a Finnigan MAT 252 mass spectrometer equipped with a beam automated sample preparation device.

Fourier transform infrared (FTIR) analyses were conducted on loose samples of plaster, mud-brick and mortar. The samples were ground to a powder and embedded in KBr pellets for transmission measurements using an Agilent Cary 660 infrared Spectra from 4000-400 cm-1, a resolution of 4 cm-1. Analysis of calcium using the grinding curve method followed Regen et al. (2009).

CALCULATED CARBONATE ABUNDANCE

In Layer 2, the distributions of carbonate abundance in mortar and mud-brick are similar. Samples from Layers 3 and 4 contain more carbonate, but our sample size is not large enough to compare distributions between materials. Roundout structures in these levels have a more normal distribution with a mean of 8% CaCO3.

Stable Isotopes

As reported by Meitner and Quade (2012), some samples contain isocapic ratios that are consistent with ash, while others contain ratios that are consistent with local freshwater limestone. This has implications for the methodology established in this study.

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Analysis of carbonates using grinding curves has been reported as an approach to distinguishing between calcite of pyrogenic origin (ash and lime plaster) and geologic origin (Regen et al. 2009). We conducted a plot of some mapping curves using locally available calcareous materials, modern references, and our particularities of sediment-size fractionation methods, and construction materials from the site. Our results indicate that some of the construction materials plot within the range of ashes and lime plaster, however, the local freshwater limestone falls within the range of ashes. These results suggest that grinding curves must be employed cautiously of Asıklı Höyük. In the future, quantification of the frequency of use of lime and as plaster at the site will likely involve a combination of isotopic analyses and grinding curves.