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AN ATTEMPTED RECONSTRUCTION OF DESIGN PROCEDURES
AND CONCEPTS DURING THE REIGN OF SULTAN QĀYTBĀY
(872/1468-901/1496) IN JERUSALEM AND CAIRO:

With special reference to the Madrasa Al-Ashrafiyya
and the Minbar in the Khānaqāh of Farag Ibn Barqūq.

Volumes I-II and Portfolio

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(PhD/MSc/MLitt/MAdmin/Diploma) PhDTITLE OF THESIS AN ATTEMPTED RECONSTRUCTION OF DESIGN PROCEDURES AND CONCEPTS DURING
THE REIGN OF SULTAN QĀYTBĀY (872/1468-901/1496) IN JERUSALEM AND CAIRODate 24th August 1979. Signature *Archibald George Walls*

Abstract

Using existing architectural evidence, supported by historical records and a comparative study of the contemporary architecture in Cairo a logical design sequence is followed to produce a reconstruction of the Madrasa of Sultan Qāytbāy, (al-Ashrafiyya) 887/1482, built at the Third Shrine of Islam, al-Ḥaram al-Sharīf in Jerusalem, and which was destroyed by an Earthquake in 952/1545.

Other than the unique reconstruction of al-Ashrafiyya, the main findings are, a proportional geometry and decorative grammars. The proportional geometry controls the plan and through its details the elevations, these in turn are related to the numbers and heights of stone courses forming standardised components.

Some of the decorative areas combine to form grammars expressing visually their architectural context. Irrefutable support for such grammars is provided by the stone Minbar of Sultan Qāytbāy presented to the Khānaqāh of Farag ibn Barqūq, 888/1483, in Cairo.



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In accordance with the appropriate regulations I hereby submit the thesis detailed above for examination and I declare

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KEY TO THE ABBREVIATIONS IN ALPHABETICAL ORDER

- AARP Art and Archaeology Research Papers.
- AI Ars Islamicas.
- AIJ The Architecture of Islamic Jerusalem.
- AR Architectural Review.
- AUC American University in Cairo.
- CIA Corpus Inscriptionum Arabicarum.
- GU Generating Unit.
- JPOS Journal of the Palestine Oriental Society.
- JSA Journal of the Society of Arts.
- MASI Memoirs of the Archaeological Society of India.
- QDAP Quarterly of the Department of Antiquities in Palestine.
-
- 000 This symbol encloses the number of the monument in the Index to Mohammedan Monuments in Cairo.

0.01 The Dilemma of Unity in Islamic Architecture.

Scholars in all areas of Islamic study are fascinated by and are often at pains to underline the unity inherent in Islam. This can be manifested in a multitude of ways, it can be demonstrated against the theological background established by the Qur'an, or, it may be seen as transcending the barriers enclosing the various arts and sciences of Islam.¹

If it is seen in terms of art and architecture, it can be explained on the grand scale by trading connections built up in times of peace and stability or by forced population movements in the face of conflict, both forces that can transfer from one geographical location to another the artistic traditions, expertise, and techniques previously reserved to the former location but which through their transference are unified with other Islamic traditions.² The visual expression of these artistic traditions formed by the social, psychological, ethnic, religious, economic functions are all involved as Grabar says:

"Despite the overwhelming variety of motifs, it is possible to organise them according to broad categories the first and largest consists of vegetal elements the second group consists of designs which can only be defined as geometric the third group is a miscellaneous category, which after further study, may be defined more exactly or incorporated into either one of the first two".³

Ettinghausen in his introduction to his essay 'Interaction and Integration in Islamic Art' summarises what I find to be my dilemma with regard to unity, he writes that, "In spite of the apparent uniform character of Islamic art everybody who becomes familiar with its various aspects realises more and more the tremendous variety in the different regions and even in the changing periods within a single territory".⁴ Faced with all the assertions concerned with the presence of unity especially in art and architecture one question seems to me to be predominant: if there/

there is this unity, what is its physical nature and how extensive is it in specific instances, and can I, as an architect, isolate and recognise the unity in a manner which could conceivably be appropriate to the medieval architect or craftsman?

