The Scientific and Technology Analysis Approach to the Art Work and Architecture of Al Haram Al Shrif in Makkah

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Abstract

Al Haram Al Shrif in Makkah is the holiest spot on the earth to Muslims. Every year about 14 million people are visiting the place from around the world, this number is increasing over the coming years. No author so far has been able to offer a fundamental study on its patterns, although there are many studies on Islamic patterns on other Islamic sites like Al Hambra and Al-Andolothia Mosque in Spain, the Mosques in Turkey and Morocco. The Central purpose of the research is to get the attention of the world in general, and the people of Islamic countries in particular, on the potential of architecture and decoration art of Al Haram Al Shrif Mosque in Makkah.

The study is focusing at the symmetrical properties of Islamic Art work in Makkah Mosque, which help to revel and discover the hidden secret surrounded this kind of geometrical art. Such experience has enormous values, not only for Islamic artists, but also for mathematicians, designers, computer scientists, physicists, chemists, crystallographers, art historians, archaeologists and others.

This research is carrying out extensive study patterns classification and analysis using theoretical and technological approach like crystallographic patterns (two dimension art), Frieze patterns (one dimension art), and Rosette patterns (point and line art), in addition to the use of Computer Graphics Technology. This research studied all architectural decoration in the Haram Al-Shrif Mosque.

Keywords: *Makkah, Islamic patterns, Symmetrical properties, Geometrical patterns, Frieze patterns, Rosette patterns.*

1. Introduction

The nations of the world agreed that the monuments and antiques are belonging to the country of its origin and considered as its own possessions. Therefore the old age materials must be evaluated and looked after as treasures by the government because of its belonging to the current and future people of the country. Islamic countries have been fortunate because they have a large share of archaeological materials in the world, and more diversified since prehistoric times and through all the Islamic periods [17]. Therefore, this kind of study worthwhile.

Islamic art has shown that the Muslim artists were not incapacitated at all in art innovation, whether the arts are applied or abstract, like in the other science, it is clear that Muslims have big contribution on many area such as Algebra, mathematics, architecture, designing, chemistry, medicine, pottery, ceramic, carpets, ..etc which have imitated by the west [9, 15]. Islamic art has effect beyond the needs of education, teaching and learning, the experience of sciences, technology and art in unison is satisfying to the aesthetic and cultural needs of intelligent beings everywhere.

In order to give brief introduction with focus on an importance of Islamic art on Kabbah without going deep down the history or antiques, it is worth to give briefly an idea of the beginning construction of Kabbah over the times up to date with current works and the future plan. In fact, this introduction lays the initial importance and information to offer the reader the comprehensive vision and the beginning source of Islamic art in Al Kabbah.

The study will become the blue print to readers and researchers who wish to explore the Makkah's Architecture and its art work further.

2. In Praise of Makkah Mosque

Muslims and before them the Arabs [3, 17], have known different kind of arts prior to mid 14 century, Architecture is one of these arts. The work of mosaic, painting the walls and internal decoration are well known to their culture, and they are different type of architecture art. Model the currency, instrument money, vaccination of bronze, silver and carpet-weaving, painting on pottery and ceramics ... etc are also another kind of work well known in Islamic art.

The Arabian Peninsula's art relied on materials like clay and stone colored, lead, fatty substances of plant, gypsum, precious wood, white marble, granite, sheets of gold, silver, precious stones, age of ivory and other more of building icon materials, Mosque of Al Kabbah can be considered the prototype building in the Arabian Peninsula, and one of the most prominent of these models, also one of the extreme beautiful buildings of the Islamic world, moreover, it is one of the top and utmost magnificent decorative, and design building in the world. The structure is engineering giant within the city of Makkah, surrounded by mountains on all sides.

Kabbah is the first house of Allah set to the people on the earth, it is the Sacred House and the Old House, Muslims face the direction of the Kabbah in each pray when performing salat (prayer). It is symbolizing their vast, and unified community of worship. Allah revealed to Ibrahim (peace be upon him) place of the Old House and building, he was assisted by his son Ismail (peace be upon him) in

building it. "Taking Buana to Ibrahim the place the house that does not involve me something and cleanse my house for Taivin and existing and Alrkaa prayer".

Figure 1 shows a form diagram of the Kabbah at the time of Ibrahim (peace be upon him) [1]. It has one opened access like door and without a roof. It is cube with 10'x12'x15' dimensions. The cube connotes the "idea of the center" in the geometry of space.

Kabbah was constructed in Makkah centuries before the birth of Islam, and has been ravaged and rebuilt more than once, also has refurnished and extended over different Islamic era (Al Rashidiya, Al Umayyad, Al Abbasid, Al Ottoman, and Al Saud) after Ibrahim era.

