Plastering the Prehistory: Marl as a unique material to cover, maintain and decorate the Neolithic walls of Çatalhöyük

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Abstract: Çatalhöyük (World Heritage site, c.7400 BC) is a renowned Neolithic site in central Anatolia, Turkey on account of its size, well-preserved mudbrick architecture and wall art. The current international project led by Professor Ian Hodder has been continuing since the 1990's and the studies showed that people of Çatalhöyük were highly aware of their natural environment and knew how to skillfully modify their resources to develop various material technologies according to their needs. One of the most important material technologies evident at Çatalhöyük makes the site unique within the Neolithic Anatolia and the Near East is the use of 'Marl' as a plastering material to cover the internal surfaces of the mudbrick walls. This paper is based on the most recent research undertaken on the technology of the Çatalhöyük wall 'plasters' and paintings and will aim to look at what it is meant by 'plaster and plastering' in the context of Neolithic Çatalhöyük, identify materials and their characteristics, define the areas of use and terminologies between the different materials and answer some of the controversial questions on the Çatalhöyük wall plasters, such as the use of true lime plaster.

Plaster and Plastering at Çatalhöyük

The renowned heritage site Çatalhöyük is situated on the Konya plain in central Anatolia. The site consists of two mounds, the East Mound (Neolithic, around 7400 to 6000 cal. BC) and the West Mound (Chalcolithic, 6000-5600 cal BC) (Fig.1).

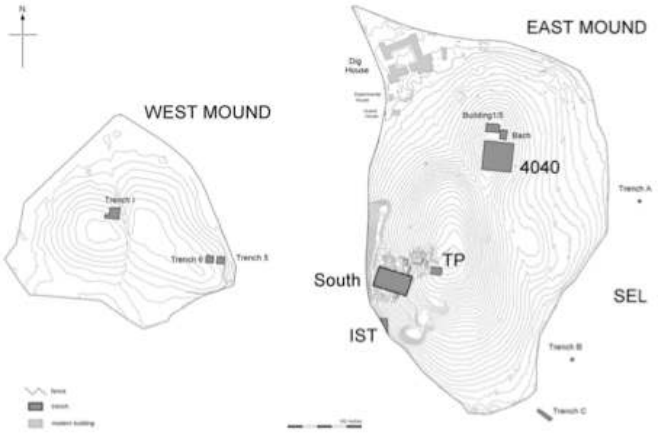

Fig.1 The plan of the recently excavated areas at Çatalhöyük (Çatalhöyük Research Project, Archive Report 2006, p.2)

It was first excavated by James Mellaart between 1961-1965 when he exposed a large Neolithic settlement which was, according to the current excavation project run by Prof. Ian Hodder (1993-ongoing) occupied for approximately 1400 years [1]. Mellart found that the buildings (later identified as houses) were built onto the demolished walls of earlier buildings for a continuous occupation and constructed closely to each other to form an "agglomerated" settlement with external (midden) areas around them [2].

The houses were built of mudbrick. The walls of most buildings were "plastered" and some were decorated with paintings of various designs (Fig.2) as well as animal reliefs including large *bucrania* (bull head) installations [2].

Fig.2 Recent geometric paintings from B80, South Area (Jason Quinlan, Çatalhöyük Research Project)

Current archaeological studies show that that people of Çatalhöyük were highly aware of their natural environment and knew how to skillfully modify their resources to develop various material technologies according to their needs. Locally derived sediments, clays and marls were used routinely to coat walls and floors. At this point it is important to define what it is meant by 'plaster and plastering' in the context of Neolithic Çatalhöyük wall

plasters and wall decorations. Studies have shown that in general the Neolithic plasters used at most other sites in central/southeastern Anatolia and the Near East were mainly true 'calcined' lime plaster.

The question asked in this paper is 'were true lime plasters used at Catalhöyük or were all wall and floor coatings constructed with mud derived from natural sediments?'.

Marl as the material under study

Marl is a natural sediment, composed of very fine-grained calcium carbonate and also rich in clay. In this paper, we will use the term 'coating' to describe the materials that were used to smooth the wall and floor surfaces, because the terms 'plaster or plastering' may only imply the use of true (calcined) lime plasters.

Geologically, marl used at Çatalhöyük is derived from the Konya Basin, which extends underneath the site. The Konya Basin is flat and inland with a local geology dominated by white, carbonate mudstones, (marls) and the alluvial plains associated with the river systems. Paleoenvironmental studies on the surroundings of Çatalhöyük show that the basin was occupied by the palaeolake Konya which formed during the last glacial maximum (c. 25,000 cal. BC) [3, 4, 5, 6]. The tributaries of the River May joined the Çarşamba River, which then flowed towards the south of Çatalhöyük, divide the East and West mounds.

The lacustrine marls vary in colour from white to pale brown and differ with respect to content of lithic fragments and organic material. The marls are interbedded with sands, silts and gravels.