I can see that the nature of unity can be visually expressed by, and is found within, the three broad categories noted by Grabar; but there are others in the field of Islamic art who maintain that a meaning can be attached to a specific design and that this meaning can be verbalised. I find that I cannot accept that a verbalised meaning can be conveyed by each and every decorative composition, but I find I cannot deny the likelihood of a visualised one. In fact my hypothesis is that in the notable examples of high quality Mamlūk architecture a visualised meaning does exist. But, just as the expression of the nuances and form of a piece of music have a greater clarity when in an exposé use is made of a musical instrument to illustrate them, rather than an excessive reliance on words to provide the meaning, I believe that architectural experiences are often best expressed in visual terms. For example, later in this Dissertation the stone minbar presented by Sultan Qāytbāy to the Khānaqāh of Farag b. Barqūq is analysed in great detail, to my eyes it offers a statement not only on its own symmetry, which is normal for a minbar, but much more it concerns itself with a statement about the symmetry of the Khānaqāh; orally to present my findings and the reasons behind them takes tens of pages compared to a graphical presentation of only five figures.

How extensive is unity, and can it be measured? If it can be measured where on a scale ranging from the macro-levels to the micro-levels does it lie? Does it embrace the scale's extremities or does it exist for only part of the scale? I think of unity in the architectural context as having to be physically demonstrable, I am therefore perplexed when it/

it is suggested that aspects of unity extend beyond the point where man cannot rely on his own senses when forming his judgements and instead has to take cognisance of facts inconceivable to and undiscovered by the artists of earlier historic periods. This type of thinking is provided by Nasr in a footnote during a discourse on 'The Cosmos and its Mathematical Study'.

"As one of the foremost Western students of Islamic architecture in its relation to mathematics, Keith Critchlow, has shown certain complicated patterns of Islamic art are identical with the internal structure of various natural substances discovered by modern science. Critchlow has said that it seems that the Muslims discovered the inner structure of matter without splitting molecules and atoms. This can, in fact, be easily explained if one understands the traditional role of number and figure, the hierarchy of universal existence and the principle that the 'heart' of physical objects can only be understood in an ultimate sense through a knowledge of their archetypes, rather than by means of indefinite analysis and division, although every analytical study of a legitimate nature reflects again the archetype of the object in question on its own level of reality".⁵

Am I really being asked to accept that since the discoveries of modern science reveal a mathematical structure at a microscopic level that this has any bearing on the superb geometrical patterns of Islamic art, whether they were produced by the Umayyads or the Ottomans?

Referring again to Nasr, he concludes his discourse with the well worn cry.

"Nowhere is the sacred character of mathematics in the Islamic world view more evident than in art, where with the help of geometry and arithmetic matter is ennobled and a sacred ambience created wherein is directly reflected the ubiquitous Presence of the One in the many".⁶

In one sense I admit to this being a final statement, but in another sense it should be the beginning of Islamic architectural appreciation and investigation leading into areas where it may be possible theoretically to reconstitute Islamic works of art from criteria deduced from other known and existing works of art. Those of us who are fortunate enough to work on the evidence at first hand as a job, or, those who have time from other interests for such diversions, must strive/

strive to understand and show precisely what was in the minds of the craftsmen and how they detailed their architectural contributions to make a statement. An efficacious route is to choose a high period in the architectural arts sustained either by one powerful patron or by one atelier over a reasonable period of years. Having thoroughly investigated the period it would then be advantageous to use this fund of knowledge by applying it to the periods immediately before and after the chosen one. However, in my case the first stage has still years of basic cataloguing to do and so I have not embarked on the second stage, nor have I had the opportunity to trace the antecedents of the many decorative elements current at the time of Sultan Qāyqbāy.

In a recent article by Grabar he concludes it thus:

"Whatever the reasons Islamic art did manage to evolve a type of visual tension which is quite different from the man-centredness of Western art or the natural complexities of Chinese art. It is tension which ought to be stressed, it seems to me, for, in a deeper sense, it bequeaths the interpretation and pleasure of the artistic experience to the viewer and leaves him free to make his own choices and judgments. Therein lies its greatest achievements, even if we cannot quite explain as yet why it was so".

What is being stressed is clearly the visual impact and the subsequent stimulation produced by objects made in the Islamic traditions. My fieldwork so far has lead me to similar conclusions which I think are justified and supported by the architectural evidence.