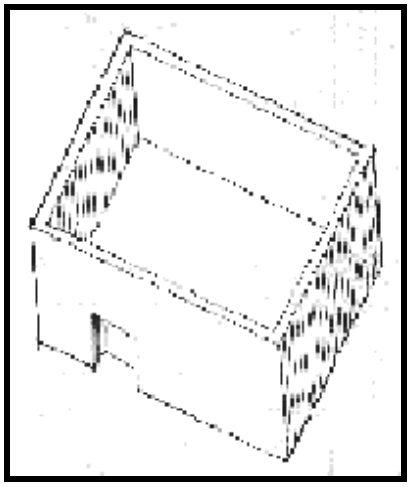

Fig. 1. Kabbah in the era of Ibrahim (peace be upon him)

Figure 2 is drawing of the form of the Kabbah with its grand Mosque at the time of Al Ottoman era [1].

The Founder of Saudi Arabia HRH the King Abdul Aziz Al Saud (Allah place his mercy up on him) has controlled Makkah, and established the modern kingdom of Saudi Arabia. He has accepted guardianship of the holy sites as a prime responsibility of the kingdom.

Figure 3 is a picture taken from the sky by "www.waragant.net" show the grand Mosque in the current Al Saud era.

Figures 4 and 5 are illustration of current extension work and future work [2].

The Mosque is lavishly decorated with stone and wood carvings and tile patterns on most of the ceilings, walls, and floors. Islamic art does not use representations of living beings as general direction in doing their art, but heavily uses geometric patterns, especially symmetrical pattern (repeating patterns).

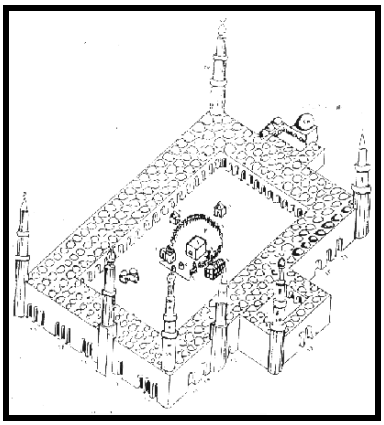

Fig. 2. The Grand Mosque in the era of the Ottoman Empire

Fig. 3. the grand Mosque in the current Al Saud era

Fig. 4. The grand mosque with current extension plan

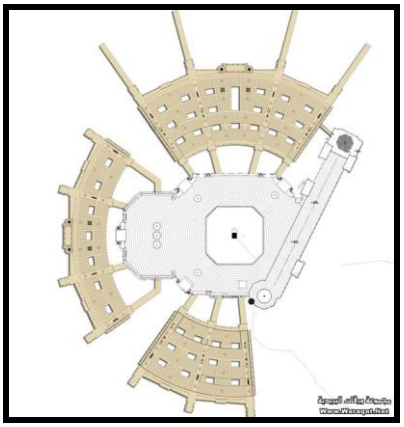

Fig. 5. The grand Mosque with future extension plan

3. In Praise of Islamic Art

It is proved that Islamic Art has originality and unique sense of style and beauty. Muslims have invented arts impressed the world, Europe for several centuries has learnt from it to construct their buildings and to explain scientific and artistic complex concept in their schools and universities [27]. The Islamic art always has its identity and clear own characteristics, although in its infancy the art has influenced by the arts of neighboring nations where Islam was spreading.

It is worth mentioning that the orientalists and western scientists were pioneers in the study and highlight the importance of Islamic decoration as a source of different study sciences, such as physics, architecture, Art, mathematics, and history.... etc. They who have stepped to the east the first building blocks to study and research their Islamic art founding. Moreover, their contribution is very clear in dissemination, classifying them and highlight their value, for example Edith Müller [20, 21], Grünbaum, Grünbaum, & Shephard, 1986 [12] and Montesinos J [18].

Any Islamic symmetrical pattern, seen as stretching and repeating indefinitely in two directions, can of course be classified to belong to one of the seventeen Crystallography patterns. there is no indication to show that at that time it was known in the Muslim culture or elsewhere, that it was only possible to make 17 Crystallography patterns. but there is no evidence to show that there has been an intention of the artists to make as many different patterns types as possible, Yet all of the 17 Crystallography patterns can be found in Islamic Art, see Martin, G.E page 111 [19], Welyl H Page 103 [36], Pérez-Gómez, R. (1987) [22], Mentesions J. [18] and Abas & Salman [27].

