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An investigation of the methods of production: zellij of Meshouar (XIVth century, Algeria)

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→ PROBLEMATIC

The excavations in 2008-2009 of a palace of the XIVth century and more recent occupation level brought to light decorations of unmoved *zellij*s of an artistic and technical high quality as well as numerous fragments resulting from these compositions. The size of rooms and the variety of the used motives raise the question of an *abd al-wadid* specificity for the composition of decorative structures and also evolution in the manufacturing of these mosaics. May we express the same conclusions for the very composition of *zellij*s (glaze, coloring and ceramic support)? May we can determine a characteristic know-how of Tlemcen and *abd al-wadid* art and identify specific workshops? A double study of art history and techniques was then undertaken by a multidisciplinary team.

→ PRESENTATION OF THE SITE

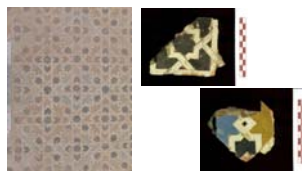
This palace, which a large main alcoved-room opening by a portico on a court as well as appendices was brought to light, dates for his major part of the second half of the XIVth century. The analysis of decorations and stratigraphy lets appear a period of abandonment and reoccupation before a profound modification to the modern time which included this room with alcove in an elongated room. The French activity of the XIXth century which little modified this new sequencing and grounds sealed by the time, kept the *zellij* levels brought to light during the excavation.



→ MATERIAL

The greater part *zellij* fragments took part in compositions still in their place. They correspond to five identified ornamental types; each of them admitted several colors. Studies of geometric structures were made for each of the various motives to understand their composition and, also, to be able to compare them with the advance of the sciences by the time. A search on their frequency in the western islam architectures was also realized.

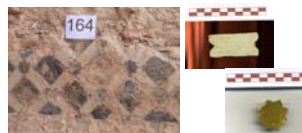
Type 1 (17 samples analysed): Decorated polygons and square *zellij*s situated in the main room (baguette of 1cm of wide, 1 cm of thickness, beveled size). The composition of this decoration and the staggered arrangement of the colored elements place them unquestionably in the second half of the XIVth century. This decoration seems, at the moment, typical of tlemcenian art, even if variants appeared in other contemporary monuments.



Type 2 (20 samples): Elements juxtaposed in the North of the main room (squared by 2 cms aside, diamond 5cms long on 2 cms wide and 1,5 cms in thickness, beveled marked). This motive is attested in dated buildings from XIVth century Morocco as the madrasa-zawiya of Chella, the madrasa Bu inaniya of Fes or still in Andalusian buildings as Pierre the 1st palace in Sevilla.



Type 3 (12 samples): Interlaces *zellij*s enhanced with octagonal stars were found in their original place under the portico (baguette 6 cms long and 3 wide, star 4 cms high and 2 cms of thickness, squared by 5*5*2, cutsbeveled). This type of composition is very frequent in panelling under court yard porticoes in Alhambra palaces from the XIVth century (Granada), for example.



Type 4 (15 samples): Lozanged squares which associate a two-colored black and white scheme; they were found in an appendix in the northeast part of the main room (between 7 and 9 cms aside and 2 cms in thickness, straight size). The rather important size of square *zellij*s as well as their location incite to believe that they date of a reorganization in the modern later period of *abd al-wadid* reign.



Type 5: Polychromatic squares of 4,5 cms aside and 2cms in thickness, beveled cut. These *zellij*s is attested in "repair" in type 1 composition. They appeared so, present at an upper level situated in 0,20 cms from the primitive ground in the eastern part of the alcoved-room. These decorations thus testify of a reorganization, after a possible period of abandonment. They undoubtedly take place after the 1-2-3 types; they are however previous to the type 4 and date, maybe, from the end of the XIVth or the beginning of the XVth century.

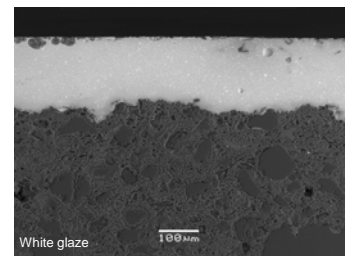
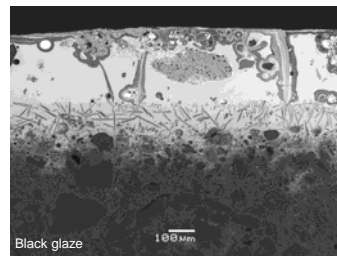


Shaping of decorations

These decorations are constituted by enamelled tiles of « *zellij* » ceramic which were cut in the demand, according to the needs of the ornamental composition. The various pieces were then assembled using a lime mortar. Their bevelle-edge cut allowed a better positioning in the mortar and a better assembly of the various elements of the ornamental structure.