The methods I have used to reach my conclusions are, for the architecture accurate surveys drawn-up at a scale not smaller than 1:50, and for the architectural decoration paper squeezes. (See Appendix A). But I have also consciously developed my own natural visual sequence into a chronology of 'Appreciation Levels'.

The method using Appreciation Level is an attempt at recording the precise order in which an initiate assimilates the numerous elements of a design/

design with continual reference back to previous visual experiences and mental stimuli. I suggest that in the elements a natural order can be found which, in general terms, assists the efforts of the uninitiated as well as those initiates who can apperceive the visual compatibilities and conflicts reflected in the design. With these activities in mind I originally chose the term 'Recognition Levels' before discarding it on the grounds that it implied the item is 'known again' or 'identified as known before', thus I saw the term to be restrictive. On the other hand the word 'Appreciation' is apposite, it may be defined as:

estimation; judgement; perception; adequate recognition; rise in value; critique.⁸ To each of the words chosen to qualify and define the word 'Appreciation' can be ascribed a function to be attempted by a person when confronted by an object for the first time. This, therefore, is a more accurate term to apply to the ordering of elements.

There is, I think, a general thought process connected to Appreciation Levels regardless of the size and type of artifact. The first level is the recognition of the material(s) used in the artifact's construction, assuming that there does exist between the observer and the observed a satisfactory proximity. The second level in this chronology can involve an appreciation of size, of scale and of the architectonic qualities and purposes of the object, leading on perhaps to an appreciation of the over-all shape, and then on to the substructures or repetitious elements which may then lead back to a fuller appreciation of the over-all shape by emphasising it. At this stage in the chronological ordering of the Appreciation Levels a slight change can occur in the type of information perceived, the object's main visual elements come into focus allowing the component parts to be determined and classified, e.g. a geometric skeleton with nodes or the softer curving lines of vegetal patterns.

This/

This last Appreciation Level is likely to be the final level attained by the observer and thus it is here that the judgements concerning the beauty and the interest of the artifact are made based on the design content seen in this and the preceding levels. I like to think that as the medieval craftsmen realised the limited visual abilities of the average casual observer so he strived to present the major design elements with the strength, clarity, and meaning which might be comprehended without excessive mental exertions. The prizes await those with more developed powers of observation and perception in the guise of further Appreciation Levels hidden in the subtle and complex relationships of the smaller repetitive elements and whose exploration creates new rythms and harmonies.

0.02

Background to the Dissertation

Obviously when in 1968 I arrived in Jerusalem for the first time to launch the British School of Archaeology in Jerusalem's Architectural Survey I did not say to myself, 'Now, show that a tripartite relationship exists between the proportional systems controlling the overall form of a building, and the detailing of an elevation which relates back to the height of the stone courses.' My sights were considerably lower, they had to be because I was uninitiated in the ways of Islam and its cultural heritage, but just as important a reason was that there were few sources where material relevant to the arab medieval architecture of Jerusalem could be found. The two principal sources still are the arabic inscriptions so well researched and presented in their historical settings by Max van Berchem in the Corpus Inscriptionum Arabicarum⁹, and the architectural photographs taken by Sir Archibald Creswell¹⁰ before the 1927 earthquake and the more recent architectural depredations conceived and accomplished by political hysteria. The minor sources in this specific area of study are the works of Clermont-Ganneau¹¹, Vincent and Abel¹², the two journals of the Pro-Jerusalem Society/

Society¹³, and contributions of the architects Harvey¹⁴ and Briggs¹⁵.

Between 1968 and 1975 while Architect to the BSAJ I recorded a collection of buildings along the Tariq Bāb al-Silsila with foundation dates spread throughout the Mamlūk Period 1250-1517. As my survey gathered impetus an awareness of the proportions underlying the designs of the buildings gradually dawned on me. Eventually this awareness extended to encompass the articulation or elevational treatment and the areas of applied decoration.

The first building to be surveyed, the Turbat of Barakat Khān c.1280-90, provided the first (and only Islamic?) example of 'integrated decoration', where the detailing of three separate architectural elements expressed not only an aesthetic value, but more importantly they expressed their structural functions. (See Appendix C).

