Μουσείο Μπενάκη

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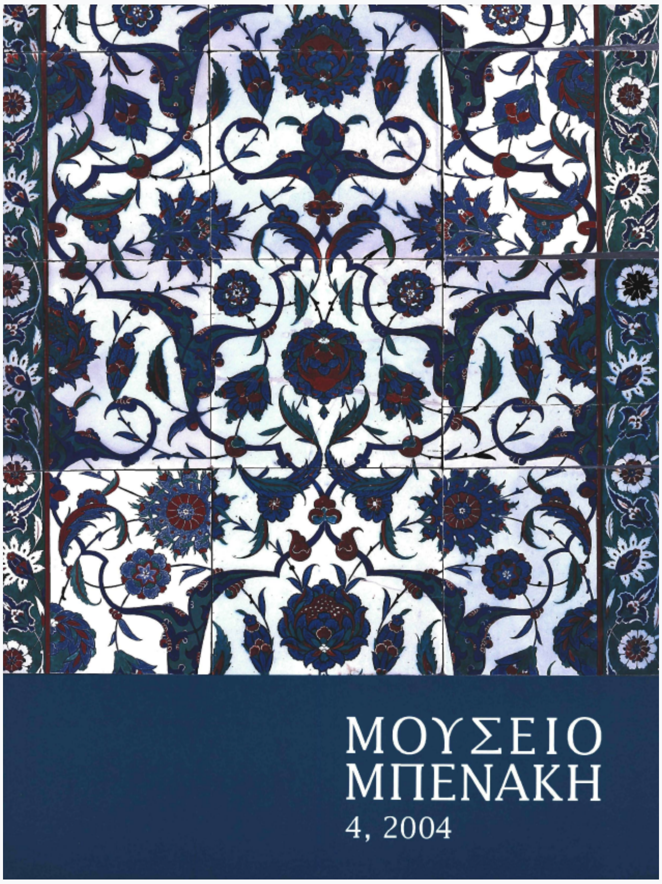

Η ανασύσταση και αποκατάσταση ενός πίνακα με πλακίδια Ιζνίκ στο Μουσείο Ισλαμικών Τεχνών

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The reconstruction of an Iznik tile panel, Benaki Museum Islamic Art Collection

THIS PAPER BUILDS on research by Prof. Walter B. Denny which led to the conceptual reconstruction of an impressive Iznik tile panel which originally adorned the second imperial residence in Edirne (Adrianoupolis).[1] The decision of the Benaki Museum trustees to rehouse the Islamic Art collection in new premises gave us the opportunity to participate in a group effort at realizing a sweeping vision –the reconstruction of a spectacular Iznik artifact and its presentation to the public, while respecting conservation ideology and practice. The project could not have come to fruition without the collaboration with the Gulbenkian Museum, which lent key sections of the panel and also the exemplary technical team who worked of us on the various facets of the project. The resulting scientific examination of the materials corroborates the bibliographical evidence that the panel dates to the mid-16th century, the most accomplished period of Iznik ceramic production.

The original tiles were dispersed on the residence's destruction, but they have resurfaced in a number of renowned museum collections. In the early 1990's Prof. W. B. Denny identified various groups of tiles as belonging to the same composition, and as a result the nine tiles from the Benaki Museum (nos 113 a-c, 92) and the 15 tiles from the Calouste Gulbenkian Foundation were recently reunited. The various remaining tiles –six from the Victoria & Albert Museum, London (no 428-1900) and two in the Österreichisches Museum für Angewandte Kunst, Vienna– were reproduced as infills. Tiles belonging to New York's Metropolitan Museum collection (no. 02.5.95ab 181281, no. 02.5.102 191282), which are stylistically identical to Benaki tiles no. 92, were also taken into consideration.

In its current form, the reconstructed panel is three tiles wide by eleven tiles high with total dimensions of 3.40m in height by 1.014 m in width (fig. 1). Unit tile size is approximately 0.309 m in height, 0.338 m in width and ~1.5-2 cm in thickness. The negligible differences in dimensions are attributable to the process of manufacture as well as to tile type (border or central).

The decorative program

The rich tapestries of intertwined vegetal and floral motifs depicted with brilliant colors (mostly blues, greens and reds) under transparent glazes epitomize Iznik (Nicaea) ceramic output. This innovative technology reached unprecedented heights of technical and aesthetic excellence in the 16th century and left a lasting legacy in ceramic production, which extended well beyond the borders of the Ottoman empire.[2] Tile revetments were used to both enrich and define the surfaces and architectural features of major religious and secular monuments.[3] Revetment tiles[4] represent one of the most characteristic forms of Iznik production in an apogee of architectural and decorative synergy. Unified-field panels with stylized floral and foliate motifs and intertwined sinuous stems, framed in contrasting color borders, evoke the heavenly gardens of paradise.

The reconstructed panel in question is one of the few surviving examples of Iznik production to adorn a secular building. The tripartite panel is divided horizontally into the base, the central unified white ground field and

Fig. 1. The reconstructed panel.

the crowning section with the cupola, while the overall design is mirrored along a central vertical axis. A green-ground border outlined in red, which bears intertwined floral scrolls of stylized flowers, palmettes and blue lotus blossoms, frames the composition on three sides and outlines its various sections. The border is not constituted of separate rectangular tiles but shares standard tile space with the white-ground central field. The base, which is two tiles high, features a central scalloped cartouche with an upper pendant containing floral motifs. It is crowned by complex spandrels with red and white arabesque on a blue ground; the background of imitation Breccia is rendered in manganese purple and white.

The arabesque design of the central white-ground panel in the *saz* leaf and rosette style[5] is deployed up to a total of seven tiles in height. The decorative program of interlaced leaves and stems interspersed with palmettes and blossoms is repeated at three-tile-high intervals. The upper part of this section features a pointed arch delineated by the green-ground border, while the spandrels are decorated with white arabesque on a cobalt blue ground, reflecting the infill decoration of the spandrels of the base.

The crowning section of the panel is constituted of two rows of tiles bearing the incomplete cupola, though it lacks the upper horizontal border. The brilliant blue cupola stands out from the white background, its curvature emphasized by red, radial 'joint lines'. A broad band with delicate arabesque on a cobalt blue and green background, punctuated by touches of red, encircles the drum. A similar, larger-scale design decorates the bottom half of the cupola crown.

Technological Characteristics

On the basis of stylistic considerations and quality of execution, the panel is attributable to the 16th century. Our microscopy findings corroborate this: the tiles' lead-rich quartz frit body and slip layer, and the underglaze decoration of brilliant colors under a clear/translucent layer of glaze with no crackle,[6] are among the characteristics which have made Iznik tiles famous for their beauty and durability. The samples were examined under the stereomicroscope (Nikon SMZ 800 20-63X) and the pigments[7] and glaze were further analyzed by electron microscope (Philips XL 30 ESEM).[8]

The ceramic tile body was produced from a mixture of 65-75% quartz, 15-18% soda-lime frit, 3-4% high-lead

Fig. 2. Tile no. 92, cross section, 60x. Note the 150-200 μm-thick transparent glaze layer.

