Star Pattern on Mamluk Enameled Glass

The Muslim artist had made his surpass in discovering a group of geometric designs that form what one might term "star patterns" by assembling geometric patterns with each other.(1) The word star pattern, *ṭabaq naǧmī*(2) is not known in the main sources and Mamluk documents. Instead, the word *ḍarb ḫaīyṭ* is used to refer to this type of patterns like saying *(minbar ḍarb ḫaīyṭ)* or referring to a plated door (*nuḥās ḍarb ḫaīyṭ*)(3) or referring to each geometric element solely like (*aḫīyāṭ*) of hexagons, octagons, decagons.(4)

It is also a terminology used by the masters of crafts referring to a type of geometric designs either on wood or marble or others. These designs were drawn by a string that is immersed in plaster and then to strain it between two nails in the desired direction then to uplift the string on the required material.(5) This technique was widespread in Egypt in order to protect the wooden panels against curvature as a result of heat and humidity, in addition to being easy in transferring and dovetailing. Moreover, Egypt was poor in possessing the valuable types of wood that it would be necessary to import the best types and to make use of every small piece.(6)

The geometrical composition of a complete star pattern is based on a central core known as: central star(7), *naǧm*, or cogwheel(8), *tirs*. Then small lozenges known as: *lawzah* that are radiatively arranged around the central star. Then hexagons known as: *kindah* that usually has six sides encircles the lozenges. Then irregular pointed hexagons known as: *kindah* used to surround the central star .(9)

The first recognizable examples of star patterns made its appearance in the Middle East as early as the beginning of the 2nd century A.H. / 8th century AD., in the form of

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(1) A.'Abd al-Rāziq, *al-Ḥaḍārah al-islāmīyah fī al-'uṣūr al-wuṣṭā, al-'ulūm al-'aqlīyah*, Cairo, 2003, p. 58; Lee, Islamic Star Patterns, in Muqarnas, IV, Leiden, 1987, p. 182

(2) It is important to refer to other terminologies for star patterns in Irāq where it is known as «*al-rub'*» because drawing this kind of geometric pattern was done inside a square the nit was repeated many times to produce the required design. See : K.al-Ğanābī, *Ḥawl al-zaḫārif al-handasīyah al-islāmīyah, sūmar*, Vols.I,II, pt. XXXIV, 1978, p. 144

(3) A.Ibrāhīm, *al-Waṯāi'q fī ḫidmat al-āṯār*, in *al-mu'tamar al-ṯānī l al-āṯār fī al-bilād al-'arabīyah*, Cairo, 1958 p. 254 ; M.Amīn, L. Ibrāhīm, *al-Muṣṭalaḥāt al-mi'mārīyah fī al-waṯā'iq al-mamlūkīyah*, Cairo, 1990, p. 74

(4) M.Amīn, L.Ibrāhīm, *al-Muṣṭalaḥāt al-mi'mārīyah*, p. 74

(5) A.Ibrāhīm, *al-Waṯāi'q fī ḫidmat al-āṯār*, p. 254. M.Amīn, L. Ibrāhīm, *al-Muṣṭalaḥāt al-mi'mārīyah*, p. 74

(6) N.Abū Bakr, *al-Manābir fī al-'aṣrīyn al-mamlūkī w-l-turkī,* Ph.D thesis, Cairo University, 1985, p. 61; A.'Abd al-Rāziq, *al-Funūn al-islāmīyah ḥatā nihāīyat al-'aṣr al-fāṭimī*, Cairo, 2001 pp. 94,95

(7) F.Šāf'ī, "*Mumaīyizāt al-aḫšāb al-muzaḫrafah fī al-Ṭirāzaīyn al-'Abbāsī wa-l-Fāṭimī fī maṣr*", BFA, Cairo University, Vol. XVI, pt. I, May, 1954, p.83; A.'Abd al-Rāziq, *al-Funūn ḥatā nihāīyat al-fāṭimī*, p. 33; H.al-Bāšah, *al-Funūn al-islāmīyah w-l-waẓā'if 'alā al-aṯār al-'arabīyah*, III, Cairo, 1965-1966, p.103; Karnouk, Form and Ornament of the Cairene Baḥarī Minbar, in Annales Islamologiques, Tome XVII, volume consacré du centenaire de l' Ifao, Cairo, 1981, p.129