The Mausoleum of the amīr Kīlānī c.1350, suggested another aspect of Mamlūk design, a system of proportion based on a module. The module in this instance equals the width of the 'gap site' into which the Mausoleum was fitted. (See Appendix B).

Indubitably the most decorated building for its size in Jerusalem, the tiny Mausoleum of Turkān Khātūn 1352-53 introduced me to a synonymic system of decoration or more simply interrelated. This is expressed by three identically sized internal panels divided into the same basic design fields and borders, but there is a visual twist, at first sight the decoration of each of the panels appears to be independent of the other two, but later it transpires that their origins are identical. (See Appendix C).

Being aware of the harmonies introduced into the designs of the buildings I had surveyed through the use of proportional and decorative systems I applied myself to the discerning of these same qualities elsewhere in Mamlūk/

Mamlūk Jerusalem. The building which is indisputably the culmination of the Mamlūk architectural arts in Jerusalem was coincidentally the last structure I recorded while Architect to the BSAJ, the Madrasa of the Sultan Qāyṭbāy known as al-Ashrafiyya, 886/1482. From the start I concentrated on the decoration of al-Ashrafiyya as an Israeli was supposed to have carried out an architectural survey: this has now been published in Hebrew¹⁶ which has the advantage that few people will read it and perpetuate his gross inaccuracies.

It was al-Ashrafiyya that made me aware of the part decorative systems could be made to fulfill in making a specific visual statement not just with two or three decorative areas but visual series composed of many more. Unfortunately al-Ashrafiyya's fabric over the centuries has succumbed to the devastation of earthquakes and the abrasiveness of the elements with the result that the quantity of decoration has been reduced to the detriment of a comprehensive vocabulary of Mamlūk designs. However, although al-Ashrafiyya is badly disfigured it is still the core of my thesis due to its unique position, its founder, and its architectural conception and because I believe that through their study a practical understanding can be gained of the procedures followed by architects in the Mamlūk Period.

My studies in Cairo have through the minbar presented by Qāyṭbāy to the Khānaqāh of Farag b. Barqūq supported my hypothesis of decorative systems making statements. Cairo was also most beneficial in providing clues and in some cases the answers to queries which had arisen in al-Ashrafiyya.

Before embarking on the meat of the Dissertation I must make clear that I view my work so far as only a beginning and that I hope its value is two-fold; it will provide primary material for others in the areas of Islamic architecture and the fine arts, as well as adding to the understanding/

1.01 The Sources

Today's building represents the result of a checkered building process, which was devastated by an earthquake a short time after its completion, thus considerable reliance must be given to the sources contemporaneous with the construction of al-Ashrafiyya. One such document is the 22.5m long waqfiyya (title deeds of a religious endowment) written by al-Sheikh-Khitab ibn Omar al-Dauḥawī¹ for Sultan Qāytbāy; it details the Old Ashrafiyya before renovation, the arrangement of the completed al-Ashrafiyya concluding with the land and buildings forming the waqf (religious endowment). A second source is Qāḍī Mujīr al-Dīn al ʿUlaymī, Al-Uns al-Jalīl² which acts as a guide to the religious monuments in Jerusalem and Hebron at the time, included in it is information concerning the founders of the various foundations, the construction dates as well as descriptions of their physical form.

In modern times the work of a number of people has encompassed al-Ashrafiyya in one way or another, however in my opinion only two add substantially to the historical record. The first, and the foremost, must be the epigraphist Max van Berchem's monumental and exhaustive work Corpus Inscriptionum Arabicarum³ which layed the foundations on which any study of the Islamic architecture of Jerusalem must be based, he edits three hundred inscriptions in arabic, provides a translation of each and in his commentaries extends his remarks beyond the purely historical background information to associated architectural aspects. The second modern author is Shlomo Tamari⁴ who has to be referred to as he is the first to publish large scale drawings of the plans and elevation of al-Ashrafiyya⁵. Unfortunately it will become apparent as the description of al-Ashrafiyya advances that Tamari fails to reach even the most minimal standard of architectural recording which is the essence of the type of study attempted by him. The danger inherent in the/

the article is that through the impression of confidence and competence Tamari's study will be accepted without any hesitation by all who have not had to check his accuracy⁶.