Fig. 3. Tile no. 92, cross section 30x. Note the blue color of the glaze layer, which is attributed to the significant staining power of the cobalt pigment.

frit and 8-13% non-calcareous clay.[9] The clay provided the elasticity necessary for forming the quartz-rich body and during firing reacted with the glass and to a limited extent with the crushed quartz to produce intersticial glass that bonded together the quartz body.[10] The slip, the brilliant white ground for painting, was then applied on the biscuit. The slip layer, which is very similar in structure to the biscuit, was manufactured from selected materials from which iron impurities were removed, so as not to discolor it. Its thickness ranges from 500-600 μm.

The paint layer is preserved under a 150-200 μm-thick, glassy layer of translucent glaze[11] (fig. 2). The glaze was applied as a slurry of ground frit, prepared with silica and soda known as *bora* (potassium-sodium carbonate with some chlorine and sulphate),[12] with the addition of fluxing agents –lead and tin oxides.[13] The inclusion of lead as flux resulted in lower firing temperatures ($T^{o}C < 850$-$900^{o}C$)[14] than those required for firing ceramics with a pure alkaline frit, and provided elasticity which improved the fit between slip and glaze.[15] Analysis of the clear glaze[16] yielded 15.8% soda/Na_2O, 29.4% lead oxide PbO, 48% silica, 2.6% tin oxide/SnO_2 (see table 1, an. 1).

The panel's vivid color palette includes emerald green, cobalt blue, pale blue and coral red (typically applied in relief), black for the outlines and purple in the base of the composition. The rendering of the colors, especially the pale blue and emerald green, is painterly, though the color fields are well contained within the outlines. The paint layer was produced by mixing lead-rich frit with the mineral pigments, which were for the most part available locally and less often imported. With the exception of red, the pigments dissolved into the glaze during firing and were diffused through it.[17]

Pigment analyses, in terms of colorants and quantities, are also in agreement with those reported in the relevant literature.[18] The dominant colors of the panel are green (the main colorant oxide is cupric oxide, CuO), cobalt blue (main colorant oxide cobalt, CoO)[19] (fig. 3), light blue and red (main colorant oxide ferric oxide, Fe_2O_3), which is applied in characteristic relief. It is, however, the presence of the manganese purple (main colorant oxide manganese oxide, MnO) which places the tiles' production safely in the mid-16th century, as, due to its volatility, its use as a colorant was brief (1550-1585) and it was soon replaced by red.[20]

The reconstruction methodology

The reconstruction of an artifact whose beauty is largely reliant on the complex interweaving and rhythmic repetition of lush yet stylized motifs, unified in a structured` yet organic architectural composition, necessitates more than just a discerning eye. It is also incumbent on the knowledge of materials and manufacture techniques, and a familiarity with styles, trends and execution, as well as an overall awareness of the history and adventures of the components over time. Furthermore, extensive detective work is necessary in order to conceptually assemble complete entities from disparate, often widely dispersed sections. In the case of this large and complex tile panel, the various sections were owned by a number of museum collections and exhibited as autonomous panels (fig. 4).

As well as the available studies, the reconstruction process relied on the systematic scrutiny of the decorative details in association with the overall tile grid. The starting point for the synthesis of the components was

Table 1. Electron-probe analysis of the glaze and pigments

an. no	Color Element oxide	(Na_2O)	(MgO)	(Al_2O_3)	(P_2O_5)	(SiO_2)	(SO_3)	(Cl)	(K_2O)	(CaO)	(Cr_2O_3)	(MnO)	(Fe_2O_3)	(CoO)	(NiO)	(CuO)	(As_2O_3)	(SnO_2)	(PbO)
1	clear	15.8	0.3	1.2	ND	48.7	ND	0.7	0.5	0.7	ND	ND	0.4	0.2	0.2	ND	ND	2.6	29.4
2	purple	13.3	0.3	1.5	ND	54.4	ND	0.5	0.4	0.8	ND	1.1	0.3	ND	ND	ND	ND	2.4	25.2
3	green	11.4	0.2	1.0	ND	48.4	ND	0.5	0.4	0.9	ND	0.2	0.3	0.2	ND	1.2	ND	2.5	32.9
4	blue	13.3	0.4	1.0	ND	58.0	ND	0.4	0.3	0.6	ND	0.1	0.3	0.2	0.1	0.1	ND	1.9	23.5
5	red	2.8	0.3	1.5	ND	81.8	ND	0.5	0.3	1.3	ND	0.3	9.5	ND	ND	0.3	ND	0.3	1.2

Note: the pigments analyzed were within the glaze layer at a depth of 50-100 μm from the sample's outer surface. The beam was rastered over an area of 100 x100 μm. At least three readings were averaged for each color.

Fig. 4. The assembly of the Benaki Museum tiles no. 92, before reconstruction.

the existence of the unifying feature of the panel –the green-ground border which both frames it and divides it into its major iconographic components. The base and cupola sections were quite complete in and of themselves, so that emphasis was given to the way they were matched with the central panel. The only part which warrants some discussion is the synthesis and final height of the unified panel.

Although the decorative motifs of the central field are repetitive, they are not interchangeable, as they do not correspond exactly to the tile grid (the horizontal and vertical axes created by their sides). At first glance, it would seem that a central tile such as the upper tile of fig. 10 (now in row five) could be swapped with the corresponding central tile three rows above (row eight), yet the motif is not positioned in the same place on the tile in each case (fig. 5). This misalignment of design and tile unit, which translates into a unique relationship between each tile and its location, is a not uncommon feature of unified panels, and arises from the way they were designed. The design was first executed on cartoons, which were transferred onto expanses of standard size tiles, arranged so that the finished product would fit into its preordained architectural space.[21] Reconstruction with similar, but not identical, recycled tiles was quite a common practice in Ottoman decoration since the intricacy of the designs and the lack of precision in the relationship between design and tile grid lent themselves to such treatment. Such reconstructions with tiles bearing similar motifs in similar colors did not by any means compromise the overall richness and evocative power of the designs and are often not obvious to the casual observer. Authenticity was here subordinated to the overall aesthetic value.

The first step in generating the reconstruction proposal was to correctly overlay the Benaki and Gulbenkian tiles on the overall schematic design (fig. 5). The available tiles from the other collections were then reexamined with a view to their possible insertion into this panel. The lower section (Benaki no. 92) was preserved in its entirety, thus making the Metropolitan tiles redundant and reinforcing the hypothesis of the existence of twin or multiple panels. For the unified-field section, the reconstruction up to the seventh row of tiles resulted from correct placement of Benaki Museum tiles nos 13 a-c and Gulbenkian tiles nos 1724,[22] 1704, 1683, 1650, 1659; the insertion of the two tiles from Vienna's MAK Museum in the sixth and