(8) Karnouk, Form and Ornament, p. 129

(9) A.'Abd al-Rāziq, *al-Funūn ḥatā nihāīyat al-fāṭimī*, p. 33, *al-Ḥaḍārah al-islāmīyah*, p. 58; Karnouk, Form and Ornament, p. 129

open work of marble window grilles in the Great Mosque of Damascus in the western vestibule that incorporate curvilinear elements.(1)

Concerning enameled glass vessels during the Mamluk period which are decorated with star patterns: a glass bowl(2) (Pl.1) is among the group of works that Mamluk craftsmen in Cairo created for exportation to the Rasūlīd court of Yemen, either as gifts from the Mamluk sultans or as a result of direct Rasūlīd patronage. This large bowl belongs to the same line of productions as it includes an inscribed dedication in addition to the five-petalled rosette commonly identified as the emblem of the family of the Rasūlīd court in Yemen. This dedication is in the form of nasḫī inscriptions including the name of al-Malik al-Muǧāhid ʻAlī who ruled since 721-764 A.H./1321-1363 AD.(3) The inner bottom of the bowl is decorated with (6) pointed star surrounded by regular hexagons. (Fig. 1) (Pl.1/a). The nasḫī inscriptions that are inscribed on the bowl can be read as:

عز لمولانا السلطان الملك المجاهد علي بن داوود عز نصره

"Glory to our lord, the sultan al-Malik al-Muǧāhid ʻAlī Ibn Dāwūd, may his victory be glorious" (4)

(Fig. 1)
(6) pointed star on a glass bowl
Done by the researcher

This decoration is considered as a beginning for star patterns on glass as it is not a complete star pattern due to the absence of lozenges.

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(1) Creswell, A Short Account of Early Muslim Architecture, Cairo, 1989, pl. 32; Lee, Star Patterns, p.185, Broug, Geometric design, New York, 2013, p. 15

(2) It is preserved in Toledo Museum of Art under number. 1944.33. See: Lamm, Mittelalterliche Gläser und Steinschnittarbeiten aus dem Nahen Osten, Berlin, 1929-1930, II, 180:9; Porter.Venetia, Enamelled glass made for the Rasulid Sultans of the Yemen, in Gilded and Enamelled Glass from the Middle East, London, 1998, p. 93, Pl. 21.4; Carboni.Stefano and Whitehouse.David, Glass of the Sultans, New York, 2001, p. 266, pl. 132

(3) Carboni and Whitehouse, Glass, pp. 266, 267

(4) Carboni and Whitehouse, Glass, p. 267

Another example of a gilded and enameled glass candlestick[1] (Pl. 2) is probably dated to Egypt in 740-765 A.H./1340- 1365 AD.[2] According to others, this candlestick is dated to Syria in 638-648 A.H./1240-1250 AD. Which means before the Mamluk period.[3] The geometric composition on this glass candlestick resembles those on marble objects to a great extant. Just like those on the lower register of miḥrāb al-madrasah al-ṭaīybarsīyah which is dated to 709 A.H./1309 AD. with the same form of the (8) pointed star patterns and their halves connected by (5) pointed stars (*nuğūm ḫumāsīyah*) and octagons (*muṯamman*).[4]

It consists of a hollow, slightly tapered conical base topped by a cylindrical candlestick socket. The main decoration of this candlestick is on its body forming a large register of geometric composition of star patterns.[5] This register is in turn divided into three registers: A row of complete (8) pointed star patterns in the middle register; half (8) pointed star patterns in the upper and lower register. The three registers are connected by (5) pointed stars (*nuğūm ḫumāsīyah*) and octagons (*muṯamman*).[6] (Fig. 2)

(Fig. 2)
Complete (8) pointed system and two halves
from the glass candlestick
Done by the researcher

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(1) It is preserved in the Corning museum of glass under number. 90.1.1. See: Lamm, Mittelalterliche Gläser, pl. 126:17, Carboni and Whitehouse, Glass, p. 270, pl. 134

(2) Carboni and Whitehouse, Glass, p. 270

(3) *Wiḥdit al-fann al-islāmī, ma'raḍ 'an al-fann al-islāmī bi markaz al-malik Faīyṣal le-l-buḥūṯ wa-l-dirāsāt al-islāmīyah*, al-Rīyāḍ, 1984, p. 169, pl. 149

(4) Ḥ. Ramaḍān, *al-Maḥārīb al-ruḫāmīyah fī Qāhirat al-mamālīk al-baḥarīyah*, M.A, Faculty of Archaeology, Cairo University, 1981, p. 163

(5) Carboni and Whitehouse, Glass, p. 270

(6) According to Carboni, the geometric composition on this glass candlestick is made up of octagons and (5) pointed and (8) pointed stars, besides elongated hexagons. Thus he could not differentiate between the complete (8) pointed star pattern and using the (5) pointed star as a linking element. See: Carboni and Whitehouse, Glass, p. 270

Gilding is used for the outlines of the composition[1] in the rosette decorating the center of each central star (*tirs*), the pear-shaped leave[2] in the center of each hexagon (*kindah*), the small circle in the center of each (5) pointed star (*nuğūm ḫumāsīyah)* and the whirling rosette[3] in the center of each octagon (*muṯamman*).