Muslim Artists have introduced complete artistic and decorative system, in the context of integration between what is spiritual and what is physical, each character has its natural position as require, which lead to produce the final, wonderful and decorative Art. And establishes a comprehensive vision of a unique symmetrical decoration Art in all its forms. The geometric nature of Islamic design, incorporating complex symmetries, has been well-explored from a mathematical point of view. Patterning and symmetry are two different scientific world but they has solidarity in Islamic Art. but it can be said that, there is no correlation between science and other is equivalent to the relationship between symmetry and decoration in Islamic Art, they are faces of one coin and then indispensable to each other.

The majority of the Islamic patterns are running patterns, they extend beyond the frame in which they exist. This is a characteristic which take the echo of the creation of the universe system. The completion of these forms is contemplative who owns a beauty beyond form.

A fairly sophisticated discussion about Islamic art must point out that Islamic art does not find a exploration study and research done among modern Muslims, hoping this will change in the future.

4. Background and The Investigation

How did the sophisticated Islamic geometrical patterns which are to be found on the walls and ground surfaces, on windows as frames and shields, on doors dated from the beginning building of Al Makkah Mosque and onwards evolve?. Clearly, they did not progress spontaneously. The artists, artisans, architects and designers who created and perpetuated Art work were mainly done by the giant construction company called Bin Laden in the Al Saud era.

Previous work has done by the author dealt with the analysis, classification and production of symmetrical patterns through the use of geometric and group-theoretic methods [25, 27, 31, 24], tilings [30], colour & text [28], colour pixels [30, 29], biometrics and symmetry [32], tracking sepsis movement [33], Also, the use of methods for the seventeen distinct types of two-colour Frieze patterns [26]. Work by other researchers and scientists [16, 13] had been carried out to produce images through the use of other methods. Over the past years the author have used computer graphics to collect, study and analysis four hundred patterns on two dimensions plane. It found that p3m1, pmg, pg, and pgg are very rare Crystallography patterns types and in many cases not attractive to the eye or to look at. P6m, p4m, c2m, p2m, pm p6 and p4 are very common pattern type [27].

There are many studies on Islamic patterns exist on Al Hambra (Spain), Egypt and Turkey. These studies are mainly focus on two dimension patterns. There is no study on the Al haram. One frequently asked question is whether all the 17 Crystallography patterns types or 7 Frieze patterns types can be found in Makkah Mosque?. Another question, what types of Rosette patterns exist?.

The research involved an extensive study of the different kind of patterns exist in Al Haram, it went beyond the steps of two dimension patterns. The study is analysing and classify the Rosette and one dimension patterns in addition to two dimensions patterns.

This work will made a large contribution towards classifying patterns in Makkah. Based on the finding and at the end of the study, there will be recommendation and advice is giving to the company that look after the internal

architecture work in the Al Haram.

5. Basic Theoretical Concepts and Definitions

In nature, the notion of symmetry is often associated with harmony of forms and beauty, and its concept is widely applied in the design of objects of all shapes and sizes, such as in Arts, Architecture and even Music [5, 11, 10]. The discussion is about the basic geometrical and theoretical concept of symmetry in various forms, such as reflection, glide reflection, rotational and translation symmetry, also it includes Crystallographic, Frieze, and Rosette symmetry patterns. Section seven content examples found in Al Haram Al Shrif in Makkah that illustrate the beauty of symmetry and the beauty of the Architecture.

The task of this section is to explain an important concept that needed in developing the methodology in the next part, It is build to drive and establish efficient path for classification and generation of Islamic pattern in Makkah Mosque. This information is focused to avoid any unnecessary and irrelevant details for simplifying reasons. The definitions and concept are as follow:

Pattern: It is an artistic or decorative design [8]

Symmetry Pattern: A pattern is symmetric if there are translations, rotations, reflections, or glide reflection which when applied to the pattern leave the appearance of the pattern unchanged. [27, 31]

Crystallographic Pattern: We will say that a Crystallographic Pattern is a pattern which covers the entire plane and can be produced by repeatedly applying transformations to a finite motif (and to the images of that motif) [4].

Frieze Pattern: It is an infinite strip with a repeating pattern, is called a Frieze pattern [7].

Rosette Pattern: It is any pattern having a flowerlike form [8], for example **R0**, **D2**, … etc as explain below.

R0: Reflection Symmetry Pattern has only one reflection.

Dn: Reflection Symmetry Pattern if the pattern has n fold reflection and n fold rotation, for example, **D2** is Reflection Symmetry Pattern has 2 fold reflection and 2 fold rotation, **D4** is Reflection Symmetry Pattern has 4 fold reflection and 4 fold rotation, **D8** is Reflection Symmetry Pattern has 8 fold reflection and 8 fold rotation.