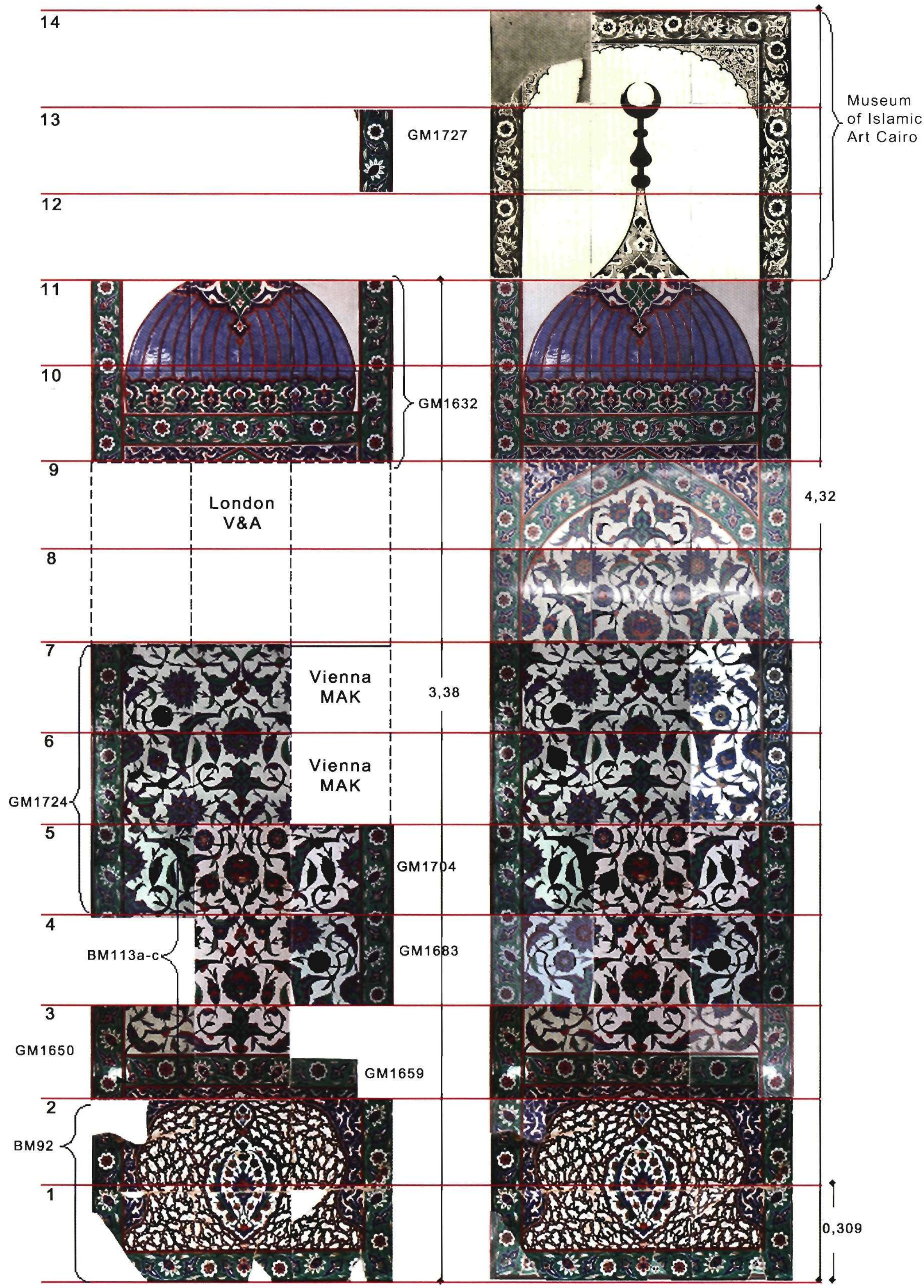

Fig. 5. The reconstruction of the panel: (a) available tiles, and (b) proposal for a maximal reconstruction.

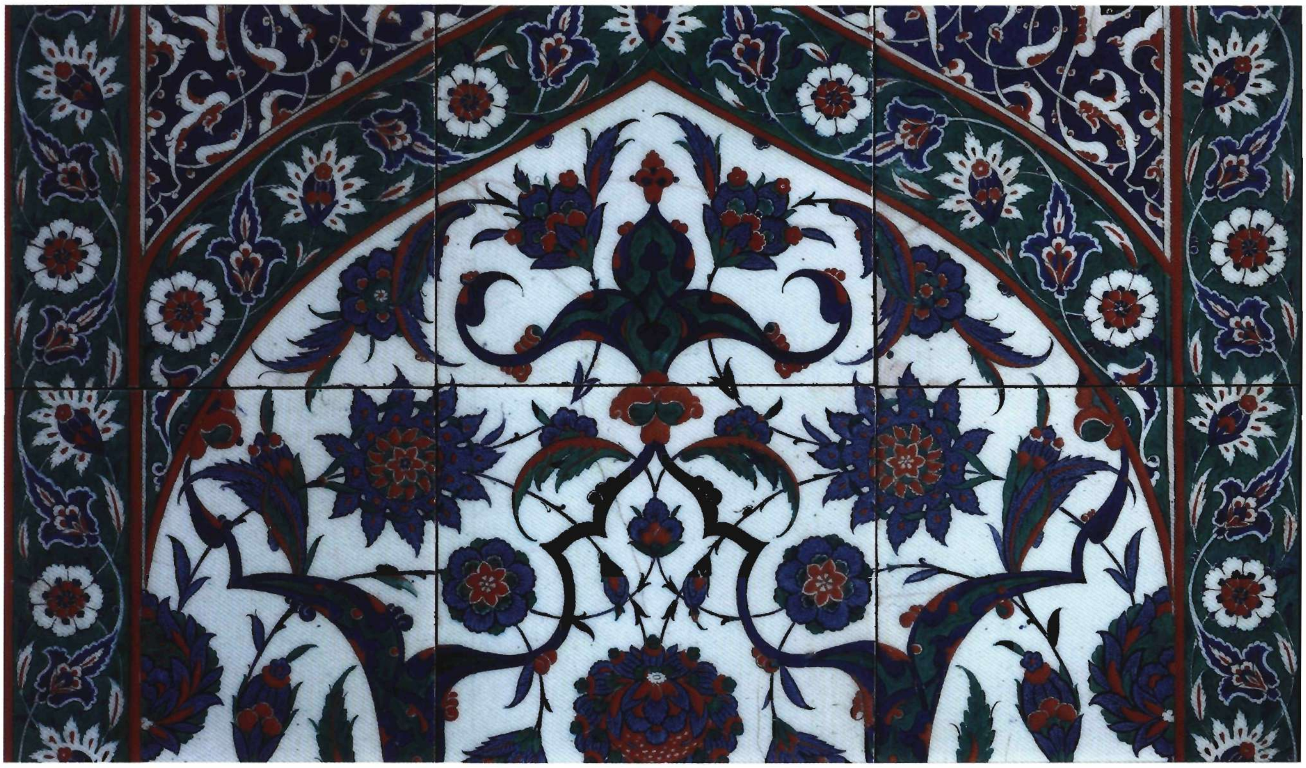

Fig. 6. The six-tile panel from the Victoria & Albert Museum Collection, London, no. 428-1900.