Red enamel is used for decorating the interior of some (5) pointed stars (*nuğūm ḫumāsīyah*) whereas green enamel is used for the rest of the (5) pointed stars; blue enamel is used for all the central stars (*tirs*), hexagons (*kindāt*) and octagons (*muṯamman*). White enamel is used for the lozenges (*lawzāt*).

Yet the main geometric decoration of the (8) pointed star patterns and the repetitive inscribed *nasḫī* inscriptions suggest 7th century A.H./14th century AD. attribution in spite of not pointing to any specific period in Mamluk history. The inscriptions can be read as follows:

عز لمولانا العالم العادل المجاهد المرابط المثاغر المؤيد المظفر المنصور الملك العالم العادل

المجاهد المرابط المثاغر المؤيد المظفر المنصور الملك العالم العادل المجاهد المرابط المثاغر

المؤيد المظفر المنصور الملك العالم

"Glory to our lord, the sovereign, the learned, the just, the holy warrior, the defender, the protector of the frontiers, the fortified {by God}, the triumphant, the victorious"

According to Carboni, this corning candlestick may well have been used in a religious setting, regarding the usage of the stylized whirling rosette motif that is often used as a verse separator in Mamluk Qur'ān.[4]

The (12) pointed star pattern in its complete and half forms is represented on glasswork objects on contrary to the (8) pointed stars on the earlier glass vessels.[5] By the way, it is displayed once in its complete form on glass basin and on a glass tray.

Gilded and enameled glass basin in Cleveland Museum bears the (12) pointed star patterns within circular medallions[6] (Pl. 3). The star pattern here either on the body or the rim of the basin comprises its three main components of a central star, lozenges and hexagons surrounded by crow's nests (*baīyt ġurāb*) (Fig. 3).

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(1) Carboni and Whitehouse, Glass, p. 270

(2) According to Carboni, this is described as spadelike motif. See: Carboni and Whitehouse, Glass, p. 270

(3) Carboni and Whitehouse, Glass, p. 270

(4) Carboni and Whitehouse, Glass, p. 270

(5) See: Lamm., Mittelalterliche Gläser, pl. 132:21

(6) Carboni and Whitehouse, Glass, pp. 272,273, pl. 135

(Fig. 3)
Complete (12) pointed star pattern on the glass basin
Done by the researcher

The previously mentioned (12) pointed star pattern on the glass basin differs from that on the glass tray (Pl. 4). Here the main complete (12) pointed star pattern is arranged within a large hexagon in the center of each circular medallion on the tray. In addition to the presence of six half (12) pointed stars at the rim of each medallion. The hexagons which used to surround the star pattern are replaced here by irregular (5) sided shapes. These shapes are interfered with those of the half patterns. Thus the complete pattern is connected with its half forms by these common hexagons.

(Fig. 4)
Complete (12) pointed star pattern on glass tray
Done by the researcher

Analysis for the appearance of star patterns on enameled glass

In accordance to the fact that artists during the Mamluk period excelled in the execution of enameled and gilded glass,[1] Craftsmen who work with cold glass vessels after its shaping are assigned to decorate its surfaces either by carving, gilding, enameling or etching.[2] Those obtained pigments that are used in enameling from natural materials from earth, originating from one of three basic sources: mineral colors, plant colors or colors derived from the animal kingdom.[3] While the art of gilding can be traced back hundreds of years. The application of gold is to reflect light or to illuminate a piece of work which reflects a profound visual effect and embodying a richness that cannot be achieved by the application of paint alone.[4]

One of the best examples is the gilded and enameled example[5] is a glass basin[2] of Cleveland Museum (Pl. 5). (12) pointed forms of star patterns are represented inside medallions on the rim and the body of the basin. The outlines of all the elements of the star patterns are done by gilding. The interiors of the elements are decorated by enameling. As the central star (*tirs*) is represented in white enamel with a central gilded rosette, lozenges (*lawzāt*) are done in red enamel, while hexagons (*kindāt*) are done in blue enamel with central gilded clover-like motifs0.[6]