1.02

A Skeleton Chronology

Van Berchem in his commentary discusses in minute detail the textural evidence surrounding the construction of al-Ashrafiyya which he considers to be of archaeological value. The essential dates for any architectural history of al-Ashrafiyya are as follows:

870-72 A small simple madrasa typical of Jerusalem was constructed for Sultan Khushqadum on top of the west riwāq of al-Ḥaram al-Sharīf by the amīr Ḥasan al-Sharīf Superintendent of the two Ḥarams in Jerusalem and Hebron⁷.

872 At the time Khushqadum died the Old Madrasa's exterior was complete, and a year later the interior was finished. Following this death the amīr Ḥasan travelled to Cairo to pay homage to the new sultan, al-Sultan al-Malik al-Ashraf Abu-n-Naṣr Qāyrbāy, and to request that the madrasa in Jerusalem might be honoured with Qāyrbāy's name which, on his acceptance, could then be inscribed on the entrance of the old Madrasa.

873 The interior of the Old Madrasa (now named al-Ashrafiyya) is completed by the amīr Birdibak Tāji, the new Superintendent of the two Ḥarams. The entrance was by the same gate that lead up to the Minaret of Bāb al-Silsila (Ma'dhanat al-Maḥkama) by way of a narrow and difficult stair. The accommodation was composed of a meeting hall (majma^c), a passage way, and a separate room for the sheikh all on top of the riwāq. Opposite and over the east iwān of the Madrasa of the amīr Mankalī-bughā (Madrasa Baladiyya was a courtyard or terrace with some more rooms.

875/

- 875 The construction text of the Old Madrasa is dated 1st Rabi^c I of the year 875 (28th August 1470) and includes the name of Nāṣir al-Dīn Muḥammad b. an-Nashāshībī, treasurer of Qāyṭbāy who, in Muḥarram 875 (July 1470), was appointed Superintendent of the two Ḥarams.⁸
- 876 Qāyṭbāy gives an order to demolish and replace the Old Madrasa.
- 877 Qāyṭbāy attaches to the madrasa sixty sufīs, pupils and lawyers, he also gave waqf property situated in the town of Gaza. The upper parts of the Old Madrasa are partially demolished⁹.
- 880 On Monday, 27th Rajab, Qāyṭbāy visited Jerusalem and attended the mid-day prayers in his madrasa. He was so far from being impressed with the appearance of the Old Madrasa that he ordered its demolition prior to the construction of an edifice more in keeping with his royal stature.
- 884 A demolition order arrived in Jerusalem on Wednesday, 3rd Rabi^c II.
- 885 The foundations of the new al-Ashrafiyya 1st Phase were cut on Sunday, 24th Sha^c bān. The architects commenced with the construction of the meeting hall for the sufīs (al-majma^c ahl-sufiyya) below the riwāq. At the same time they commenced the demolition of the Old Madrasa on top of the riwāq¹⁰. The workmen may have been local and therefore not up to the standards aspired to by the Sheikh of the Madrasa who went to Cairo to involve Qāyṭbāy more fully in the project.
- 886 A team of masons, architects, sculptors, under the leadership of a highly skilled and trusted Christian architect were dispatched from Cairo. The Christian used the authority granted him to demolish/

demolish the recently embarked upon building activities (forming al-Ashrafiyya 1st Phase) because they were unsatisfactory. He extended the demolition work southward to include three arches of the riwāq, and so began the construction of the final al-Ashrafiyya¹¹.

887 Commemorating the completion of the construction of Al-Ashrafiyya is an inscription dated Rajab I of the year 887 (August-September 1482)¹². As was the normal practice the marblers began their work after the completion of the structure.

1.03 The Description

The importance of obtaining a contemporary description of a historic building cannot be undervalued, especially when it describes a royal foundation in the Third Shrine of Islam which shortly after was to be destroyed by an earthquake. Again, I will rely on (and paraphrase) van Berchem while he steers me through the complexities of Mujīr al-Dīn's text where it deals with al-Ashrafiyya's planning arrangements¹³. At present I will ignore van Berchem's own identification of specific items since we occasionally disagree: let it not be forgotten that my purpose is an attempt at recreating the design and its processes and that any arguments at this stage might be distracting and unnecessarily complicate the issues.