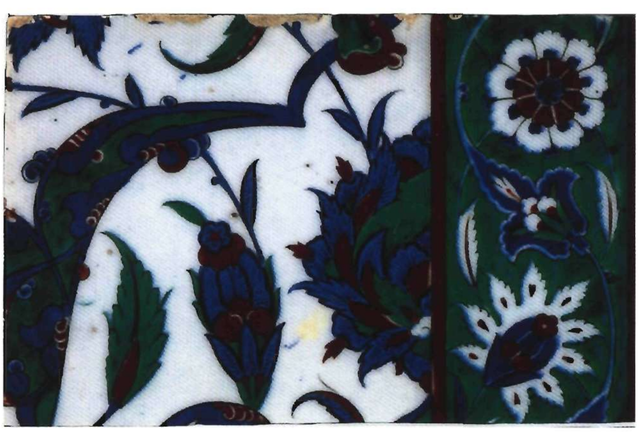

Fig. 7. Tile fragment, Gulbenkian no. 1704b.

seventh rows also results in a good fit, which suggests that they too belong to this particular panel. The central section, which terminates in a pointed arch deployed on two rows of tiles from the Victoria & Albert Museum (nos 428-1900) (fig. 6), unquestionably adjoins the cupola section as the matching details, including the arch's apex, are completed on the lower zone of the cupola tiles

Fig. 8. Tile fragment, Gulbenkian no. 1727.

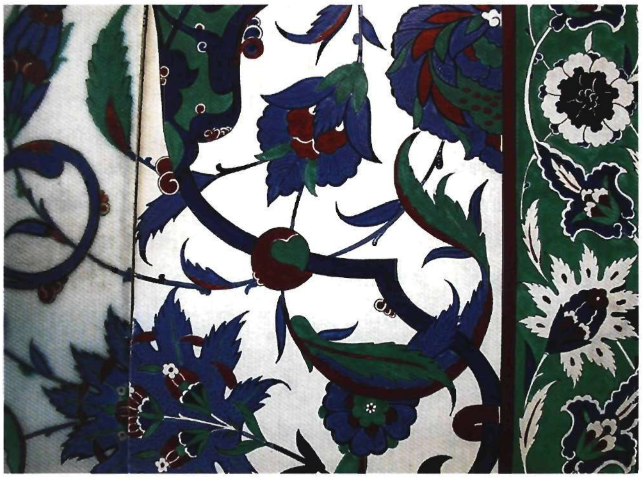

Fig 9. Row six, tile infill. The design and colour palette were reproduced without the richness and depth of the original texture and painting.

(Gulbenkian no. 1632). The total height of the section is however arbitrary, as the pattern could in theory be repeated indefinitely: indeed the insertion of tile Gulbenkian no. 1704b (fig. 7) would necessitate the addition of three more rows of tiles.[23] The slight discrepancies in design match between rows 7 and 8 –between the bottom of the Victoria & Albert Museum panel and the top of the Gulbenkian five-tile panel no. 1724– may also suggest the possibility that the panel was originally taller.

The completion of the cupola section in the maximal reconstruction (fig. 5b) is due to the ingenious discovery by curator Mina Moraitou of a three tile-high panel (1,01 x 0,94 m) in the catalogue of the Museum of Islamic Art in Cairo, which boasts a slender finial with upturned crescent atop the onion shaped dome. Whilst according to the description, the border tiles boast the green-ground border and the white background, the middle right hand side tile is identical to tile fragment Gulbenkian no 1727 (fig. 7). This fragment (dimensions 30,7 x 27 cm) bears an identical green-ground border with red outline on an otherwise white ground, along with the very end of the lowest part of a spandrel. The addition of the Cairo panel (inv. no 6218) in rows 12-14 (fig. 5b)[24] handsomely completes the architectural section of the tripartite panel in a composition which emulates contemporary textile and carpet designs, bookbindings, ornamental woodwork and metalwork.[25]

Fig. 10. Benaki Museum tiles nos 113 a-c, before conservation.

Display and conservation

The reconstruction aims to display the panel in a manner as close to the original as possible with emphasis on the overall decorative value. All original tiles were incorporated, with the exception of tile fragment Gulbenkian no. 1727, which would have required extended infills, exceeding the original tiles in number, without adding much to the overall conception. In the same spirit, small tile fragments were also left out.

The infill tiles (Victoria & Albert Museum panel[26] and select single ones) were cast from moulds taken from the originals, so as to reproduce the irregularities of both the surface microrelief and the dimensions. Infills were cast with a mortar resembling the ceramic body, comprised of white Portland cement, marble powder and brick dust in a ratio of binder to aggregate 1:2,5, reinforced with polyethelene fibers. The slip was made with a thin layer of white mortar composed of white Portland cement and marble powder in a ratio of binder to aggregate 1: 1. A calcium compound mortar with acrylic (Polyfilla) was used for superficial infills. Acrylic-based paints were used for drawing and an acrylic varnish was used to protect the newly painted areas. The painted decoration was skillfully executed by artist K. Mavragani (fig. 9), the aim being to make the infill sections less distracting but not invisible to the viewer. The design and color palette were reproduced without the richness and depth of the original texture and painting

The Benaki museum tiles (nos 113 a-c, no. 92), which had been assembled using disparate infills –tile fragments and timber– (fig. 4), were dismantled and repaired. All tiles were chipped on the edges and along fracture joints, while fragments had been affixed with shellac and infilled with plaster of Paris (fig. 10). The tiles were cleaned with water and liquid PH neutral soap, while the remains of the shellac adhesive were removed with ethyl alcohol poultices.[27] Fragments were reattached with a cellulose nitrate adhesive (Paraloid B72 HMG) and missing parts were cast with the same mortar as was used for casting tile units.[28]

The tiles were mounted on lightweight rigid laminated panels of honeycomb construction[29] in seven distinct sections. The foremost consideration in mounting was to design a reversible articulated system which would allow for dismantling with the minimum stress being incurred by the tiles.[30] Each section was fixed to the wall by means of a pair of interlocking stainless steel plates (⌠⌡ in section), one of which was attached to the wall and the other to the panel. This system ensures thin joints between sections, thus respecting the overall uniformity of the panel. A laminated stainless plate (inverted L in section) was used to frame the four sides of the panel in order to disguise irregularities on the edges and to conceal the mounting system.

The reconstructed panel is now on display to the general public in all its former glory. It is prominently displayed on the west wall of Room IV in the new Benaki Islamic Art Museum along with objects from the 16th to the 19th centuries –rare metal and wooden artifacts and the celebrated Bursa textiles– which mark the zenith of the Ottoman Empire's patronage of the arts.

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NOTES

1. W. B. Denny – A. Ertuğ, *Gardens of Paradise. 16th Century Turkish Ceramic Tile Decoration* (Istanbul 1998) 144.

2. For a comprehensive overview of the evolution of Iznik ceramic manufacture: J. Carswell, *Iznik Pottery* (London 1998); V. Porter, *Islamic Tiles* (Lond on 1995).

3. The peak of Iznik tile production (mid-16th century) coincides with the reign of Sultan Süleyman the Magnificent, whose patronage of the arts is exemplified in the works

of the great architect Sinan. Tile revetments adorned the interiors and exteriors of many a palace, mausoleum and mosque in cities like Istanbul and Edirne.

4. Often called *Çînî*, a term used to denote pottery and all kinds of ceramics made of clay and silica: N. Atasoy – J. Raby, *Iznik: The Pottery of Ottoman Turkey* (London 1989) 23.

5. Y. Petsopoulos, Introduction-The Ottoman Style, in: *Tulips, Arabesques and Turbans. Decorative Arts from the Ottoman Empire* (London 1982) 8.