Back to the red enamel which is repeated on the crow's nests (*baīyt ġurāb*). The empty space between the crow's nests and the edges of each medallion is filled with white enamel. [7]

Glass tray in the Metropolitan Museum of Art which is considered according to Carboni, the best parallel for the Cleveland basin, regarding its floral motifs that are almost identical to those on the basin. Star patterns are represented within medallions like the basin, in addition to the usage of the same enameling colors: blue, red and

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(1) Atil, Art of the Mamluks, p. 132

(2) Martin Birk Molter, Glassmaking, in Arts and Crafts of the Islamic Lands, London, 2013, pp. 254, 256

(3) Cranswick. David, Traditional Pigments, in Arts and Crafts of the Islamic Lands, p. 150

(4) Mills. Mark, Gilding, in Arts and Crafts of the Islamic Lands, p. 170.

(5) Glass inlay is often called enamel, that the vitreous material is employed in the powdered state and fused into position by heating. See: Alfred.Lucas, Materials and Industries, p. 193. Generally enamel is a mixture of various metal oxides that are grinded together with small pieces of colored glass, then this mixture is mixed with gum or any oily substance then is subjected to heating to be transformed into a liquid state. The enamel's color differs according to the used metal oxides, as copper oxide with liquid lead give green enamel, iron oxide gives red enamel, antimony acid gives yellow enamel, and grinded lazordi stone gives blue enamel. This enamel is drawn over the glass vessel then to be entered in ovens to fix the drawn enamels. See: M.Dāwūd, *al-Miškāwāt al-zuğāğīyah fī al-'aṣr al-mamlūkī*, M.A. Thesis, I, Cairo University, 1971, p. 246; Ward, Mosque Lamps and Enamelled Glass: Getting the Dates Right, in Mamluk Studies, I, Germany, 2012, pp. 58, 59; A.'Abd al-Rāziq, *al-Funūn, al-Ayyūbī w-l-Mamlūkī*, pp. 245, 246

(2) According to Esin Atil, it is called vase and it seems to be more an objet d'art than a functional vessel as it is unique in shape; either it is a basin with such an exaggerated everted rim or a lamp with flattened neck. See: Atil, Art of the Mamluks, p. 132. According to Carboni it is known as spittoon or basin. See: Carboni and Whitehouse, Glass of the Sultans, p. 272

(6) Carboni and Whitehouse, Glass of the Sultans, p. 272

(7) Atil, Art of the Mamluks, pl. 51

white.[1] The difference is in forming the outlines of the patterns of white enamel instead of gilding. Also, in spite of having the same form of (12) pointed star pattern within medallions, it differ in its general design. Those on the basin follow the circular form of the medallion, whereas those on the tray each medallion has a complete form in the center within what looks like a large hexagon surrounded by half forms.[2]

Gilded outlines are also used on star patterns of the glass candlestick (Pl. 2). Its complete forms of star patterns are represented as a band on the center of the candlestick's body, flanked from top and bottom by half forms. Blue, red, white and green colored enameling are used here. Blue enamel is the most dominant enameling here is the blue color. It is used for the central stars (*tirs*) and octagons (*muṯamman*), white enamel is used for lozenges (*lawzāt*) while green enamel is alternating with the green one and used for the (5) pointed stars (*nuǧūm ḫumāsīyah*).[3]

Decorative techniques of star patterns on enameled glass

After the glass vessel is shaped, for applying decorations over it, the artist drew a patron for the required design on a piece of paper then to perforate the outlines in order to be ready to copy it over the glass vessel. The artist had to bring a piece of cotton filled with colored powder and to wipe over the perforated design. By the way, the design now is copied over the glass vessel; finally he just had to delimit his design by a line of red enamel.[4] According to Rachel Ward, the artist sketched the design usually with powdered gold mixed with fluid medium such as Arabic gum.[5]

Hereafter, the required areas to be colored are filled with enamels[6] which act as colored pigments laid on the surface of the glass vessel. These pigments are formed from colored glasses, made to fuse at low temperature. The colored enameled glass is ground into a fine powder and mixed with a gum or other viscous liquid to hold it together before firing.[7] Enamels are then applied to a glass surface using an oil-based medium and a brush or a reed pen. [8] Provided that, the artist had to change his brush or or to clean it every time he used a color in order not to mix the colored enamels with each others.[9]

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(1) Carboni and Whitehouse, Glass of the Sultans, p. 273

(2) This tray probably functioned as a food tray. See: Lamm. Carl Johan, Mittelalterliche Gläser, 139:1; Ars Vitraria: Glass in the Metropolitan Museum of Art, The Metropolitan Museum of Art Bulletin, Vol. LIX, 2001, p. 31.