Cn: Rotational Symmetry Pattern has n fold rotation, for example, **C2** is Rotational Symmetry Pattern has 2 fold rotation, **C4** is Rotational Symmetry Pattern, has 4 fold rotation.

Algorithms are developed in the following Scientific approach section 6.1, below notation and explanation used in these algorithms;

T The symbol **T** denotes a **Cell template tile** in which a cell is to be placed. **Cell** is the set of **Frames (Cell elements),** The concept **Frame** present the position part in the Cell template tile. It is one entity in the set of entities presenting the continue bath movement of the line, It is constructed of one point "coordinate (x,y)". It is assumed that the template cell has no symmetries.

$\mathbf{T^a_b}$ In general, the subscripted symbol **T** is used to denote a tile generated by mirroring **T** in the line **ab**.

$\mathbf{T^c_\omega}$ The symbol **T** is used to denote the tile generated by rotating **T** about the point **C** through degrees ω.

$\mathbf{T_{ab}}$ The symbol is used to denote the tile generated by movement with the distance **ab** followed by a mirror in the line joining the points **a** and **b**. In some cases of using **2ab** or **3ab**, the movement distance will be twice or three time of the distance between **a** and **b**.

U Construct of **Unit tile U** by gluing to **T** the Transformed versions of **T** as shown in the algorithms. A notation **P2,U** or **Pg,U** are used to present the unit tile that used to copied to produce the P2 or Pg pattern types.

+ The symbol + has used to denote the action of gluing two tiles together.

6. Methodology

The methodology has divided into two approaches or stages, which called Scientific and Technology approaches. The analysis and classification is starting at scientific approach then move to technology approach as require. The Scientific approach mainly concern with theory part of the study. The Technology approach mainly concern with practical part to confirm the theoretical part when there is confusing in the theoretical analysis part. Infect, the need of this part explained in section 6.2, and it is mainly to check and exam some of the Crystallography and Frieze patterns types. However, Technology approach has to apply when pattern is required to generate and recreate.

The point needed to be clearly understood before continuing, is that the classification will depend on whether or not color, add motif, add calligraphy …. etc in any discussion of symmetrical patterns analysis are taken into account, most of the analysis does not concern itself with colors, add figure and so on.

6.1 Scientific Approach

The first stage in the methodology is Scientific approach, it is used to analyze and construct theoretically Islamic pattern collected from Al Haram al shrif, the out come of the approach is grouping of patterns. There are analysis

diagrams for Crystallographic and Frieze patterns classification, they are exist in various books and websites, therefore, there is no need to include them in this paper, for information on Crystallography and Frieze patterns types analysis diagrams see [23, 24, 27].

Scientific approach is summarized in the below flowchart figure 6. the diagram clearly stated the first question should asked whether the pattern is two dimensional pattern or not?. If it is, the reader should refer to the classification method to find the type of Crystallography pattern. If the pattern is not one of Crystallographic patterns, means, it is not symmetry. If the result of the pattern examination is not in two dimension, the following question should be asked, is the pattern in one dimension? If the answer yes to this question, the reader should refer to the classification method of Frieze pattern to find the type of it. If the pattern is not one of Frieze patterns type, means, it is not symmetry. If the result of the pattern examination is not in one dimension, then the checking will be against Rosette patterns. There are two groups of Rosette patterns, they are depended on reflection and rotation of the pattern. If the pattern examination is not in one dimension, the following question should be asked, does the pattern has reflection? The pattern of Ro type if it has only one reflection and Dn type if it has n fold reflection and n fold rotation. If the pattern has no reflection, the following question should be asked, does the pattern has rotation? Cn type of pattern if it has n fold rotation and the pattern is not symmetry if it has no rotation.

The following information will explained the basic and main algorithms used in the approach, it is only for Crystallography patterns, although Frieze and Rosette patterns algorithms are part of Crystallography algorithms. There are mainly five different type of tiles categorized by their inner angles and their sides, These are; 1) parallelogram, 2) triangle, 3) rectangle, 4) square and 5) rhombus. Below, list of algorithms give the heart of the interactive computer graphics algorithms for the construction of each of the seventeen types of two-dimensional repeat patterns. The reader will find different algorithm published in references [17, 18, 23].

