

Exploring the Diverse Mosaic Patterns and Materials of the Phra Si Rattana Chedi: A Classification and Analysis

Phra Si Rattana Chedi'nin Çeşitli Mozaik Desenlerini ve Malzemelerini Keşfetmek: Bir Sınıflandırma ve Analiz

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Abstract

This paper explores the intricate mosaic artistry at the Phra Si Rattana Chedi, within The Emerald Buddha Temple. Focused on the gold-mosaic patterns adorning the stupa walls, the study examines its historical significance dating back to King Rama I's reign. Serving as a poignant symbol of Thailand's cultural opulence, the stupa's resplendent mosaic adornments showcase impeccable craftsmanship. Through meticulous classification and analysis, this paper unveils the profound interplay between artistic expression, cultural heritage, and architectural magnificence within this revered sanctuary.

Keywords: The Phra Si Rattana Chedi, Wat Phra Kaew, mosaic patterns, mosaic materials, architectural elements.

Öz

Bu makalede, Zümrüt Buda Tapınağı'ndaki Phra Si Rattana Chedi'deki karmaşık mozaik sanatı incelenmektedir. Stupa duvarlarını süsleyen altın mozaik desenlerine odaklanan bu çalışmada, Kral Rama I'in saltanatına kadar uzanan mozaiklerin tarihi önemi ele alınmaktadır. Tayland'ın kültürel zenginliğinin dokunaklı bir sembolü olarak hizmet eden stupanın muhteşem mozaik süslemeleri kusursuz işçilik örneklerini sergilemektedir. Bu makale, titiz bir sınıflandırma ve analiz yoluyla, bu saygı duyulan kutsal alandaki sanatsal ifade, kültürel miras ve mimari ihtişam arasındaki derin etkileşimi ortaya koymaktadır.

Anahtar Kelimeler: Phra Si Rattana Chedi, Wat Phra Kaew, mozaik desenler, mozaik malzemeler, mimari unsurlar.

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The current situation of mosaic at the Phra Si Rattana Chedi in the temple of The Emerald Buddha (Wat Phra Kaew) the object of this paper, is part of doctoral thesis called “To create parametric art from Tessellation and Aesthetic features of Thai mosaic.” which is developing at the Faculty of Fine and Applied Arts, Khon Kaen university, Thailand.

This study focuses on the gold colored mosaic patterns and materials on walls which can be found at “Phra Si Rattana Chedi” in the temple of the Emerald Buddha (Wat Phra Kaew). The study is limited to areas of the mosaic which can be easily accessed from the ground.

1. A Brief History About the Temple of The Emerald Buddha (Wat Phra Kaew)

The temple of The Emerald Buddha (Wat Phra Kaew), situated within The Grand Palace in Bangkok, holds great historical significance and carries a profound legacy (Fig. 1). Its construction can be attributed to the benevolence of King Rama I (20 March 1737 – 7 September 1809 AD), a prominent monarch who established Bangkok as the capital in 1782 and undertook the establishment of the Grand Palace. This practice of erecting royal temples within palace precincts traces its roots back to antiquity, exemplified by notable instances such as Wat Mahathat in the Sukhothai Palace and Wat Phra Si Sanphet in the Ayutthaya Palace.

The temple of The Emerald Buddha serves as a sacred sanctuary for numerous momentous state and royal ceremonies, ceremoniously presided over by the reigning monarch and attended by eminent government dignitaries. This elevated role has endowed the temple with unparalleled significance, designating it as the preeminent national place of worship and a venerated national shrine, profoundly esteemed by both the monarchy and the state. Such a position solidifies its stature as an integral element of Thailand’s cultural heritage and a revered symbol of religious and national reverence (Naengnoi Saksit et al. 1988: 284).

Throughout the years, Wat Phra Si Rattana Satsadaram has received generous donations of sacred and valuable objects from successive monarchs, transforming it into a revered treasury. The primary impetus behind the construction of this temple was to enshrine the esteemed Phra Phuttha Maha Mani Rattana Patimakorn, also known as King Buddha Yodfa Chulalok the Great (King Rama I), who had brought the sacred relic from Laos and initially enshrined it at the building in front of the Phra Prang of Wat Arun Ratchawaram. Subsequently, upon his ascension to the throne as the inaugural king of the Chakri dynasty (ราชวงศ์จักรี), King Rama I invited Phra Phuttha Maha Mani Rattana Patimakorn to be enshrined in the new Ubosot of the monastery on Monday, March 2, 1784, an event of profound significance (Naengnoi Saksit et al. 1988: 284).

The construction of Wat Phra Si Rattana Satsadaram was deeply influenced by religious beliefs and cosmic principles. The temple complex encompasses a diverse array of buildings, each serving specific religious purposes, and designed in a variety of Thai architectural styles. Despite the diverse architectural expressions, the constructions remain faithful to the traditional principles of Thai religious architecture, reflecting a harmonious blend of sacred customs and artistic craftsmanship (Naengnoi Saksit et al. 1988: 284).

The enduring legacy of Wat Phra Si Rattana Satsadaram as a spiritual sanctuary and a repository of royal patronage further underscores its profound cultural

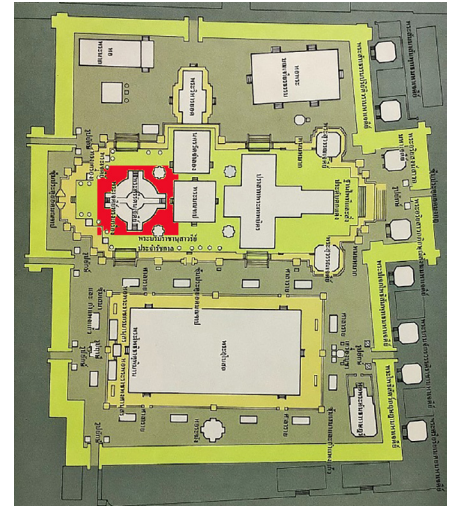


Figure 1
Plan of the temple of The Emerald Buddha (Wat Phra Kaew). Red inset shows the location of the study area (Naengnoi Saksit et al. 1988: 284).

significance within the realm of Thai religious and architectural heritage as shown in (Fig.2).

Figure 2

The temple of The Emerald Buddha (Wat Phra Kaew) in The Grand Palace, Phra Nakhon, Bangkok, Thailand (Naengnoi Saksit et al. 1988: 284).



2. A Brief History About the Phra Si Rattana Chedi

Thai cultural heritage is not complete without stupas. The stupa is referred to as “Chedi” or “Phra Chedi” in Siamese. “Phra Chedi” is the Thai word for a reliquary or a religious monument. Many “Chedis” with different sizes and decorative styles may be present in one Wat, or there may be just one “chedi” that is fairly enormous. Stupas are most frequently used to house holy relics and serve as centres of devotion for Buddhist communities. A meritorious act is circumnavigating the Phra Chedi or the Bot with lit candles. On certain Buddhist holy days, such as Wisakhabucha day, Thai Buddhists always carry out this practice on full moon evenings (Thomprasert 2013: 55).