Analytical study undertaken for this research aimed to clarify the nature of marl particularly in relation to its use as a base for the wall paintings in the Çatalhöyük houses, and to identify if there is a variation in the chemical and physical properties of the marl mixes used. Macroscopic and microscopic observations helped to divide the selected painted marl samples into two groups in terms of their application method, i.e. multi-layered and single layer application. The main clay mineral in the marl is smectite. Multi-layers of marl coating were formed by the regular application of marl on top of each other for routine repairing and maintenance or sometimes social/ritual reasons (Fig.3). It was soft textured with fine (wash, <1000µm) and coarser (base, >1000µm) layers. The practice of multi layering form showed variation throughout time and through the different parts of the site so whilst some buildings presented 450 layers, some only consisted of 10 layers or less [7]. As Matthews indicates this practice might have been based on seasonal or annual cycles supporting a continuing local tradition of plastering today, where the process is repeated annually in villages and particularly undertaken during the dry summer months.

Fig.3 The multi-layered marl with white and pale brown marls

The single-layer form consisted of one layer of marl and the examples were found to have very hard, highly burnished surfaces with red and yellow ochre. These were recorded to come from the earlier levels of the site and were considered to be true lime plasters by Matthews [8].

38 samples were collected from Çatalhöyük. The samples were made into cross-sections and thin-sections and studied under polarised light microscopy (PLM) and reflected light microscopy (RLM). These analyses were also supported by the scanning electron microscopy (Philips XL-30 ESEM (EDAX)) to study the painted marl fabrics in higher magnifications. Study of the marl fabrics and the character of the mineral/organic inclusions within them enabled to identify four different types of marl used at throughout the Neolithic Çatalhöyük (7400-6000 cal. BC), as well as determining their potential sources around the region where Çatalhöyük was located. The four marl types are described in Table 1 below, followed by the corresponding figures (Figs 4, 5, 6, 7).

Table 1 The summary of the 4 types of painted marl identified under PLM via cross and thin-section analysis.

Marl type/Texture	Minerals	Colour under naked eye/optical microscopy	Found in multi/ single layered form	Inclusions/plant material
1/Fine,silty	Feldspar, plagioclase feldspar, quartz, hornblende, *Unio sp.* shells, mica, gypsum, calcite, iron oxide. Calcium <50%.particle size 20-1000µm (x100)	Pale brown and white/brown	Multi-layered	Sparse to moderate/ rich
2/Fine, silty,coarse, sandy	Feldspar, plagioclase feldspar, quartz, hornblende, *Unio sp.* shells, mica, gypsum, calcite, iron oxide. Calcium <50%, particle size 10-3000µm (x100)	Pale brown/brown	Multi or two layered?	Moderate to rich/ moderate
3/Coarse, sandy	Feldspar, quartz, hornblende (brown/green), basaltic lithic fragments, iron oxide. Calcium <20%, particle size 30-1300µm (x100)	Brown/bright brown	Single layered	Rich/none
4/Fine, silty	Large marl lumps, andesite, sandstone, micritic limestone Calcium >50%, 20-2200µm (x100)	White/yellowish grey	Single layered	Sparse/none

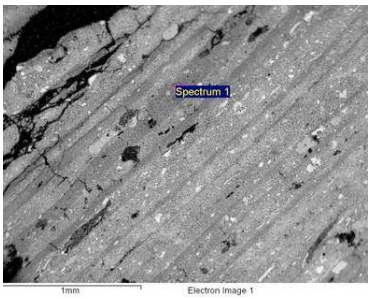

Fig. 4 SEM (EDAX) image of a Type 1 marl with a fine/silty fabric with the inclusion of shells

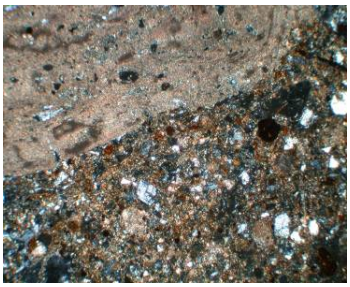

Fig.5 A thin section image of Type 3 marl by PLM, showing the finer and coarser layers, x400

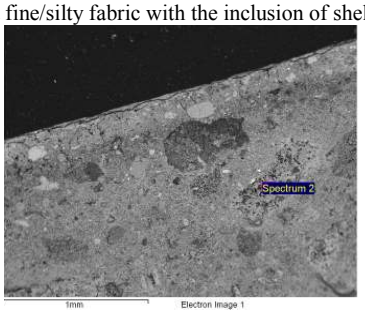

Fig.6 SEM (EDAX) image of a Type 4 marl showing possible clay inclusions.

Fig.7 A thin section image of a Type 4 marl by PLM showing the single layered fine plaster with the red pigment layer above, x400.

Table 1 above shows the typology of painted plasters available on the site. All the mineral and rock inclusions in the marl fabrics were mainly derived from the surrounding basin which includes varied lithologies, spanning from the Palaeozoic to Neogene lithologies, ultimately derived from the Taurus mountain range. Sediment was carried into, and distributed across the basin by the Çarsamba and May rivers and includes fragments of andesites, carbonates and schists. It is the differences in inclusions present that are key in identifying the clay sources for the clay-based materials at Çatalhöyük.