1. P1,U = T , where T is parallelogram.
2. P2,U = T + To180 , where T is triangle.
3. Pm,U = T+ Tce , where T is rectangle.
4. Pg,U = T+ Thd , where T is rectangle.
5. Pmm,U = T+ Tce + Tge + Te180 , where T is rectangle.
6. Pmg,U = T+ Tce + T2hd + T3hd , where T is rectangle.
7. Pgg,U = T+ Thd + Te180 + Tbf , where T is rectangle.
8. Cm,U = T+ Tab , where T is triangle.
9. Cmm,U = T+ Tab + Tcb + Tb180 , where T is triangle .
10. P4,U = T+ To90 + To180 + To270 , where T is square.
11. P4mg,U =T1+T1c90+T1c180+T1c270, where T1= T+ Tcb and T is square.
12. P4m,U =T1+T1b90+T1b180+T1b270,where T1= T+ Tab and T square.
13. P3,U = T+ To120 + To240 , where T is rhombus.
14. P3m1,U = T1+ T1b120 + Tb240 , where T1= T+ Tab and T is rhombus
15. P31m,U = T1+ T1c120 + T1c240 , where T1= T+ Tab and T is triangle.
16. P6,U = T1+ T1ab , where T1= T+ T c120 + Tc240 and T is triangle .
17. P6m,U = T2+ T2ab , where T2= T1 + T1 c120 , & T1= T+ Tab and T is triangle.

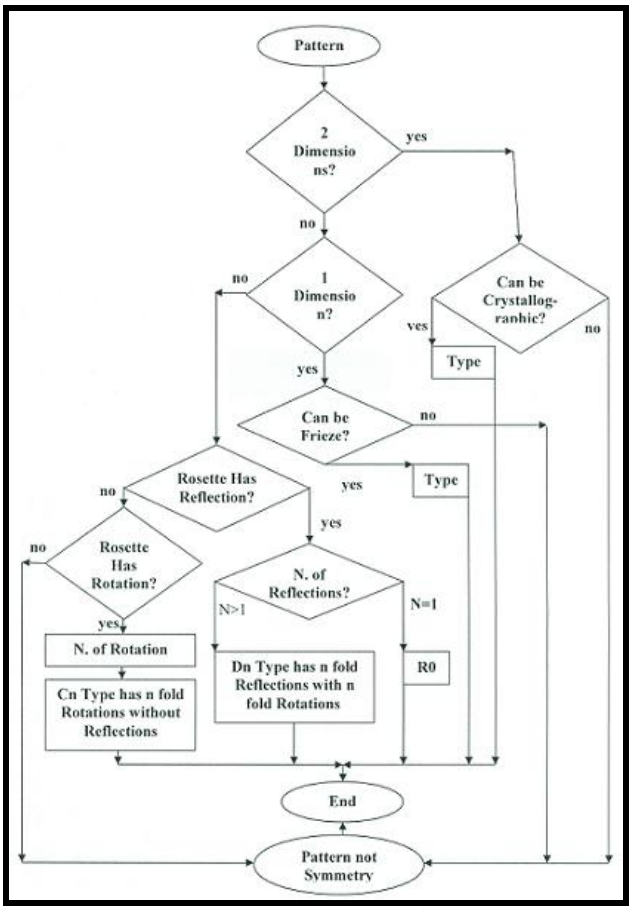

Fig. 6. Flowchart explain the Scientific approach

6.2 Technology Approach

The important of this approach come from, there are very complicated patterns in two dimension patterns where the researcher find very difficult to identify the belonging type

out of seventeen. In a number of cases the scholars are disputed on specific patterns type belonging. For example, the study by Grünbaum B, Grünbaum Z and. Shephard G.C. show that there are four pattern types missing in Al hambra patterns [12]. But " Péres-Gómez R., [22], claims to have found the last four missing patterns, although the picture of P3m1 pattern type is not included in his study. And José María Montesinos [18] includes pictures of all 17 patterns type in his book "Classical Tessellations and Three-Manifolds", although Grünbaum B [14] cannot see how P3m1 pattern type is classification in Montesino's book, moreover he asked the scholars for explanation of Montesino's clarification. Similar argument has existed on Egyptian patterns, see [14, 22, 36] for details. It is clearly understood that there are kind of difficulties among scholars in decided on pattern type. In order to overcome these kind of confusing, Technology approach is important to solve this issue, Computer Aided Design is the main element used in this approach.

AutoCAD is a well known computer aided drafting package. It would be inappropriate to discuss here in detail as to how this package is working. However, the commands explained some AutoCAD feature that found particularly useful to carry out the paper work.

The classical methods of constructing Islamic patterns involve the use of various shaped tiles, grids and the facility to construct and position certain shapes such as polygons and circles on these grids [6]. The modern methods uses different kind of region with transformations as require to produce the pattern type [27], A CAD package is an ideal tool for these operations. The facility to construct various shapes accurately, to manipulate them and apply transformations, trim, extend … etc. are fairly commonly available in all CAD package.