King Mongkut - titled Rama IV (18 October 1804 - 1 October 1868 AD), the fourth monarch of Siam, was graciously pleased to have The Phra Si Rattana Chedi (Fig. 3) constructed in 1851, the style of the Great Chedi in Wat Phra Si Sanphet, Ayutthaya to enshrine the Buddha relics of he got it from Sri Lanka and gave it the name Phra Sratana Chedi, but the construction not finished when he passed away (Naengnoi Saksit et al. 1988).

In preparation for the celebration of the 100th anniversary of Bangkok in the reign of King Chulalongkorn - titled King Rama V (20 September 1853 – 23 October 1910AD) (Bhamorabut 1983), His Highness assigned (Krom Luang Adisorn Udomdej พระเจ้าน้องยาเธอ กรมหมื่นอดิศรอุดมเดช, 15 March 1856 – 16 April 1925 AD)¹ [4], when he held the title of Phra Sratana Chedi. Decorated with gold mosaic tiles outside and painted interior walls, made door panels and marble floors inside and graciously bestowed upon Her Royal Highness Princess Maha Chakri Sirindhorn Sappasat Suphakit when he held the title of Phra Chao Nong Ya Thee, Prince Thong Tham Thawan. Yawong Tha decorated with gold mosaic tiles outside the whole body².

1 P. N. K. N. Museum, 20 July 2024. [Online]. Available: <https://culture.ssru.ac.th/event/view/1008>.

2 “Siammanussati,” [Online]. Available: <http://www.siammanussati.com/?s=Princess+Maha+Chakri+Sirindhorn+>.



Figure 3

The entrance to The Phra Si Rattana Chedi at the temple of The Emerald Buddha (Wat Phra Kaew) in The Grand Palace, Bangkok.

According to Mr. Carl Alfred Bock, a notable Norwegian government official, author, naturalist, and explorer, the commemoration of Bangkok's 100th anniversary during the reign of King Chulalongkorn, titled King Rama V, on the 21st of April 1892, marked a significant event in the history of Wat Phra Si Rattana Satsadaram. During this ceremony of final dedication, an elaborate and grand celebration took place, culminating in the naming of the temple as 'Wat Phra Kaew' with particular emphasis on the Phra Si Rattana Chedi, which was adorned with splendid gold mosaic tiles. These mosaic tiles were specially crafted in Germany, commissioned by H. R. H. Krom Mun Aditson Udom Det for this auspicious occasion (Bock 1884).

In the year 1932, preparations for the 150th Anniversary Celebration of Bangkok, during the reign of Prajadhipok, titled King Rama VII (8 November 1893 – 30 May 1941), entailed a restoration project for the exterior of Phra Si Rattana Chedi. As part of this restoration effort, the gold mosaic tiled walls were repaired, and damaged mosaic tiles were replaced. Additionally, meticulous attention was given to fixing intricate decorative elements, such as lotus flowers, rooster leaves, swan tails, and small chedi on the arch (Bock 1884: 386-387).

The accounts provided by Mr. Carl Alfred Bock offer valuable historical insights into the significant ceremonial dedications and restoration efforts that have embellished Wat Phra Si Rattana Satsadaram, contributing to its enduring architectural splendor and cultural significance (Naengnoi Saksit et al. 1988).

According to Pirasri Povatong, the planning for the commemoration of Bangkok's bicentennial anniversary was initiated in 1976, during the reign of King Bhumibol the Great, titled Rama IX (5 December 1927 – 13 October 2016 AD). A central objective of this momentous event was the restoration and renovation of Wat Phra Si Rattana Satsadaram. To oversee this significant endeavor, the Thai Government established a Working Committee for the Restoration and Reconstruction of Wat Phra Si Rattana Satsadaram in 1976. This committee consisted of professionals specializing in various branches of Thai art and architecture (Pirasri Povatong 2021: 3-4).

Recognizing the esteemed importance of the project, the Thai Government sought the favor of King Bhumibol the Great [8], who appointed HRH Princess Maha Chakri Sirindhorn as the President of the Board of Directors for the Restoration

and Reconstruction of the Grand Palace and the Temple. Princess Maha Chakri Sirindhorn's eminent position facilitated her leadership role throughout the implementation of the project, spanning the years 1977 to 1980 AD.

The involvement of the working committee and the eminent leadership of HRH Princess Maha Chakri Sirindhorn exemplify the commitment of the Thai Government and the monarchy to preserve and enhance the cultural heritage of Wat Phra Si Rattana Satsadaram. The meticulous restoration and renovation efforts undertaken during the bicentennial celebration contributed significantly to the enduring reverence of this temple within the Grand Palace complex (Pirasri Povatong 2021: 3-4).

According to Mr. Somchai Supalak Ampaiporn (สมชาย ศกัลภ์อ่ำไพพร) (an interview in 25 August 2022 AD), the Phra Sri Rattana Chedi was restored once again, by changing some of the gold mosaic tiles that decorate the exterior and restore damaged parts but still retains, it was specially imported for this purpose from Italy, the characteristics of the original art did not change in any way architectural style Phra Sri Rattana Chedi is a circular chedi in Lanka style. The same pattern as the 3 pagodas at Wat Phra Si Sanphet Phra Nakhon Si Ayutthaya Province It is a pagoda made of bricks and cement decorated with golden mosaic tiles. Inside the hollow is enshrined a small chedi containing the Buddha's relics³.

Overall, The Phra Si Rattana Chedi symbolizes the intricate craftsmanship, artistic brilliance, and rich cultural heritage of Thailand, showcasing the profound connections between Thailand and Italy (Lohapon 2007) through its splendid mosaic patterns and ornate design. The Chedi remains a treasured gem, reflecting the nation's history and its harmonious blending of various cultural influences.

Objective

The objective of this paper is to classify and analyze the mosaic patterns and materials found in the Phra Si Rattana Chedi, based on the different architectural elements present in the structure.

Methodology

This paper utilized a systematic approach to analyze the mosaic patterns and materials in the Phra Si Rattana Chedi. The methodology included the following steps:

1. Data Collection: Extensive research was conducted, gathering information from various sources such as literature reviews, historical records, and expert insights.
2. Pattern Identification: The collected data were carefully examined to identify and document the different mosaic patterns present in the Phra Si Rattana Chedi, analyzing their types based on their design characteristics. Identify the Geometric Mosaic Pattern (TMGPs), Organic Mosaic Pattern (TMOPs), and Animal Mosaic Pattern (TMAPs) if present.
3. Categorization: The identified mosaic patterns were categorized based on the architectural elements within the Phra Si Rattana Chedi, forming the basis for classification.

³ M. S. S. Ampaiporn, Interviewee, *Mosaic restoration at the Phra Sri Rattana Chedi*. [Interview]. 25 August 2022.

4. Frequency Analysis: Perform a frequency analysis of the mosaic patterns to determine the prevalence of each pattern type. Calculate the occurrence of TMGPs, TMOPs, and TMAPs among the architectural elements and variations on The Phra Si Rattana Chedi's façade.

5. Materials Analysis: Analyze the materials used in the mosaic creation, such as the types of tesserae, color variations, and any historical references to the origin and procurement of mosaic materials.

In summary, this paper employed a systematic methodology to classify and analyze the mosaic patterns and materials in the Phra Si Rattana Chedi. By examining their architectural elements, cultural influences, and historical context, the paper aimed to enhance understanding of the artistic significance and cultural exchange represented by the mosaic decorations.