6. D. W. Kingery, P. B. Vandiver, *Ceramic Masterpieces – Art, Structure and Technology* (New York 1986) 123-33; S. Paynter et al., The Production Technology of Iznik Pottery – a reassessment, *Archaeometry* 46,3 (2004) 421-37; M. S. Tite, Iznik Pottery: An investigation of the methods of production, *Archaeometry* 31,2 (1989) 115-32.

7. Samples were taken from five characteristic pigments of the Iznik palette on Benaki Museum tile no. 92.

8. We are indebted to chem. engineer D. Papageorgiou for the electron microscope analyses, performed at Titan Cement Company research laboratories.

9. Paynter et al. (n. 6) 430. These recent findings are broadly consistent with Abu'l-Qasim's classic recipe (10 parts silica, one part white clay and one part frit): Atasoy – Raby (n. 4) 50.

10. Paynter et al (n. 6) 422.

11. The advent of the underglaze painting technique supersedes the *cuerda secca* technique in the mid 16th century, the period which coincides with innovations in Iznik tile production: Porter (n. 2) 103-04.

12. Atasoy – Raby (n. 4) 52. Recent research suggests that the source for alkalis was probably a purified soda-rich plant ash: Paynter et al (n. 6) 436.

13. The Iznik glaze was a lead-alkaline-tin mixture, but the ratio of lead was 30% for the glaze compared to almost 50% for the body frit; the glaze also contained about 4.7% tin oxide: Atasoy – Raby (n. 4) 60.

14. Higher firing temperatures would result in diffusion of the pigments in the glaze, a process also reduced by the presence of tin: Tite (n. 6) 129.

15. Atasoy – Raby (n. 4) 51, 66. Tin oxides were used in glazes acted as opacifiers. Iznik translucent glazes are distinctive in that they contain a significant percentage of tin which remained for the most part in solution, possibly due to a reducing atmosphere during firing. Tin did not act as an opacifier but as stabilizer also limiting pigment diffusion into the glaze: Tite (n. 6) 123-24.

16. The recipe for producing the Iznik glaze remained largely unchanged from the 16th century to the early 17th century. It was constituted of 11-12% sodium oxide, 28-34% lead oxide, 49-57% silica and 3% tin oxide, which is comparable to the data from our analysis: F. Okyar, The technology of frit making in Iznik, *Key Engineering Materials* 264-268 (2004) 2391-94.

17. Tite (n. 6) 126.

18. Atasoy – Raby (n. 4) 50-70.

19. The analyses yielded a negligible percentage of cobalt due to the fact that a very small quantity had significant staining/coloring power, a characteristic which counteracted the high cost of importation from Germany or Persia: G. Degeorges – Y. Porter, *L'Art de la Ceramique dans l'Architecture Musulmane* (Paris 2001) 17-18; Atasoy – Raby (n. 4) 59, 67.

20. Atasoy – Raby (n. 4) 59.

21. Denny – Ertug (n. 1) 77.

22. Small tile sections from other panels had been inserted in the original assembly of this five-tile panel. All Gulbenkian tiles were restored at the National Tile Museum in Lisbon: see report CR5 *Relatório Tratamento de conservação e restauro de um conjunto de placas cerâmicas estilo Iznik pertencentes à Fundação Caloust Gulbenkien, 12 Maio 2004.*

23. This fragment most probably belongs to another similar panel.

24. Closer observation of the color palette, the quality of the rendering and dimensions as well as digital manipulation are needed to determine whether the Cairo panel as it stands, does indeed constitute the upper part of this panel. The Cairo panel's photograph was identified in M. Gaston Wiet, *Album du Musee Arabe du Caire* (Cairo 1930) 72, while this article was in press.

25. Petsopoulos (n. 5) 132-34.

26. Reproduction was based on photographs generously donated by the Victoria & Albert Museum.

27. J. Ashurst – N. Ashurst, *Practical Building Conservation* 2 (New York 1988) 78; S. Buys – V. Oakley, *The Conservation and Restoration of Ceramics* (Oxford 1993) 88-98.

28. The Benaki tiles were restored by conservators K. Iessai and E. Manou.

29. Aerolam, sandwich panel of glass fiber layers and aluminum honeycomb construction. P. Mora – L. Mora – P. Philippot, *Conservation of wall paintings* (London 1984) 262-81; Buys – Oakley (n. 27) 213-16.

30. Y. Lambiris manufactured all metal fasteners and plates, and stonemason I. Kladios was instrumental in the mounting procedure.

Appendix

Further research on the technology of Iznik ceramic manufacture. Tile panel no. 79, Benaki Museum Islamic Art Collection

The conservation of a significant number of Iznik tile panels, prior to their display in the Benaki Islamic Art Museum, provided an opportunity for further research into the technology of ceramic manufacture. A tile fragment from Benaki panel no. 79 was accordingly chosen for examination in association with the reconstructed panel from the Benaki and Gulbenkian collections, as the decorative programs of the two panels are similar and they were believed to be contemporary. Microscopy data was compared with the relevant studies[1] in order to ascertain provenance and narrow down the time of manufacture.

The panel from which the sample was taken consists of a group of eighteen tiles assembled from a much larger Iznik unified-field panel (fig. 1). In its present form the panel, which is missing a substantial number of tiles from the original, measures 1.35 m in height by 0.73 m (fig. 2). The composition is framed by a blue-ground border with turquoise outline featuring white palmettes, serrated leaves and cloud-like motifs. The unified-field design which features stylized blossoms, palmettes and carnations intertwined with sinuous stems and leaves, is mirrored along a central vertical axis. The dominant color palette consists of a rusty red, cobalt blue, light blue, emerald green and turquoise, with black for the outlines. The style is very similar to the design which adorns the qibla wall of the Mosque of Takieci Ibrahim Aga at Topkapı Gate in Istanbul, built in 1592,[2] though on close observation slight differences in execution between the two panels can be noted. Where the Istanbul panel boasts effulgent colors and precision of design, the colors in panel no 79 are more muted and bleed into one another –the emerald green diffuses beyond the outlines–, and the white slip is dimmer (fig. 3). The overall aesthetic quality suggests that the Benaki panel must postdate[3] the Istanbul panel.

The tile sample bears most of the colors with the exception of turquoise and light blue. Thin sections were examined under the stereomicroscope (Nikon SMZ800 10-63X) and electron microscope (Philips XL 30 ESEM), while the ceramic body composition

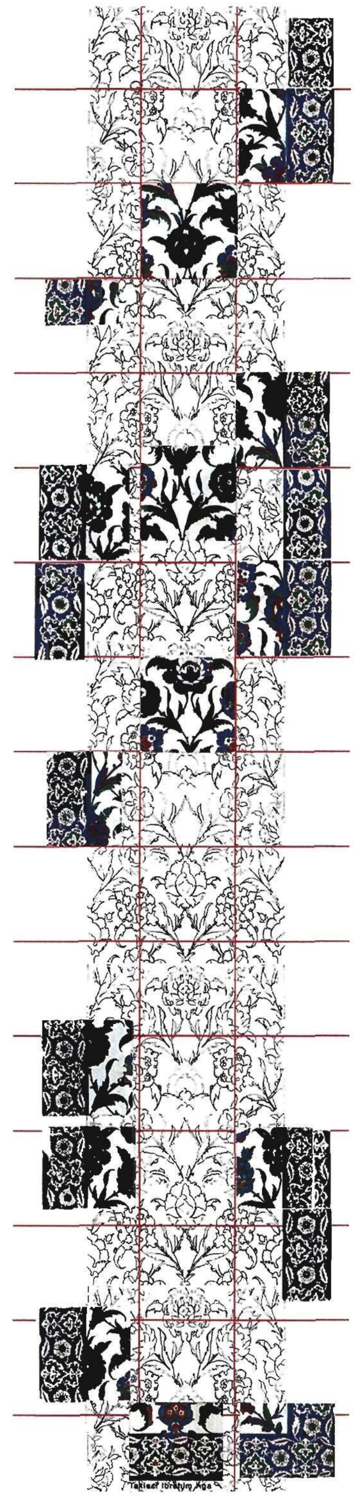


Fig. 1. Panel no. 79, overlay of existing tiles on design canvas.