Layers facility is another feature, it is highly useful because it allows for grids and intermediate constructions to be placed in separate layers, they can be switched off any time when the pattern through the development.

The block facility is the one that also needed to mention as being highly useful tool in the work. It allows for various geometrical entities to be grouped together into a single unit for manipulation. In particular multiple copies can be made on a grid, the copying object can be scaled and rotated during the process.

The analysis and creation of a pattern based on the following:

First: Image data extraction.
Extraction data of pattern is depend on two methods;

(1) External method: The extraction is using tablet (dvice) within AutoCAD. It works by fixing the image on the tablet with special installation and setup, then applying sequence of operations to obtain the coordinate for record.

(2) Internal method: the extracting is used AutoCAD only. It can be done by download the scanning image into AutoCAD with special installation and setup, then applying sequence of commands to obtain the coordinate for record.

Second: Classification and regeneration pattern.
Once the minimum data achieved from the Image data extraction step, the construction of the pattern became easy. This lead to identify type of transformations exist in the pattern. As result the pattern type can be classify without hesitation.

Both above steps required mastering AutoCAD application software.

7. Image Result of Analysis

All pictures and Images in this paper are taken by the author using Canon Camera (PowerShort, SX 21015) with 14.1 Mega pixel, then rendered using Photoshop software for publication. Artists have used patterns to decorate building for thousands of years ago, the symmetries of these patterns are key to their aesthetic beauty, the characteristic of Islamic patterns are geometrical, mathematical and artistically significance in addition to other significance.

The below images are selected for the purpose of proofing without doubt the discovery of the research. Since, It is defiantly will avoid similar argument and questions arises in Al hambra and Egypt cases [9, 14, 18, 22, 36, 12]. They were serious dispute by scholars, see section 6.2.

Frieze patterns or border patterns are commonly found in designing and decorating of Al Kabbah Mosque. Iron, stone, mosaic, marble, and color painting are main material used in creating the Art work. It is proof that all the Frieze patterns types are exist in Al Kabbah Mosque. Below Figures (7 to 13) present 7 Frieze patterns types.

Fig. 7. P111 Decretive trim on building

Fig. 8. Pm11 Decorative trim on a building

Fig. 9. P1m1 Decretive trim on arch

Fig. 10. Pmm2 Decretive trim on wall

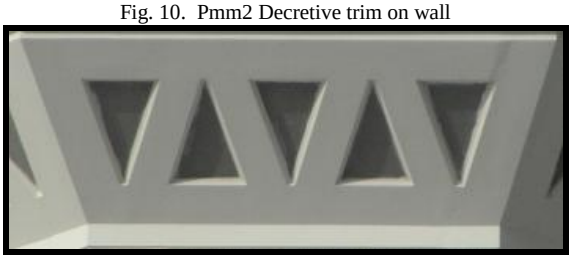

Fig. 11. Pma2 Decretive trim on minaret

Fig. 12. P112 Decretive trim on wall

Fig. 13. P1a1 Decretive trim on roof

Crystallography patterns or wallpaper patterns have been well known in Islamic art, below examples are selected patterns for each type of Crystallography pattern type found in Al Kabbah Mosque. Figures (14 to 21) present different crystallography pattern types. P1a1, Pgg, Pg, p31m, p2, p4g, p3, p3m1 and p6 pattern types are missing.