Results and Discussion

1. Classification of Architectural Elements:

The Phra Si Rattana Chedi is characterized by the presence of three distinct architectural elements, namely the base part, the middle part and the top part. These individual components harmoniously combine to form a visually captivating and well-composed stupa as following:

1.1. The Top Part:

(Plong Chanal – ปล้องไฉน), then it is the leaves and the top of (Dli Yod – ปลียอด) the beads (Swn-Pixng-Chin - ส่วนปล้องไฉน).

1.2. The Middle Part:

Above it is a square (Banllang-Chedi-Klom – บัลลังก์) throne with a pillar to support the joint (Sao Han – เสาหอน) which is made of 20 layers of glass beads from large to small overlapping.

1.3. The Base Part:

Chopping board, the lotus base (Than-Pathum – ฐานบัว) base with garlands of 3 tiers (Malai Thao - มาลัยลูกแก้ว 3 ชั้น), alternating with the base of the inverted lotus bell supporting the bell (Bua-Pak-Rakhang – องค์ระฆังทรงกลม), The exterior is all covered with golden mosaics (Fig. 4). The description of the classification of architectural elements is shown in table [1] (Cha-Um 2011: 154).

2. Classification of Mosaic Patterns and Materials that Covered the Phra Si Rattana Chedi

Glass mosaic decoration is an intricate process that involves applying glass Materials to various surfaces, creating visually captivating aesthetics. It serves both decorative and architectural purposes, enhancing the overall beauty of objects or structural elements (Silvers 1996). One notable form of glass mosaic is the gold glass mosaic, which exhibits a brilliant shimmer akin to precious gemstones when illuminated by light. This type of mosaic is particularly favored in religious architectural components, such as the renowned Phra Si Rattana Chedi, not only for its ornamental value but also for its ability to contribute to the preservation of architectural integrity over time, thus enhancing its longevity and visual appeal. Furthermore, the resilience of glass mosaic to the elements, including resistance to the effects of sunlight and rain, further solidifies its appeal in these applications.

Figure 4
Architectural elements of The Phra Si Rattana Chedi at the temple of The Emerald Buddha (Wat Phra Kaew) in The Grand Palace, Bangkok.

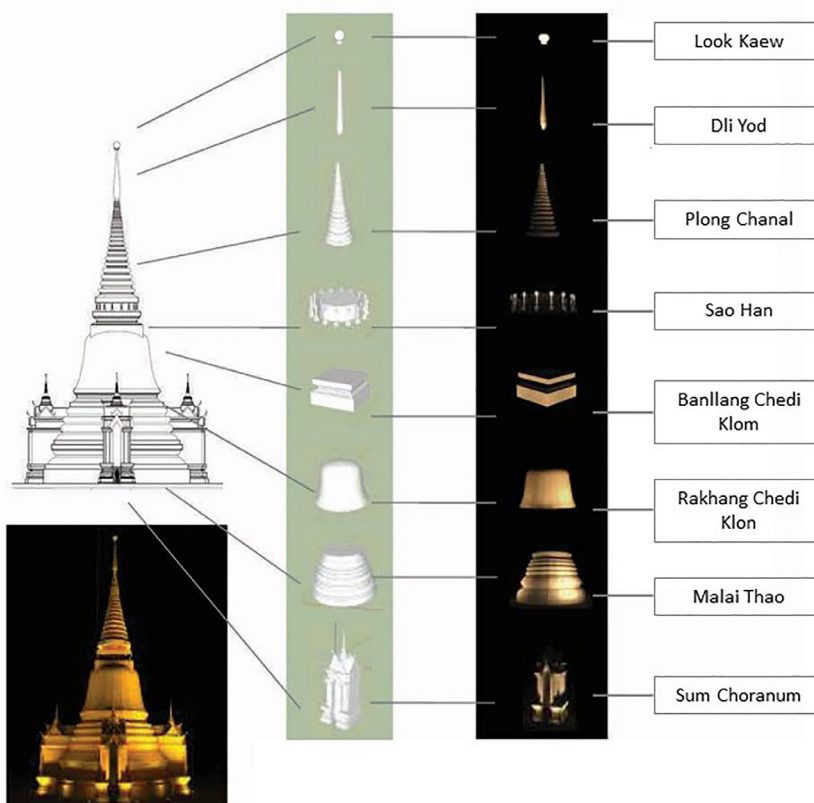


Table 1
Classification of Architectural Elements.

NO	Level of Architectural Elements	Thai Name	English Name	Discription of the architectural elements	
1	The tope part	ส่วนปล้องใจน	Swn-Pixng-Chin	Popularly made from crystal ball, looks like a drop of water called "Dew-Drops"	
2		ปลียอด	Pli-Yod	Pointing to the sky, the path to Nirvana	
3		ปล้องใจน	Plong – Chanal or Chin	Called top end of the Pagoda, made into a mosaic lotus flowers from large to small, to support "Pli-Yod" shape	
4	The middle part	ฐานเขียงกลม	Round chopping board	Inverted cornice on top	
5		เสาหวน	Sao-Han	Components element, made into a round cylinder, tiered position in all 8 directions	
6		บัลลังก์	Banllang-Chedi-Klom	An important element, base of 4 corners, support the round cylinder "Sao-Han"	
7		องค์ระซังทรงกลม	Rakhang-Chedi-Klom	Packing Buddha statue or relics or royal relics and relics	
8	The base part	ฐานบัวลูกแก้วอกไก่	Than-Bow-Lukkaew-Xkki	A mosaic lotus base	
9		มาลัยลูกแก้วเถา 3 ชั้น	3 tiered crystal ball garlands	The name of the element (Lotus petals) it's like a garland, hidden 3 layers together at the mouth of the bell	
10		บัวถลา	Baw-Thla	Lotus flower, It is a characteristic that was received from Lanka, but removed the lotus layer facing out	
11		ฐานปัทม์	Than-Pathum	The lotus base (Pathum) symbolizes the lotus flower, which serves as a foundational support for the Buddha in all of his gestures and postures	
12		ชั้ม จระนำ		Sum-Choranums-The exterior directions	The entrance arches in 4 directions
13				Sum-Choranums-Small chedi	
14				Sum-Choranums-The entrance door	
15			Sum-Choranums-Lotus and Lion base		

The utilization of gold glass mosaic extends beyond religious structures to royal buildings and other significant edifices. During the Rattanakosin period, the popularity of mosaic decoration saw a notable rise, owing to various architectural masterpieces. As evidenced by the exemplary design of the Emerald Buddha within Wat Phra Kaew, located in the Grand Palace of Bangkok, the art of mosaic decoration has its roots in the era of Ayutthaya, experienced fluctuations, and experienced a revival during King Rama III's reign.

Additionally, it is crucial to recognize the unique role played by Italian professionals serving the Siamese government during this period. These professionals, including artists, architects, and engineers, played a dual role as cultural ambassadors, introducing European cultural elements to Siam, thereby contributing to the richness and diversity of artistic expressions present in the architectural landscape (Lohapon 2007).