Application of marl types in Çatalhöyük houses

The types of marl described above were used to cover the internal surfaces of the domestic mudbrick walls and they needed regular upkeep. Whilst some houses seemed to have a shorter lifespan and therefore the walls showed only one layer of marl (Type 4 pure, white/greyish marl), others were inhabited longer resulting a build up of various marl types (Types 1-3, impure pale brown). SEM (EDAX) analysis also showed that the Type 4 white/greyish marl has a higher calcium content than the others, possibly making it more durable than the pale brown marl.

The analysis by Tung (2008) showed that there were differences between the nature of

sources and how the marls were prepared in relation to where they were applied within the houses [9]. For example different parts/rooms in the houses might have been defined as "dirty" and "clean" areas. Dirty areas were generally used for cooking as well as for production practices and covered with thicker and coarser mud, whilst the larger elaborate rooms (clean) containing platforms with burials, kerbs, benches and paintings/installations were covered using a fine, white and pale brown better quality of marl in order to indicate the importance of certain areas in the house [10]. These types of differences in the marl fabrics used for plastering/painting indicates changes in the locations from which the marl was obtained at different times and periods throughout the life of the settlement [8, 9, 11].

For covering the walls and floors, marl would have been collected in a wet or a dry state along the lake/river beds and pits followed by storing in a wet/damp environment until it was used. Experimental work carried out during the recent research showed that it would have been mixed with water to achieve either a slurry or a putty-like product depending on the area to be applied on. It was crucial that the plant inclusions were added into the marl fabrics in order to prevent shrinkage and cracking whilst drying. However, having the higher calcium carbonate content (80-87%) white marl does not seem to contain any plant material when used on the walls.

Recent research revealed that Çatalhöyük paintings were generally applied onto clay/carbonate based marls in different colours with a silty/sandy particle size [12] and also onto white, burnished surface made of a material traditionally referred to as 'soft-lime' which is derived from dolomitic carbonate sediments obtained 5 km north of the settlement. Despite the name, soft-limes are not burnt lime plasters. The practice of using both marl and soft-lime for wall coverings does not seem to follow a particular pattern throughout the life of Çatalhöyük. However the plastering practices inside the houses seem to have changed through time as the single layered marl were mainly found in earlier dates (7400-6700 cal.BC), followed by the multi-layered soft-lime/marl combinations at later periods (6800-6000 cal.BC).

As opposed to previous suggestions, the presence of weathered limestone inclusions within single-layered white marl (Type 4) also brings clarification to the question of calcined lime plaster use at Çatalhöyük. Both Mellaart's excavations [13] and Matthews's micromorphological work have argued for the presence of calcined lime plaster in the earlier dates of the site [8, 14, 15, 16] on the basis of the wall plasters with hard textures and highly burnished red and yellow ochre surfaces [7].

Doherty explains that there is no clear evidence for lime production on the site so far, although it is acknowledged that small-scale of lime burning can leave minimal trace in the archaeological record. The presence of "very fine clay impurities (primary) and subangular limestone fragments" [17] in the early plasters (analysed by Optical Microscopy and SEM-EDAX) indicate that they were not fired up to high temperatures. Otherwise these inclusions would not have survived.

Naturally available marl (and soft-lime) provide a white ground which is desirable for painting as well as for covering walls in order to create a clean surface and more light inside the houses. In this case, it would seem that calcining limestone to make plasters would have been unnecessary and less practical in the context of Çatalhöyük.

Therefore, it is safe to say that the microscopic analysis of these 'hard textured' painted marls (Type 4) does not support the claim for the use of calcined lime plaster on the earlier walls of the site. Instead, they were made of white marl with some fine-grained marl and

limestone inclusions. Later on, pale brown (impure) marls and soft-lime (in the form of base and wash layers) appeared and was commonly used for covering/painting house walls throughout the Neolithic Çatalhöyük.

Conclusion

Despite arguments to the contrary, there is no strong evidence that small-scale lime burning took place at Çatalhöyük, and marl was extensively used and possibly "deliberately preferred" as a coating material on walls and floors. Neolithic people had sufficient skills and understanding of their materials to enable them to produce hard, white surfaces suitable as supports for elaborate wall paintings. What is remarkable about the marl coatings is that they are applied extremely thinly, showing regular applications – 'redecorating/maintaining' – but also fine workmanship in terms of burnishing the leather-hard coating continually throughout the application process. Consequently, we are left with the preservation of a remarkable technology in this early Neolithic town, indicating the finest degree of skills, awareness of surrounding resources and choices, as well as understanding of the technological/logistical processes involved in using them.

To summarize the analysis of the samples presented here, it has been shown that white Type 4 marl coatings were restricted to the earlier levels (7400-6800 cal.BC) are of a different composition to the Types 1-3 pale brown marl coatings seen in later levels. The reason for this is not clear however this may indicate the long-lived practices and traditions being followed by most households who may have coated and painted their walls via experimenting with different materials and techniques, and finding the most practical methods with the availability of resources at certain times.

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