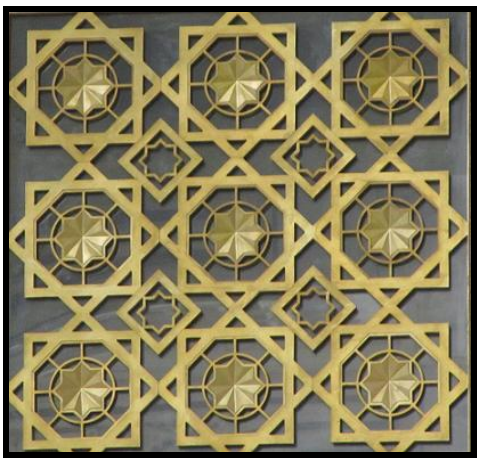

Fig. 14. P4m decoration trim of iron work

Fig. 15. P4 decoration trim of wood work

Fig. 16. P6m decoration trim of iron work

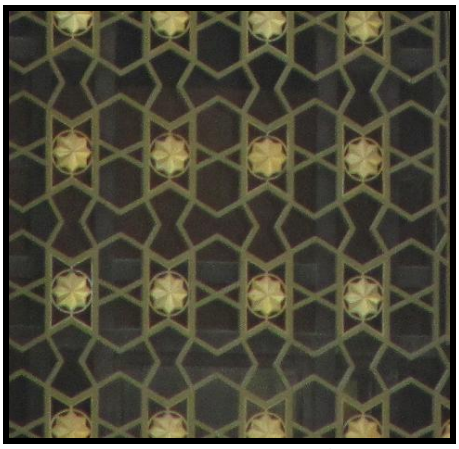

Fig. 17. Pmm2 decoration trim of iron work

Fig. 18. Pmg decoration trim of marble work

Fig. 19. Pm decoration trim of marble work

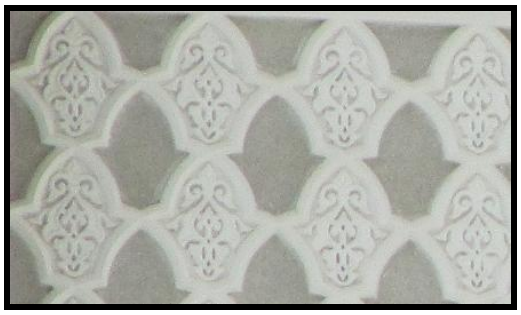

Fig. 20. Cm decoration trim of marble work

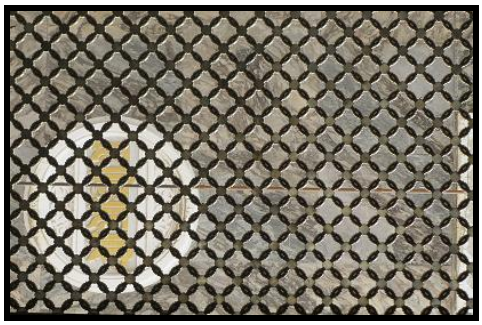

Fig. 21. Cmm decoration trim of iron work

In order to present to the reader a complete study of the patterns that are exist currently in Al Kabbah, the following question should be answer: what is the most popular pattern among the exist patterns?, Katem Suleman tile is the most frequently pattern occurring in Islamic culture, and indeed, it is the most common patterns in Al Kabbah Mosque. Figure 22 shows examples of different variations on the theme of Katem Suleman, they are made of various material. Such tile can be spotted more than 2000 times as standalone pattern in different parts of Makkah. In addition to basic tile for Frieze and Crystallography patterns.

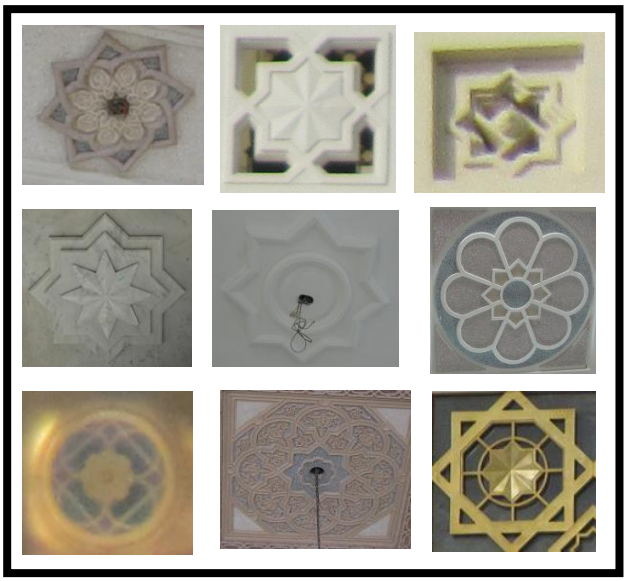

Fig. 22. Different variations of Katem Suleman tile

8. Survey Result of Classification

In all, more than 600 pictures are taken by the author to cover every part of Makkah, then examined and classified all of them. The photos has duplication of same patterns, it means that one pattern can be exist in more than one photo. But, in the case of counting, pattern is unique for each number. In another word, cannot one pattern classified and counted more than once. As result of the survey, all patterns have examined against, Rosette, Frieze, and crystallography patterns, it resulted one library or group for each, therefore, there are three libraries in total. Each library presented below by table and diagram.

Table 1 shows the distribution of Rosette Patterns and its types they have classified and countered, Diagram 1 shows graphically presentation of table 1.