2.1. Classification Mosaic Patterns in The Phra Si Rattana Chedi:

The Phra Si Rattana Chedi, located at Wat Phra Kaew, renowned as the temple of The Emerald Buddha, stands as a magnificent testament to Thailand's opulent artistic legacy, boasting a remarkable array of intricate Thai mosaic patterns. These patterns are celebrated for their elaborate designs and vibrant palette, contributing to the awe-inspiring splendor of the Phra Si Rattana Chedi. This study undertakes a comprehensive exploration encompassing the classification and systematic analysis of these exquisite patterns, illuminating their unique styles and designs. Investigating the contemporary state of Thai mosaic decorative art, the study primarily classifies the mosaic patterns into two distinctive categories: the first type based on the mosaic pattern itself and the second type based on the mosaic materials employed at Wat Phra Kaew, the temple of the Emerald Buddha. The Thai mosaic patterns in the Phra Siratana Chedi are further organized into three main types:

1. Decorative Thai Mosaic Geometric Patterns (TMGPs)
2. Decorative Thai Mosaic Organic Patterns (TMOPs)
3. Decorative Thai Mosaic Animal Patterns (TMAPs).

Each category represents a unique approach to mosaic decoration, reflecting the creative expressions of Thai artisans. as following:

2.1.1. Decorative Thai Mosaic Geometric Patterns (TMGPs):

The fundamental design elements for the decorative geometric pattern at Phra Si Rattana Chedi encompass essential conceptual components, including the major shape of mosaic, color scheme, volume, and the mosaic guide line (Andamento). As individuals encounter these forms, these elements become perceptible in the mind's eye.

According to observations, the glass golden mosaic (tessera) patterns elegantly embellish the form of Phra Si Rattana Chedi, following a grid line pattern at 45° and 90° degrees, as illustrated Diagram (Fig. 5) and (Fig. 6). shows the construction technique employed for the working lines. In this stage, the lines are meticulously marked, starting from the center (beginning) point, and extending outward. The marked lines include a line parallel to the longest wall (Line 1), a vertical line (Line 3) at a right angle to the rest line, and a diagonal 45° line (Line 2).

The decorative Thai mosaic geometric patterns (TMGPs) discovered within the architectural context of through close examination of the relevant documents

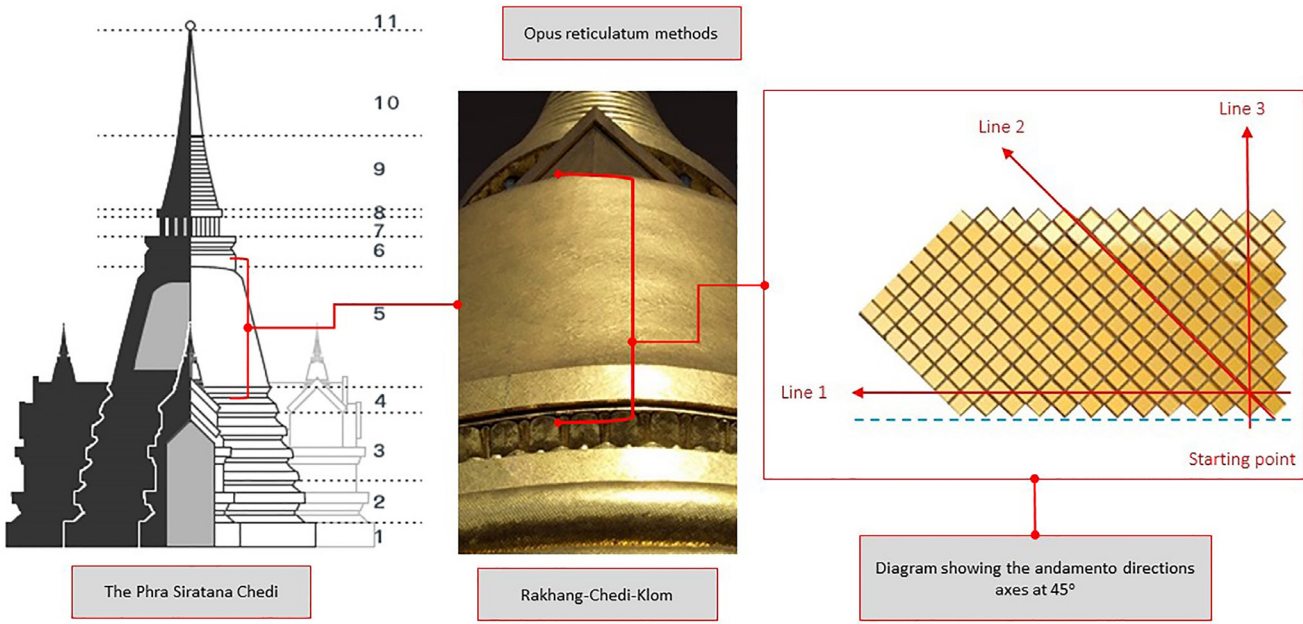
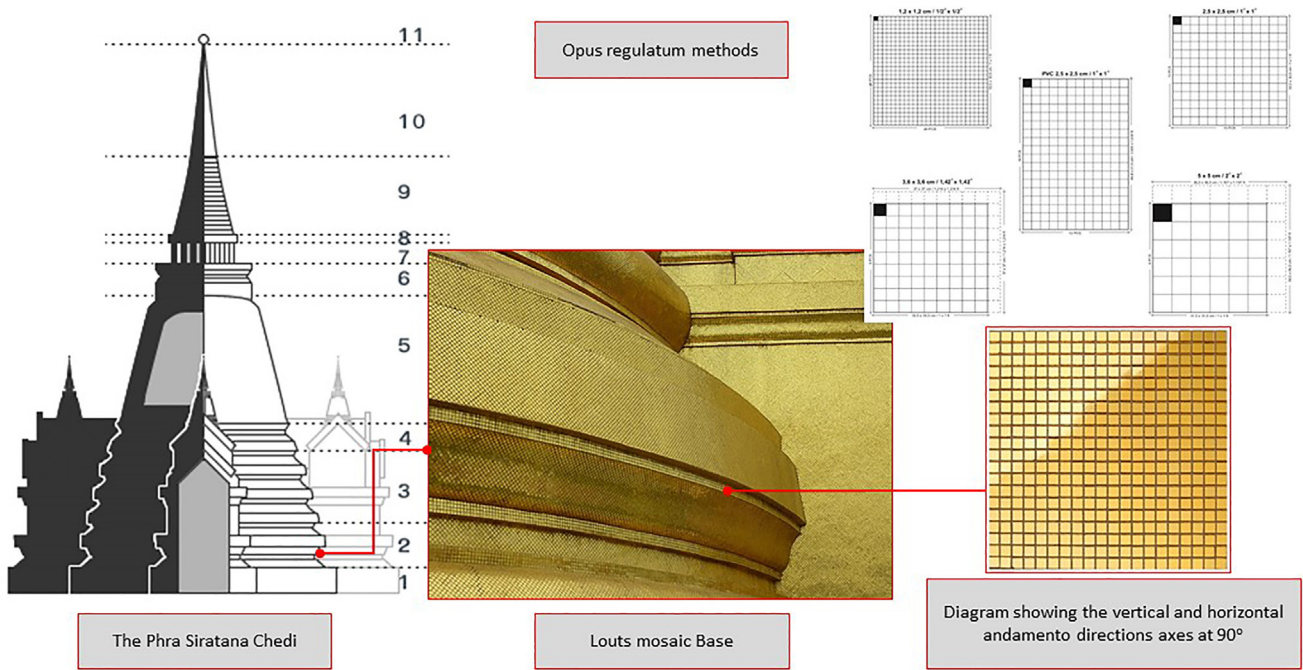
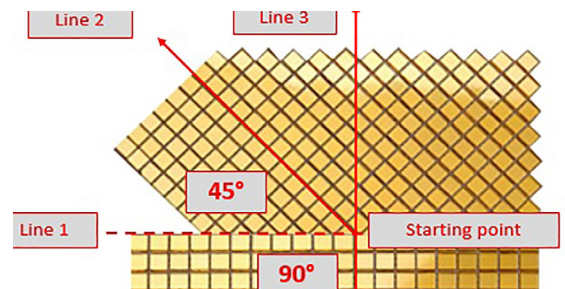