Fig. 2. Panel no. 79, current display.

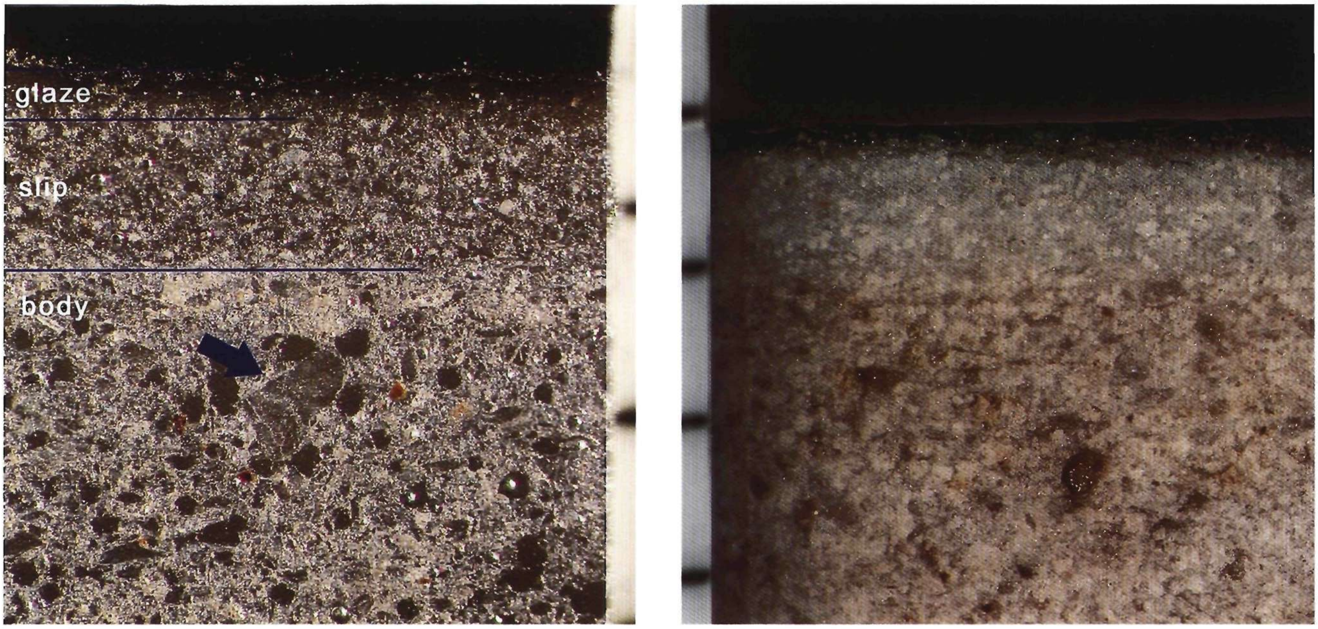
Fig. 3. Panel no 79, central tile, row 3.

was determined by XRD analysis[4] (table 1) LIBS analysis was also undertaken in order to identify the nature of the pigments, especially cobalt blue which was used in minimal quantities. Samples were taken in a manner which would provide sections through the various pigments.

The transparent glaze layer is approximately 150-200 μm thick, with the exception of the areas bearing the red pigment in relief, where it thins out considerably, to ~50 μm (figs 4, 5). Analysis of the glaze yielded lead oxide (PbO), sodium monoxide (Na_2O), calcium oxide (CaO), potassium oxide (K_2O) and tin oxide (SnO_2) (table 1 an. 2), findings which are in accordance with comparable data on the manufacture of frit, as used in different ratios in the glaze and the ceramic body of Iznik ceramics.[5]

The 700 μm-thick slip differs from the ceramic body due to its density and finer grains which do not exceed 35-40 μm, as opposed to silica crystals in the ceramic body (1.5 cm thick) which can reach up to 450 μm in size. The presence of lead oxide (PbO) indicates that frit was used in its preparation (table 1 an. 1). XRD analysis of the ceramic body yielded silica, traces of clay compounds and calcium carbonate. The glassy inclusions are randomly dispersed in the mass and do not create the interconnected network which is typical of ceramic wares from this period.[6]

The red pigment is observed as a thick, opaque layer, piled in relief (fig. 6). The color is due to the presence of ferric oxide (Fe_2O_3) (table 1 an. 5) Under the translucent glaze, the blue color is associated predominantly with cobalt oxide (CoO)[7] and the green with cupric oxide (CuO).[8]



Figs 4, 5. Thin section 40x and cross section 30x. The slip layer is more dense and fine-grained than the ceramic body. Crystal size in the slip does not exceed 40 μm whereas silica crystals in the ceramic body can reach up to 45 oμm.

Table 1. Electron-probe analysis of the glaze, colors and slip.

an. no	Color Element Oxide	(Na_2O)	(MgO)	(Al_2O_3)	(P_2O_5)	(SiO_2)	(SO_3)	(Cl)	(K_2O)	(CaO)	(Cr_2O_3)	(MnO)	(Fe_2O_3)	(CoO)	(NiO)	(CuO)	(As_2O_3)	(SnO_2)	(PbO)
1	slip*	4.2	2.1	6.1	ND	76.7	ND	0.5	0.9	3.8	ND	ND	1.3	ND	0.9	ND	ND	ND	3.5
2	clear	12.8	3.2	1.9	ND	58.3	ND	0.4	0.8	4.5	ND	ND	1.1	ND	ND	ND	ND	2.6	14.3
3	green	11.5	0.7	1.5	0.4	47.0	ND	0.9	0.6	0.9	0.2	0.2	0.8	0.1	0.2	2.2	ND	2.4	30.5
4	blue	10.2	0.6	1.7	ND	50.3	ND	0.7	0.4	1.3	ND	ND	2.1	0.3	0.3	0.4	ND	2.3	29.5
5	red	3.4	0.4	1.4	ND	84.5	ND	0.5	0.4	0.6	ND	ND	7.7	ND	ND	ND	ND	ND	1.2
6	black**	11.4	ND	0.9	0.3	46.3	ND	1.3	0.6	1.0	1.4	ND	1.0	ND	0.3	2.1	ND	2.1	31.4

Note: the pigments were detected within the glaze layer at a depth of 50-100 μm. The beam was rastered over an area of 100 x 100 μm. At least three readings were averaged for each color.
* Analysis of the slip was executed at a depth of 300 μm.
** Spot analysis of 3 μm diameter was performed on individual grains.