(3) Lamm. Carl Johan, Mittelalterliche Gläser, pl. 126, no. 17; *Wiḥdit al-fann al-islāmī,* , p. 169, pl. 149; Carboni and Whitehouse, Glass of the Sultans, p. 270, pl. 134.

(4) M. Dāwūd confirms her idea by the fact that some inscriptions or any other ornaments are extended outside the red enamel outlines which were drawn by the artist on the glass vessel. See: M.Dāwūd, *al-Miškāwāt al-zuǧāǧīyah*, p. 276.

(5) Ward, Mosque Lamps, pp. 57, 58.

(6) M.Dāwūd, *al-Miškāwāt al-zuǧāǧīyah*, p. 280; Ward, Mosque Lamps, pp. 57, 58.

(7) Watson. Oliver, Pottery and Glass: Lustre and Enamel, in Gilded and Enamelled Glass from the Middle East, London, 1998, p. 16.

(8) Carboni and Qamar, Enamelled and Gilded Glass from Islamic Lands, in Heilbrunn Timeline of Art History, New York, The Metropolitan Museum of Art, 2000, p. 31.

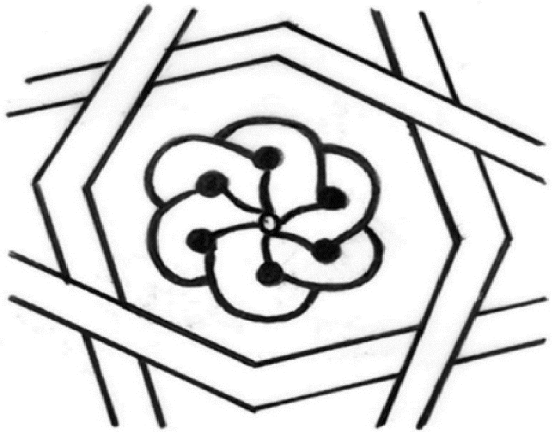
(9) M.Dāwūd, *al-Miškāwāt al-zuǧāǧīyah*, p. 280

Because individual enamel colors have different specific chemical qualities, different temperatures are required to permanently fix them on glass which means subjecting the vessel to reheating several times. (1) Then a more diluted mixture of gold was painted on between the enameled areas. Finally, the design was outlined with a line preserving the gold line beneath it. When the gold and enamels were all in place, the vessel was heated slowly until the enamels had melted and fused with the surface of the glass.(2)

Modern analyses have identified the constituents of the enamels used at this period and the temperature at which they would defuse. Red, blue and white were hard enamels, melting at around the same temperature as the body of the vessel. Yellow and green were soft enamels, melting at a much lower temperature.(3) Blue enamel is brought brought from lapis lazuli rock, green enamel is obtained by adding copper oxide to the transparent enamel or by the mixing of blue and yellow coloring ions or pigments, white is obtained from arsenate while red is from hematite or by adding iron oxide to transparent enamel.(4)

Internal decorations inside star pattern elements on glass work

Simple rosette is usually represented with its various petals that whirl in the same circle either alone or accompanied with other floral elements inside star pattern elements. Simple (6) petalled rosette is represented on the glass candlestick from Corning Museum inside the octagons (*muṯamman*). It whirls around itself. (Fig. 5)



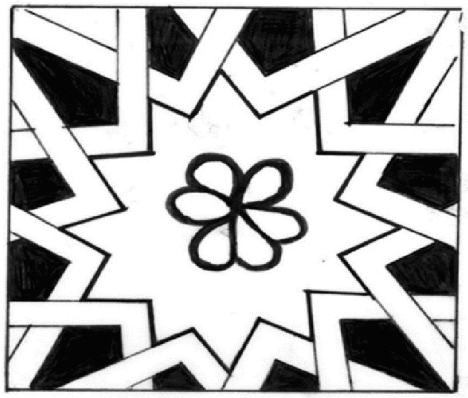
(Fig. 5)
(6) petalled rosette inside
an octagon from the glass candlestick
Done by the researcher