Figure 5
Diagram showing mosaic (TMGPs) directions axes at (90°) construction technique details of The Phra Si Rattana Chedi.

Figure 6
Diagram showing mosaic (TMGPs) directions axes at (45°) construction technique details of The Phra Si Rattana Chedi.

Figure 7
Diagram (TMGPs) showing the vertical, horizontal and diagonal lines andamento directions axes at (45° , 90°).

and careful observation, a clear interaction of vertical, horizontal and diagonal lines, known as TMGPs (Mosaic Geometric Patterns), emerged. (TMGPs) exert an effect on the andamento, which represents the flow or direction, of the mosaic lines (rows) within the compositions of the mosaic surface units (Fig. 7), as show in Table [2].



























No	Cad Designs of architectural elements	Mosaic details	Mosaic patterns type
1	 Swn-Pixng-Chin		(TMGPs)
2	 Pli-Yod		(TMGPs)
3	 Plong - Chanal		(TMGPs)
4	 Round chopping board		(TMGPs)
5	 Sao Han		(TMGPs)
6	 Banllang-Chedi-Klom		(TMGPs)
7	 Rakhang Chedi Klon		(TMGPs)
8	 Malai Thao		(TMOPs)
9			(TMGPs)
10			(TMGPs)
11			(TMGPs)
12	 Sum Chorandum		(TMGPs)
13			(TMGPs)
14			(TMOPs)
15			(TMGPs)

Table 2
Classification of Architectural Elements of
the Phra Siratana Chedi.

2.1.2. Decorative Thai Mosaic Organic Patterns (TMOPs):

The decorative Thai mosaic organic patterns (TMOPs) discovered within the architectural context of “Than-Bow-Lukkaew-Xkki ฐานบัวลูกแก้วอกไก่” exhibit notably remarkable manifestations of artistic ingenuity evident in the construction of the Phra Si Rattana Chedi. Emanating an aura of elegance, these TMOPs are skillfully fashioned in the form of a Lotus base (Fig. 8), assuming a pivotal role as the fundamental underpinning upon which the pagoda stands gracefully, carrying profound cultural and symbolic implications. Another exquisite representation of Thai mosaic organic patterns (TMOPs) adorns the gilded wooden door, enriched with enameled glass mosaic showcasing a floral motif rendered in dark green (Fig. 9), crimson, and silver hues.

Figure 8
Lotus base “Than-Bow-Lukkaew-Xkki ฐานบัวลูกแก้วอกไก่” mosaic Decorative (TMOPs).

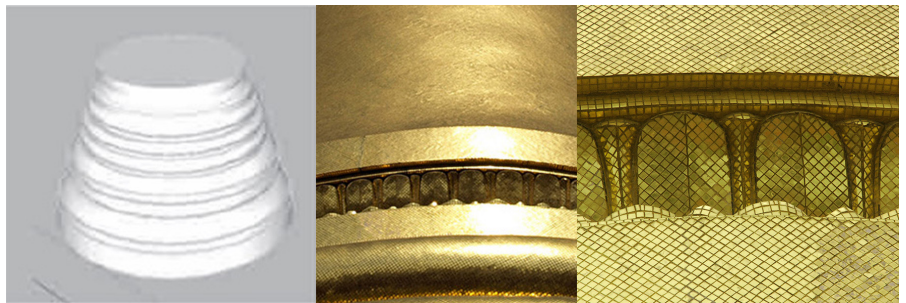
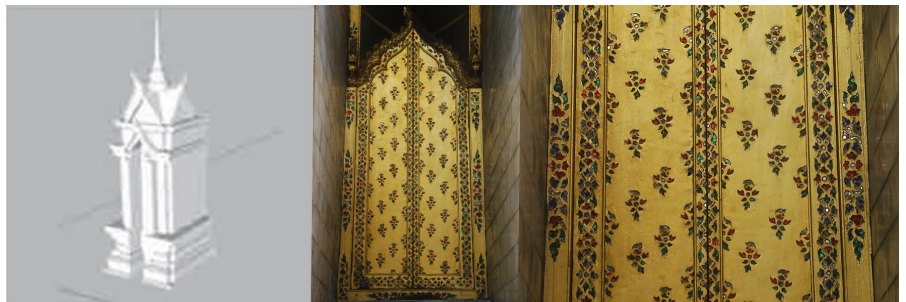


Figure 9
The entrance door mosaic flower Decorative of The Phra Si Rattana Chedi.



2.1.3. Decorative Thai Mosaic Animal Patterns (TMAPs):

The animal mosaic pattern (TMAPs) has no occurrence. The presented table [2] offers a detailed overview of the architectural elements present in the Phra Si Rattana Chedi, providing valuable insights into the mosaic patterns found within each level. The data is categorized into three types of mosaic patterns: geometric mosaic pattern (TMGPs), organic mosaic pattern (TMOPs), and animal mosaic pattern (TMAPs).

The analysis of the provides a frequency analysis of the presence of different mosaic patterns within each architectural element of the Phra Si Rattana Chedi. The data is categorized into three types of mosaic patterns geometric mosaic pattern (TMGPs), organic mosaic pattern (TMOPs), and animal mosaic pattern (TMAPs). Here is the frequency in the chart [1] analysis.

The Tope Part:

Geometric Mosaic Pattern (TMGPs): Found in all three elements (100%).

Organic Mosaic Pattern (TMOPs): Not found in any of the elements (0%).

Animal Mosaic Pattern (TMAPs): Not found in any of the elements (0%).

The Middle Part:

Geometric Mosaic Pattern (TMGPs): Found in all four elements (100%).

Organic Mosaic Pattern (TMOPs): Not found in any of the elements (0%).

Animal Mosaic Pattern (TMAPs): Not found in any of the elements (0%).

The Base Part:

Geometric Mosaic Pattern (TMGPs): Found in four out of five elements (80%).

Organic Mosaic Pattern (TMOPs): Found in one out of five elements (20%).

Animal Mosaic Pattern (TMAPs): Not found in any of the elements (0%).

Miscellaneous (Sum-Choranum):

Geometric Mosaic Pattern (TMGPs): Found in three out of four variations (75%).

Organic Mosaic Pattern (TMOPs): Found in one out of four variations (25%).