(Table 1 an. 3, 4 fig. 7). Black outlines were produced by chromite, observed as dark grains dispersed within the glaze layer where chromium trioxide (Cr_2O_3) was detected (table 1 an. 6 fig. 8).

Scientific examination and macroscopic observation of the tile panel indicate that it should be attributed to the later period of Iznik ceramic production, the mid 17th century, which witnessed the decline of manufacturing standards. Tin[9] was detected in clusters of coarse inclusions, by contrast with an even diffusion within the glaze layer, indicating a less thorough mixing of body, slip and glaze constituents, or even higher firing temperatures. Its role as a stabilizer to prevent color bleeding was thus undermined, as seen in the diffusion of the colors be-

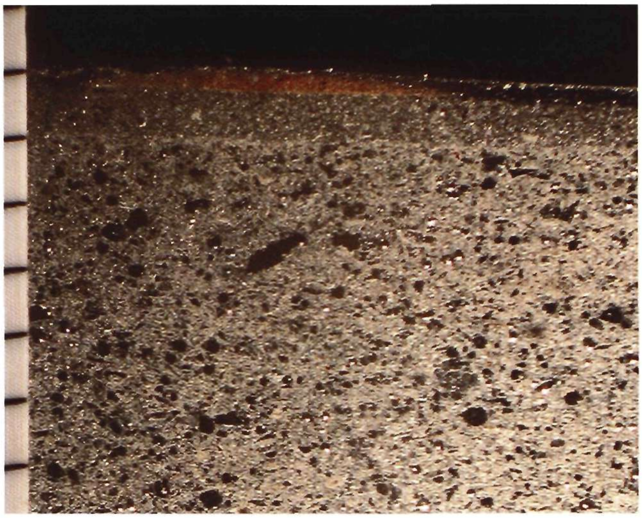


Fig. 6. Thin section, 10x. The red pigment is observed as a thick opaque layer piled in relief. Note the thining of the glaze layer over the red pigment.

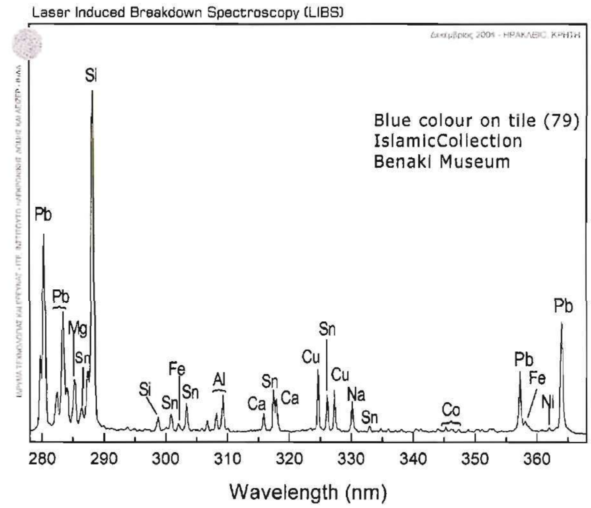


Fig. 7. LIBS (Laser Induced Breakdown Spectroscopy) analysis.

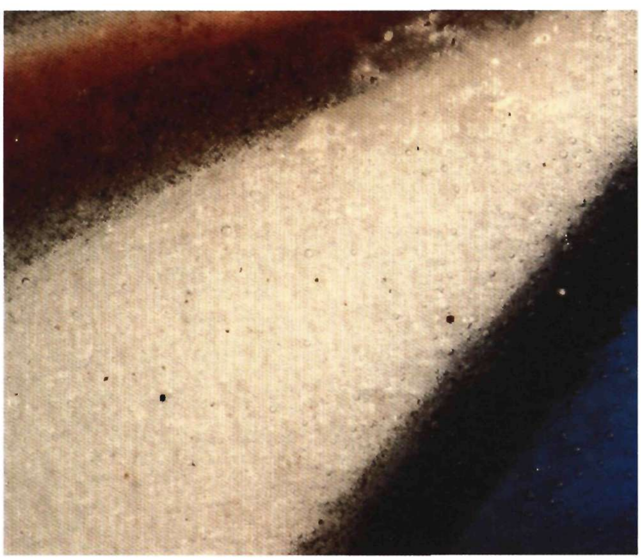


Fig. 8. Detail, upper surface of sample, 40x. The black outline of the red and blue color fields is attributed to the presence of chromium trioxide Cr_2O_3.

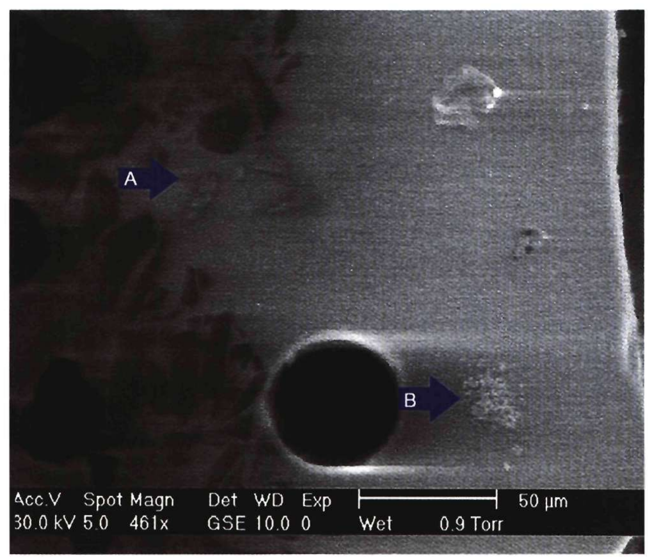


Fig. 9. SEM microphotograph of glaze layer, outer surface to the right. Chromite, Cr_2O_3 (A) and cassiterite tin oxide SnO_2 (B) were identified.

yond the outlines of the design (fig. 9). Black chromite pigment began to be used for outlines in the mid-17th century, replacing the dense, dark, iron and copper rich pigments used in the mid-16th century, while the red color appears here duller and browner by comparison with the earlier brilliant bole red.

In conclusion we believe that the comparative investigation of two dazzling and lush Iznik tile unified-field panels in the Benaki Islamic Art collection, the findings of which are summarised in this article, has made a contribution towards a better understanding of the subtle variations in execution which accompanied the evolution of Iznik art from its rise in the late 15th century to its gradual decline 100 years later.

NOTES

1. N. Atasoy – J. Raby, *Iznik. The Pottery of Ottoman Turkey* (London 1989) 50-89.

2. W. B. Denny – A. Ertuğ, *Gardens of Paradise. 16th century Turkish Ceramic Tile Decoration* (Istanbul 1998) 175 pl. 98.

3. The tile fragment with the blue-ground border which has been incorporated on the right hand side of the panel n the Mosque of Takieci Ibrahim Ağa seems to belong to panel no 79. This was possibly done during restorations following the late 19th-century earthquakes: Denny – Ertuğ (*op. cit.*) 173 pl. 98, fig. 1, central tile, first row.

4. We are indebted to chem. engineer D. Papageorgiou for the XRD analyses carried out at Titan Cement Company research laboratory.