(1) Carboni and Qamar, Enamelled and Gilded Glass, p. 31

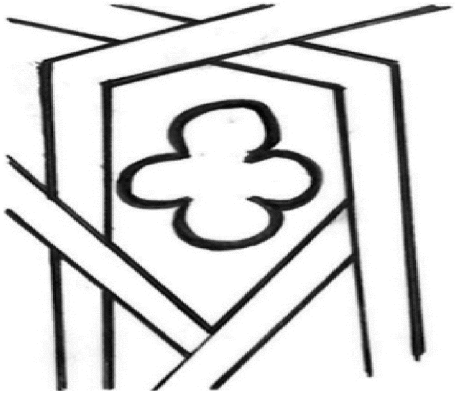
(2) Ward, Mosque Lamps, pp. 57, 58

(3) Ward, Mosque Lamps, p. 59

(4) Long time ago, lapis lazuli was a semi precious stone. Recently, it was demonstrated that its powder was used to color pottery glazes and glass enamels during the Mamluk period and sometimes mixed with cobalt ore. See: M.Dāwūd, *al-Miškāwāt al-zuğāğīyah*, p. 269; Colomban.Philippe, Pigments and Enamelling, Gilding Technology of Mamluk Mosque Lamps and Bottle, in Journal of Raman Spectroscopy, Paris, No. 43, 2012



(Fig. 6)
(6) petalled rosette inside
(12) pointed central star of
the glass basin

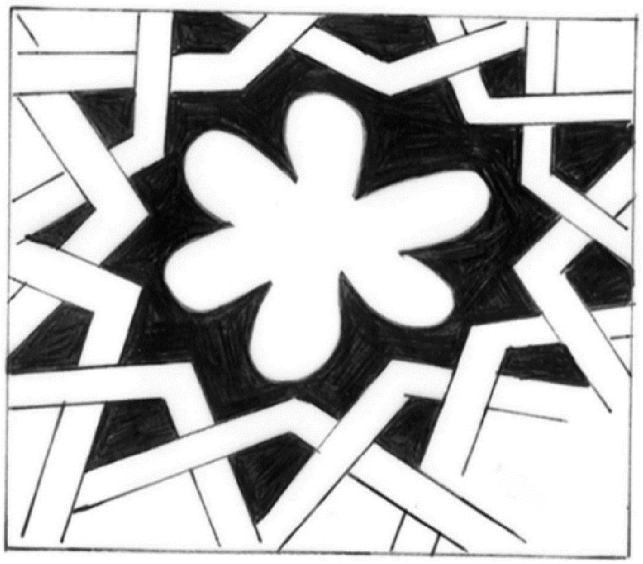


(Fig. 7)
(4) petalled rosette inside
Hexagon from the glass basin

Done by the researcher

(6) petalled rosette is decorating the interior of the (12) pointed central star (*tirs*) (Fig. 6) of the Cleveland Glass basin. While its hexagons are decorated with (4) petalled rosette (Fig. 7).

The glass tray in the Metropolitan Museum(1) which is suggested to be attributed to the previous glass basin regarding mainly to its decorations has its (12) pointed central star decorated with (6) petalled rosette (Fig. 8).



(Fig. 8)
(6) petalled rosette inside
a (12) pointed central star from the glass tray
Done by the researcher

(1) Carboni, "Islamic art", Ars Vitraria: Glass in the Metropolitan Museum of Art, vol. 59, No.1 summer 2001, p. 31

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Pate. 1
Bowl of ʻAlī Ibn Dāwūd

Plate. 1/a
The interior of the previos bowl

After: Carboni and Whitehouse, Glass of the sultans

Plate. 2
(8) pointed star patterns on glass candlestick
After**:** Carboni and Whitehouse, Glass of the sultans

Plate.3
(12) pointed star pattern on glass basin
After: Atil, Art of the Mamluks, pl. 51

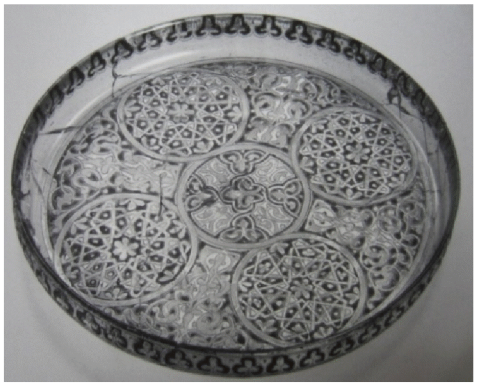

Plate. 4
(12) pointed star pattern on glass tray
After: Carboni, "Islamic art", in Ars Vitraria

Sohaila Moṣṭafā Maḥmūd