Animal Mosaic Pattern (TMAPs): Not found in any of the variations (0%).

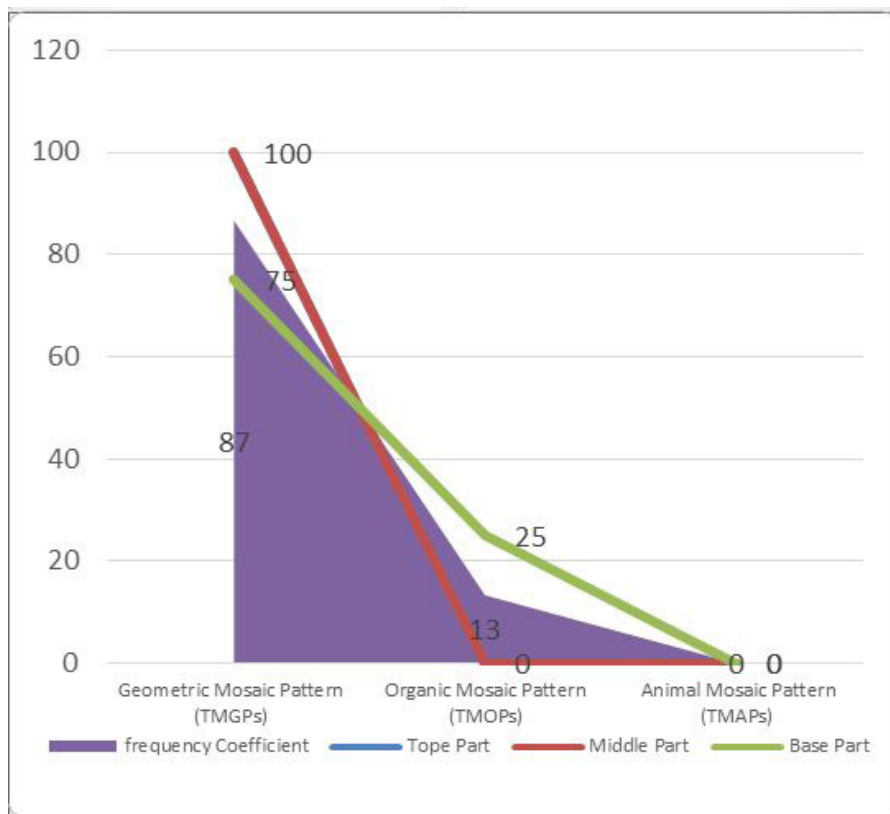


Chart 1

The frequency coefficient of the classified types of mosaic patterns in the Phra Si Rattana Chedi.

The Frequency Coefficient Average:

Geometric Mosaic Pattern (TMGPs): The average occurrence of the geometric mosaic pattern is 87% across all elements/variations. Organic mosaic pattern (TMOPs): The average occurrence of the organic mosaic pattern is 13% across all elements/variations. Animal mosaic pattern (TMAPs): The average occurrence of the animal mosaic pattern is 0% across all elements/variations.

This frequency analysis indicates that the geometric mosaic pattern (TMGPs) is the most prevalent mosaic pattern, found in the majority of the architectural elements/variations in The Phra Si Rattana Chedi. The organic mosaic pattern (TMOPs) is less common and appears in only a few specific elements/variations. The animal mosaic pattern (TMAPs) is not present in any of the examined elements/variations.

This study classifies various mosaic patterns called (TMGPs) according to several characteristics of gold glass mosaic at The Phra Si Rattana Chedi, as the following results are in Table [3].

Table 3
Classification of Andamento Types At the
Phra Si Rattana Chedi.

Andamento types	Detailedness of mosaic tile	Regularity of mosaic tile	Degree of mosaic tile alignment	Types of guideline
<i>(TMGPs) Diamond shape</i>	High	High	High	45° with the x-axis
<i>(TMGPs) directions axes at (90°)</i>	High	High	High	90° with the x-axis

The level of detailedness exhibited by each mosaic tile serves as an indicator of how effectively it represents an ornamentation source. A higher level of detailedness indicates a closer resemblance to the source of ornamentation. Consequently, the detailedness of the (TMGPs) directions at (45°, 90°) the method involving precise cutting of mosaic tiles to suit the ornamentation source is found to be high.

The regularity of a tile pertains to its uniformity in terms of shape and size. Regarding the diamond shape (TMGPs) directions at (45°), a high degree of regularity is observed. However, with regard to the (TMGPs) directions at (90°), where a background filled with regularly shaped and sized mosaic tiles is present, a high degree of regularity is noted.

The degree of tile alignment gauges how evenly the tiles conform to a specific guideline. For the (TMGPs), when tiles are laid following a 45°-degree guideline with respect to the x-axis, a high degree of alignment is evident. Similarly, for the (TMGPs), where tiles are placed along a 90°-degree guideline with respect to the x-axis, a high degree of alignment is observed.

In addition, it is difficult to clearly distinguish the andamento directions (rows) of the vertical, horizontal, and diagonal mosaic lines, which shows mixing or merging of the mosaic units (tessera). Despite the appearance of a modulus grid covering the body of the stupa. However, in certain places, such as the base of the stupa, there is a mixture between vertical, horizontal and diagonal lines andamento (rows) directions is used to express a visual rhythm.

In mosaic art, the Italian term “andamento” (plural: andamenti) refers to the arrangement and flow of mosaic pieces, known as “tesserae.” Ancient Romans and Greeks originated this technique to create visually coherent images and decorations. “Andamento”⁴ and “tiling” involve skillfully composing and fitting mosaic modules to achieve specific visual designs and expressive impacts. This approach continues to be valued in contemporary mosaic art for its ability to enhance artistic coherence and aesthetic appeal⁵.

Helped not to distinguish between directions in the andamento is to control the color of the connecting lines between the mosaic tiles or the connecting lines. The golden yellow color has been used for the join lines (grout) for each given a general harmony with the color of the golden mosaic to emphasize the chromatic value of The Phra Si Rattana Chedi body, which is the golden color as shown in (Fig. 10).

Overall, the prevalence of (TMGPs) mosaic patterns in the architectural design of The Phra Si Rattana Chedi this intriguing phenomenon highlights the pivotal significance of the structural interweaving accomplished through the implementation of the cladding grid system in the mosaic decoration,