Table 1: The analysis Result of Rosette Patterns

Rosette Pattern	R0	D8	D4	D16	D12	D10	C4	C8
Frequency	21	10	5	4	2	1	2	2

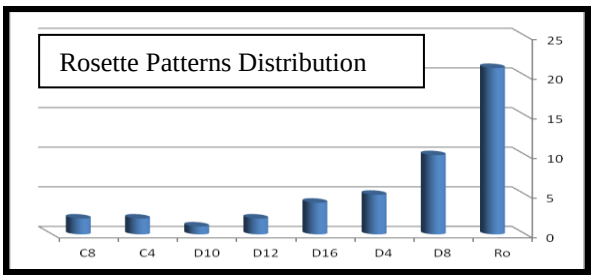

Diagram 1. Histogram view Rosette Patterns types and distribution

Table 2 below gives data for the number of Frieze patterns that have classified and countered. Diagram 2 as diagram 1, shows graphically the analysis result of table 2.

Table 2: The analysis Result of Frieze Patterns

Frieze pattern	Pm11	Pmm	P1	P1m1	Pg	P2mg	P2
Frequency	49	31	10	6	4	4	3

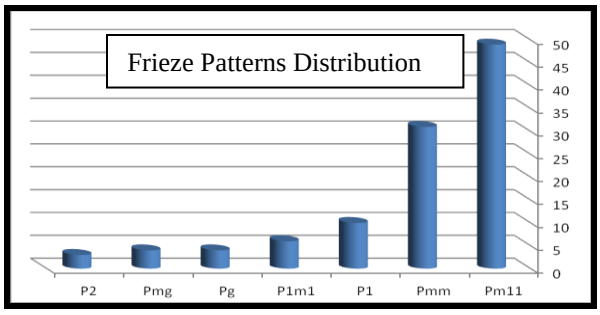

Diagram 2. Histogram view Frieze Patterns types and distribution

Table (3) shows there are few Crystallography patterns, there are a lot of pattern types not exist.

Table 3: The analysis result of Crystallography patterns

Crystallography Patterns	P4m	Cmm	Pmm	P6m	Pm	Pmg	P4	Cm	P31m	Pg
Frequency	6	5	4	2	2	2	2	1	0	0
Crystallography Patterns	P2	P4g	P3	P3m1	P6	Pgg	P1			
Frequency	0	0	0	0	0	0	0			

Diagram 3 present the table 3 graphically. It is clear there are nine different Crystallography pattern types missing. The author believes that the construction company should encourage decorator to develop patterns of special nature to reflect the golden time of the creating Islamic patterns. It is not easy task, it is innovative work to keep the influence and reputation of Islamic artists and art well known all around the world.

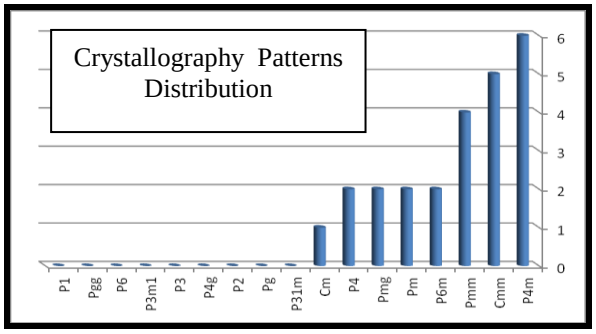

Diagram 3. Histogram view Crystallography Patterns types and distribution

Preliminary conclusion of above tables and diagrams is as follow:

- Frieze and Rosette patterns are predominated the Art work in Makkah.
- The patterns designer of the Al haram Al Makki utilized all seven of the different Frieze pattern types in their Art, patterns having both vertical and horizontal lines of symmetry were most frequently used.
- With reference to Crystallography patterns, the study shows there are a lot of rooms to develop this part of Art work.

In case of Crystallography and Frieze pattern type P1 can be produced through any other patterns types by coloring, add motif or add calligraphy to destroy the symmetry.

9. Conclusion and Recommendation

In this research, the aim was to show and reveal the different types of patterns currently exist in Kabbah Mosque. The author hope that this study have made some small contribution but that is privilege of the reader to decide, the greatest satisfaction would be come if the research applied to encourage innovation to generation Islamic Art through the use of different means and applying it on decorating the Makkah Mosque. Computer graphics combined with modern mathematics offer all sorts of new and exciting Art possibilities.

Avoiding any repetition, the reader should refer to the results in sections 7 and 8 for further conclusion details.

Bin Laden Company has done great job in building and modernize the Kabbah Mosque, their focus and major innovation lays on construction but no real improvement can be observe in part of pattern's decoration.

The Author recommendation is to look at the missing type of patterns and try to create these patterns without distraction the Islamic practice. And turn the statement by the western scholars "the mathematicians, builders, artistic in the Islamic cultures of today have little appreciation of the value of their tradition".

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