5. Atasoy – Raby (n. 1) 60.

6. The lack of a glassy network in ceramic ware manufacture is a characteristic of the period of decline, but this is not the case with tile manufacture. The maximum size of silica inclusions in 15th century tiles is 1mm, up to 10 times larger than those found in Iznik pottery: Atasoy – Raby (n. 1) ch. VI n. 10, 372.

7. We are indebted to Dr. D. Anglos and Dr. P. Pouli for the Laser Induced Breakdown Spectroscopy analyses undertaken at F.OR.TH. I.E.S.L., Heraklion, Crete.

8. The presence of iron oxides in the green colors corroborates the fact that they were produced by iron oxides in the presence of copper oxide: Atasoy – Raby (n. 1) 67-68.

9. The use of a tin glaze appears in Iznik production in the late 15th century and continued in use until the late 16th century. Phosphorus appears possibly as a glass former in combination with calcium used as flux. The glaze covering decadent ware of the mid 17th century no longer contained tin in the lead glaze, but was characterized by circa 2% phosphorus pentoxide: Atasoy – Raby (n. 1) 66-67.

ΓΙΑΝΝΑ ΔΟΓΑΝΗ – ΑΜΕΡΙΜΝΗ ΓΑΛΑΝΟΥ

Η ανασύσταση και αποκατάσταση ενός πίνακα με πλακίδια Ιζνίκ στο Μουσείο Ισλαμικών Τεχνών

Ο εντυπωσιακός πίνακας (3,40 x 1,014 μ.) που δεσπόζει στον δυτικό τοίχο της 4ης αίθουσας του Μουσείου Ισλαμικών Τεχνών και αποτελείται από 33 ορθογώνια (3 x 11) πλακίδια, αποκαταστάθηκε πρόσφατα με τη συνένωση εννέα πλακιδίων του Μουσείου Μπενάκη και 15 πλακιδίων που διατίθενται από τις συλλογές του Μουσείου Calouste Gulbenkian της Λισσαβόνας. Τα πλακίδια προέρχονται από τον διαμελισμό δίδυμων πινάκων, που ακολούθησε την καταστροφή του σουλτανικού ανακτόρου της Edirne (Αδριανούπολη) κατά τον Ρωσοτουρκικό πόλεμο. Η ευκαιρία για την ανασύσταση του πίνακα δόθηκε μέσα από την καρποφόρα συνεργασία με τον ιστορικό τέχνης W. B. Denny, ο οποίος εντόπισε τα διάσπαρτα τμήματα του πίνακα σε σημαντικές μουσειακές συλλογές του εξωτερικού.

Η κατασκευή του πίνακα τοποθετείται στην περίοδο των μεγάλων καλλιτεχνικών και τεχνολογικών καινοτομιών, που οδήγησαν, από τα μέσα του 16ου έως τις αρχές του 17ου αιώνα, την κεραμική παραγωγή του Iznik (Νίκαια) στο απόγειό της, με τη φήμη της να ξεπερνά τα όρια της Οθωμανικής αυτοκρατορίας. Τα κεραμικά αυτά, που διακοσμούνται με στυλιζαρισμένα άνθινα και φυτικά θέματα, χαρακτηρίζονται από τον πλούτο και την πολυπλοκότητα των σχεδίων τους, τα απαστράπτοντα χρώματα και τη διαφάνεια της εφυάλωσής τους. Μολονότι από συνθετική άποψη, η άνθινη σύνθεση του πίνακα εντάσσεται στο πλαίσιο που υπαγορεύεται από την περί Παραδείσου μουσουλμανική θεώρηση, η παράσταση είναι ασυνήθιστη, καθώς αναπτύσσεται σε τρία μέρη παραπέμποντας σε κάποιο αρχιτεκτόνημα με αψίδα στη βάση, άνθινο επαναλαμβανόμενο θέμα στον κυρίως κορμό και θόλο στο κλείσιμο.

Όπως έδειξε η εξέταση θραυσμάτων του πίνακα στο στερεομικροσκόπιο (Nikon SMZ800 20-63X) και η ανάλυση δειγμάτων του από την εφυάλωση και τις χρωστικές στο ηλεκτρονικό μικροσκόπιο (Philips XL 30 ESEM), αναγνωρίζονται τα βασικά τεχνολογικά χαρακτηριστικά της κεραμικής αυτής, με τη διακόσμηση να βρίσκεται ανάμεσα στο διαυγές μολυβδούχο στρώμα της εφυάλωσης και ενός κεραμικού σώματος πλούσιου σε χαλαζία. Στον λευκό κάμπο του πίνακα επικρατούν το μπλε του κοβαλτίου, το κοραλλί κόκκινο με το χαρακτηριστικό εξέχον ανάγλυφο, το σμαραγδί πράσινο, το μαύρο στα περιθώρια των σχεδίων και το μωβ στη διακόσμηση της βάσης. Οι βαφές αυτές που παρήχθησαν από συγκεκριμένες ορυκτές ουσίες, είναι επίσης χαρακτηριστικές της περιόδου αυτής, με το μαγγανιούχο μωβ να περιορίζει το χρονικό πλαίσιο της κατασκευής του πίνακα ανάμεσα στις δεκαετίες 1550 και 1580.

Το έργο της επανένωσης των τμημάτων που απαρτίζουν τον πίνακα βασίστηκε στη αναγνώριση των επιμέρους τμημάτων του και στην κατανόηση της εσωτερικής δομής της σύνθεσης, ενώ η αποκατάστασή του έγινε με γνώμονα τη ανάδειξη της αισθητικής και της καλλιτεχνικής του αξίας. Κατά την ανασύσταση του πίνακα, περιελήφθη ο μεγαλύτερος αριθμός των σωζόμενων πλακιδίων στα μουσεία Μπενάκη και Gulbenkian. Οι αναγκαίες συμπληρώσεις έγιναν με φειδώ, αποφεύγοντας τις εκτεταμένες συμπληρώσεις, οι οποίες, αν και θα οδηγούσαν στην ολοκλήρωση του πίνακα, με την επικράτηση των νέων συμπληρωμάτων, θα υποβάθμιζαν την αξία της αυθεντικότητας. Τόσο τα συντηρημένα πλακίδια, όσο και τα νέα συμπληρώματα συνενώθηκαν σε επτά ανεξάρτητους πίνακες που προσαρτήθηκαν στον τοίχο με μία αρθρωτή κατασκευή, παρέχοντας τη δυνατότητα αποσυναρμολόγησης, με την ελάχιστη επιβάρυνση στα αυθεντικά πλακίδια.

Με τον τρόπο αυτό, η εντυπωσιακή σύνθεση παρουσιάζεται με ενιαία μορφή, χωρίς δυσάρεστες ασυνέχειες, σε έναν χώρο που περιέχει σπάνια έργα μικροτεχνίας, ξυλογλυπτικής αργυροχρυσοχοΐας καθώς και τα περίφημα υφάσματα από την Προύσα (Bursa) που καλύπτουν την περίοδο από τον 16ο έως τον 19ο αιώνα, περίοδο ακμής της Οθωμανικής αυτοκρατορίας και των άλλων μεγάλων ισλαμικών αυτοκρατοριών.