4 H. Miles, “mosaics-miscellaneous-andamento,” 2016. [Online].

5 E. Betsy, “andamento the flow of a mosaic,” 2014. [Online].

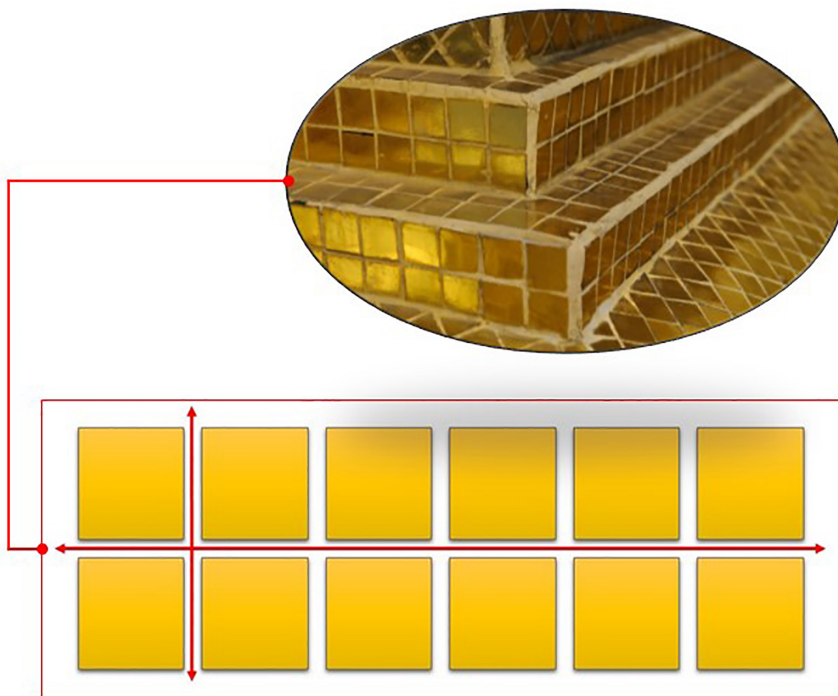


Figure 10
Diagram showing the vertical and horizontal
grout lines.

potentially reflecting historical influences from cultural exchanges between the Greco-Roman world, with its building techniques called (Opus Reticulatum and Opus Regulatum) (Pitts 2017: 134), and Buddhist regions. A noteworthy aspect emerges from the juxtaposition of surfaces, where the various axes' (rows) directions are harmoniously unified by employing identical gold mosaic colors and tile sizes, seamlessly integrating with the essential architectural elements.

2.2. Classification of the Mosaic Materials of Phra Si Rattana Chedi:

Gold glass mosaic, also known as gold “tesserae”, has experienced a resurgence in popularity as a medium for artistic expression. Its origins can be traced back to the Romans, who first utilized it in late antiquity for both floor and vault decoration. Notable examples of its early use include the depiction of a golden wreath in a floor mosaic at Antioch around 300 AD and the portrayal of gold vessels in some of the vault mosaics at Santa Costanza in Rome.

Historically, the first treaty of friendship, trade, and navigation between Siam and Italy, signed in 1868, played a pivotal role in fostering direct relations between the two countries. Over time, friendships between the nations evolved through diplomatic efforts as well as through encounters between significant figures, such as the meetings between the Duke of Genoa and the King of Siam, and even the King of Siam’s own journey to Italy. During this period, from 1868 to 1930, Italy’s influence in Siam was notable, particularly in the realms of art and architecture, with Italian professionals serving as representatives of European culture in Siam. This period marked an important phase in Siam’s modernization, wherein the presence of this “Italian intellectual colony” significantly contributed to the development of the country.

One remarkable testament to the enduring relations between Italy and Siam is the mosaic adorning the Phra Si Rattana Chedi (Stupa) in the Emerald Buddha temple, known as Wat Phra Kaew. The mosaic covering this important structure was sourced from Italy, more specifically from Angelo Orsoni s.r.l., as indicated in an email from Luca Chiesura, the Technical Commercial Manager, dated

June 28, 2023. The specifications of this gold mosaic are impressive, featuring natural yellow gold with 24 kt gold leaves. Each tessera, measuring 20x20 mm, is meticulously attached in a reverse orientation onto paper, employing traditional techniques reminiscent of the Roman and Byzantine eras. The process of fabricating this extraordinary materials takes place in their furnace located in Venice, further preserving the ancient artistry associated with gold glass mosaic.

In 1982, the oldest Italian mosaic company, Orsoni, took on the ambitious project of covering the Stupa with a 24-carat golden glass mosaic (Fig. 11), thereby blending tradition and innovation. The Orsoni furnace, established in Cannaregio in 1888 and the only one of its kind in the historic center, serves as the living embodiment of the craft's enduring legacy.

Figure 11

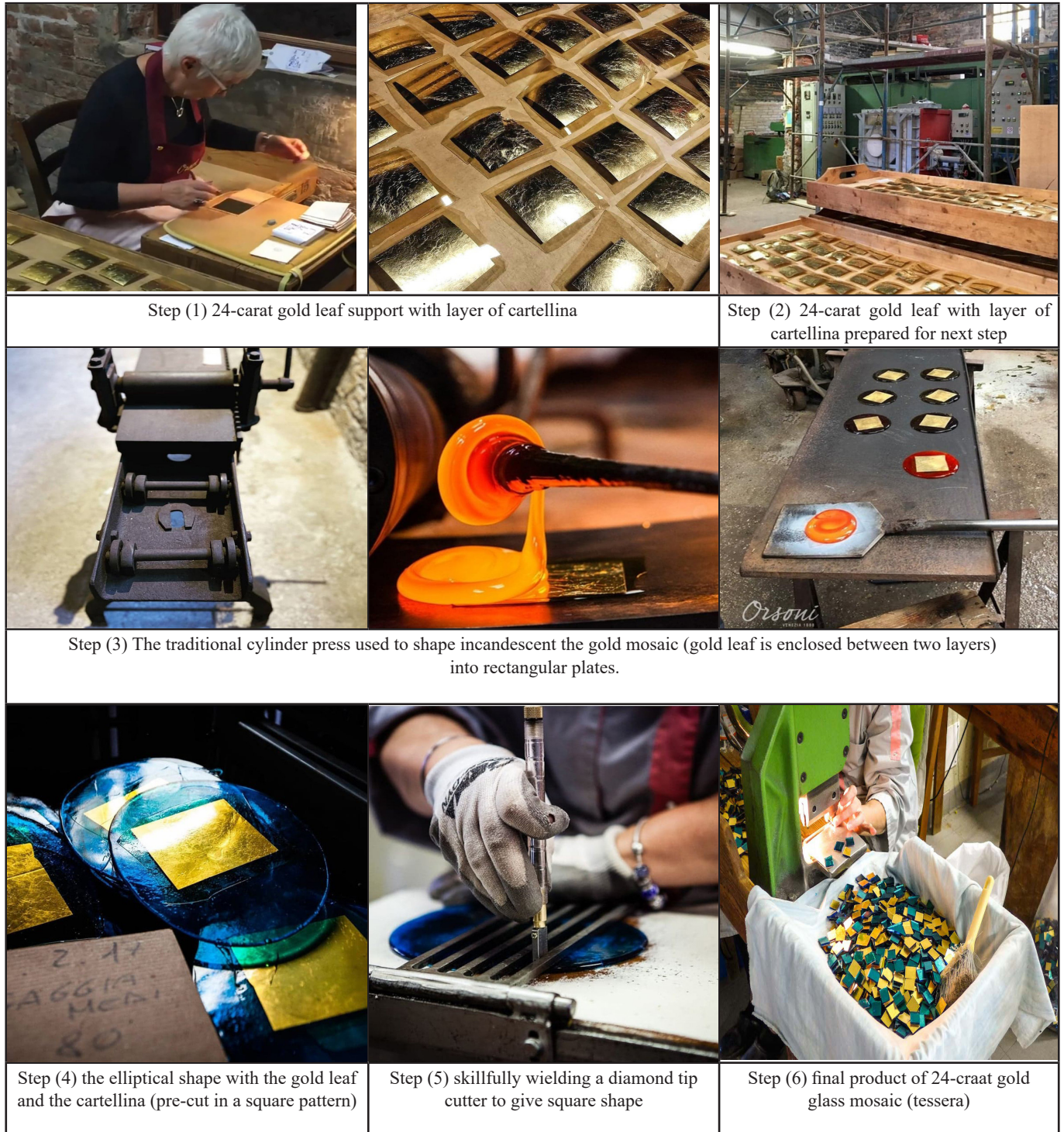
The Historic Venetian Furnace Crafting 24K Gold Leaf Mosaics, Colored Gold, and Venetian Smalti in a Vast Spectrum of 3,500 Colors, including 20 Shades of Gold. (orsoni, "orsoni," [Online]. Available: <https://orsoni.com/>).