→ SECTION STRTIGRAPHY

The bodies have relatively similar textures and contain mineral inclusions of small particle size (less than 200µm). The glazes were applied directly over the bodies, without intermediate layer. The thickness of the glazes is variable (100 to 450 µm). Independently of the type and the color of the glaze, most of the samples (2/3 : 44 of 66) exhibit a glaze-clay interface greater than 100 µm, suggesting single-cooking.



→ CHEMICAL COMPOSITION

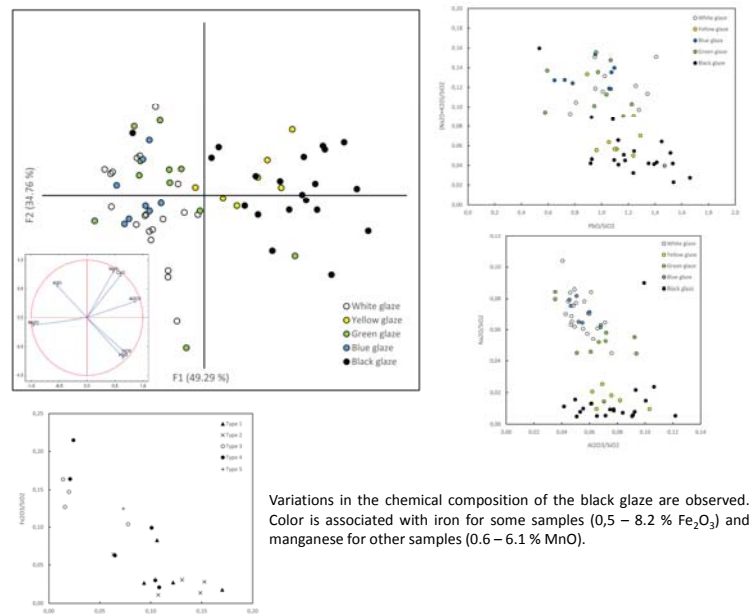
For all *zellij*s analyzed (66 samples), the comparison of the chemical elements (SEM-EDS) shows that the *zellij*s were made from the same calcareous clay soil (19 % CaO) rich in magnesium (5,6 % MgO). These observations suggest magnesian clays. The color of the terracotta is associated with iron (4.2 % Fe₂O₃). The search for a local deposit is underway.

For all types we observe lead glaze (41 % PbO ; 4 % Na₂O + K₂O). The white and blue glazes are opacified with tin oxide (6.3 to 12.7% SnO₂) and are distinguished from other transparent glazes. The black and yellow glazes generally have lower alkali, especially sodium, and higher lead contents.

The color of glazes cooked in an oxidizing atmosphere is related to:

- tin oxide and low iron content (0.3 to 1.3 % Fe₂O₃) for white glazes,
- copper ion (Cu²⁺, 0.9 to 2.9% CuO) and tin oxide (6.3 to 10.6% SnO₂) in a lead matrix for green glazes,
- iron ion (Fe³⁺) for the yellow glazes (1.8 to 3.4 % Fe₂O₃),
- cobalt ion (Co²⁺, 0.2 to 0.4 % CoO) and tin oxide (8.4 to 10.9 % in SnO₂) for blue glazes.

The white and blue glazes are made in the same way, there is only addition of cobalt for the blue glaze.



CONCLUSION

The analyzes carried out on the samples from the different types are highly homogeneous in their manufacture. The raw material used seems identical regardless of the type of *zellij* and whatever the time. Similarly, the use of pigments appears identical for each color for the *zellij*s dated from the fourteenth century as for those which are later. Only black glazes presents variable chemical compositions which could possibly mean a change in the origin of the coloring matter.

Comparisons with the results of studies carried out on *zellij*s from Chella (Rabat, Morocco) show similar processing techniques but the compositions of glazes as well as the composition of the clay soil used are different (less magnesian clay soil and more calcareous at Rabat). The lead content of the glazes is similar but the tin content is overall higher for the Tlemcen *zellij*s.