The presence of such intricate and historically significant gold glass mosaics in Siam stands as a compelling testament to the enduring bond between Italy and the friendly country, and it continues to be an integral part of their shared cultural heritage. The craftsmanship and artistry involved in these mosaics serve as a poignant reminder of the historical exchanges and collaborations that have enriched the artistic traditions of both nations.

The daily production of 300 kilos of gold mosaic and the yearly output of 10 to 12 thousand square meters of mosaic tessera demonstrate the scale of this specialized craft. This technique holds great significance as it embodies the opulence and luxury associated with the precious metal, gold, while also carrying profound symbolisms relevant to Thai Buddhist arts. Due to its use of raw materials like gold leaf for decorating important buildings, the gold mosaic tessera commands a higher cost, making it an extravagant product.

However, it is essential to recognize that the craftsmanship involved in creating these mosaics requires a high level of expertise from the glassworker. Even in the present day, a glass tesserae factory in Venice, Orsoni Smalti Veneziani, continues to dedicate specific workdays to producing gold glass mosaic tesserae using authentic gold leaves. The modern slabs of gold mosaic tesserae exhibit an elliptical shape, featuring the gold leaf and "cartellina" (pre-cut in a square pattern) at the center. The tesserae are skillfully cut only from the central area of the disc, ensuring a seamless appearance without any visible edges. The remaining glass from the slab that is not used for the tesserae is recycled, further highlighting the sustainable approach to production (Fig.12).



The process of creating these intricate mosaic tesserae involves placing a 24-carat gold leaf, weighing 0.022 grams, on a nearly circular damp glass surface that is 1.0 mm thick. The gold leaf is meticulously hand-beaten into a square shape and applied cold. Subsequently, 200 grams of molten glass, which may be colored in various shades such as yellow, green, or amber, is poured over the gold leaf. The materials are then subjected to firing at 1200 °C and annealed before being gradually cooled to room temperature. The cooling process includes a brief period at 600 °C after reaching the firing temperature of 1200 °C. Once the materials has cooled, it is carefully sliced into strips, and any burrs that do not contain gold are meticulously removed before the tesserae are sold in rods, each

Figure 12
 Progressing steps for Modern slabs, cutting procedure, and the final product tessera from Angelo Orsoni s.r.l., glass tesserae factory in Venice, Italy.
 [orsoni, “orsoni,” [Online]. Available: <https://orsoni.com/>]. [R. Bisazza, Interviewee, From Gaudi to the portraits of the sheikhs, the new life of the Orsoni furnace. [Interview]. 13 October 2017.]

measuring 2 to 10 centimeters in length (Bustacchini 1973: 56).

In the context of Buddhism, gold holds profound symbolic significance, representing various virtues and ideals such as knowledge, enlightenment, purity, happiness, and freedom. As a result, gold is associated with the sun or fire in Buddhist symbolism, further accentuating its spiritual and auspicious connotations. The integration of gold with other elements is discouraged in Buddhist art, as it is believed to diminish the intrinsic brilliance and purity of the gold itself. Consequently, gold mosaics, made exclusively from pure gold, are a predominant feature in the decoration of religious and royal edifices within the realm of traditional Thai architecture.

A compelling example exemplifying the application of pure gold mosaic can be found in the case of Phra Si Rattana Chedi. This revered architectural structure is adorned with a resplendent 24-carat gold mosaic “tessera”, reflecting the unwavering commitment to imbuing sacred spaces with the radiance and symbolism associated with gold in Buddhist beliefs. By utilizing pure gold mosaic, Phra Si Rattana Chedi embodies the spiritual essence and virtues attributed to gold in Buddhism, thereby bestowing a sense of divine sanctity and reverence upon the temple. The practice of adorning religious and royal buildings with gold mosaics in traditional Thai architecture epitomizes the deep-rooted cultural and religious significance of gold as a cherished medium for artistic expression and spiritual reflection within the Buddhist tradition⁶.

Conclusion

In conclusion, the exploration of the diverse mosaic patterns and materials used in The Phra Si Rattana Chedi at Wat Phra Kaew in The Grand Palace, Bangkok, provides valuable insights into the historical and artistic significance of this monumental art form in Thailand. Based on the findings and analyses, the following points can be drawn:

1. The history of modern mosaics in Siam (Thailand) owes its achievements to cultural and commercial exchanges with Italian mosaic companies, emphasizing the international influences that have shaped Thai mosaic art.
2. The frequency analysis of mosaic patterns in The Phra Si Rattana Chedi reveals that the geometric mosaic pattern (TMGPs) is the dominant pattern, prevalent in the majority of architectural elements and variations. The organic mosaic pattern (TMOPs) appears less frequently and is limited to specific elements/variations, while the animal mosaic pattern (TMAPs) is absent, showcasing the preference for geometric motifs in the temple's mosaic design.
3. The prevalence of TMGPs in the architectural design of The Phra Si Rattana Chedi underscores the importance of the cladding grid system in achieving a harmonious structural interweaving. This phenomenon suggests potential historical influences from cultural exchanges between the Greco-Roman world and Buddhist regions. While there may not be a direct relationship between Greco-Roman mosaic techniques and Thai mosaic decorative, the possibility of indirect influences or inspirations from various artistic forms over time should be acknowledged.
4. However, it's essential to recognize that the interpretation of patterns presented in this article is one perspective. Given the current lack of evidence

⁶ Academia (n.d.). Retrieved from https://www.academia.edu/33409893/Buddhist_Texts_on_Gold_and_Other_Metals_in_East_Asia_Preliminary_Observations.

and documentation on the mosaic patterns in Phra Si Rattana Chedi, further investigation and research are necessary. A comprehensive study would lay the groundwork for creating new knowledge, filling the gaps in the history of Thai mosaic patterns, and establishing potential connections to the global history of mosaics.

5. Golden mosaics hold significant importance in Thai architecture and the embellishment of royal temples, playing a central role in the creation of colossal and awe-inspiring art in Thailand's cultural heritage.

In conclusion, the study of mosaic patterns and materials in The Phra Si Rattana Chedi sheds light on the interplay of artistic influences and historical contexts that have contributed to the rich mosaic tradition in Thailand. The intricate patterns and craftsmanship showcased in this architectural wonder attest to the enduring significance of mosaic art in Thai cultural heritage. Further research in this field would contribute to a deeper understanding of the mosaic traditions and their global connections, providing valuable insights into the artistic exchange between different cultures across history.

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