"The ground floor comprises the meeting hall enclosing three of the west riwāq's arches. This has two doors: the first is in the north wall and alongside it is a window opening on to that part of the riwāq under the Madrasa ^CUthmāniyya; the second, which is in the east wall, is flanked by two windows, one to the left and one to the right. In the west half of the back wall of the hall is a hollowed out mihrāb, in the wall's eastern half is a window. Adjoining the hall on the south is a porch in magnificent stone, in its west wall is the door opening/

opening through which access is gained to the madrasa on the first floor.

'Beyond the door is a small vestibule, paved in marble: to the right is a small room; in the rear wall is a bench covered in marble; to the left, another door leads to the spacious stairs rising up to al-Ashrafiyya's first floor and the Minaret of Bāb al-Salām. At the top of the stair a door gives on to an open courtyard paved with white flagstones. In its north wall a rectangular doorway leads into an attractive vestibule, inside and on the right side a corridor connects with the Madrasa, built above the ground floor's meeting hall.

'This first floor Madrasa is made up of four īwāns facing each other. In the rear wall of the south or Qibla īwān, which is the most grand, is a mihrāb niche. To the east of it two windows open on to al-Ḥaram, and on the west, two more windows give on to the top of their staircase. In the īwān's east wall three windows open on to al-Ḥaram towards the terrace of al-Sakḥra: opposing them are three windows to the courtyard. The North īwān has in its north wall two windows to al-Ḥaram and two more in its east wall. The East īwān is a loggia and has three arches sitting on two marble columns. In the upper wall are extremely fine stain glass windows. The West īwān has one window on to the courtyard.

'The floor is entirely paved with polychrome marble and throughout are marble dados. All of the ceilings are timber and are decorated with gold leaf and blue paint. It is very stable and has been assembled with art and nobility.

'Near to the North īwān is a vaulted room which is entered by way of the vestibule, its door is found to the left of the entrance. It has a polychrome marble floor and is also surrounded by marble dados, two windows give on to the North īwān of the Madrasa. Above this room is found/

found an attractive room lit by a window giving on to the interior of the Madrasa and by another on to the courtyard.

'The foregoing accommodation is joined by a door with another terrace or court where there are some vaulted rooms for ablutions and lavatories, all of them are constructed over the two iwāns, south and east, and the other parts of the Madrasa Baladiyya.

'Al-Ashrafiyya contained cloth and chandeliers of such great beauty that one could not find the like elsewhere. The roof is covered externally with well fitting lead sheeting." Here is where the description ends.

The majority of the above description can be verified by those parts of al-Ashrafiyya still in existence, and with such a description those parts that are no longer extant can be imagined, as they have been by van Berchem and Sharon. But, as neither of them considered the practicalities of the architectural design which must have had a direct bearing on the final decisions; this I will attempt to remedy.

There is still outstanding one further contemporary source describing the elevational treatment of al-Ashrafiyya: "the first representation of the Dome of the Rock occurs in Bernhard of Breydenbach's Peregrinationes in Terram Sanctam (1486) after Edward Reuwich of Utrecht".¹⁴ From my own intimate knowledge of the Dome of the Rock and al-Ḥaram, the drawing is as true a representation of the buildings as is possible: I can identify precisely even the windows in the buildings along the west wall, it also shows the double ramped wall-head along al-Aqsa's east wall which was noted by Hamilton¹⁵. Thus we are considering a drawing which is not a symbolic representation of the Holy City drawn from another's experience, but one drawn on the spot.

1.04 The Date of the Earthquake

Before embarking on a description of today's ruin the historical sources may/

may be conveniently concluded by outlining the problems surrounding the precise date of the earthquake by referring to Mayer's paper on Mujīr al-Dīn's Dhayl (sequel or appendix) to his work al-Uns al-Jalīl¹⁶.

In the Leiden text of Mujīr al-Dīn's Dhayl it is stated that the earthquake occurred on the afternoon of Thursday, the tenth of Dhū al-Qa^cda of the year (written) ٩٤٧. Mayer pointed out that ٥ stood for the number 5 in medieval Arabic script, but since the year 952 was twenty-five years after the death of Mujīr al-Dīn, he preferred to conclude that the year 902 was intended. Using the tables of Freeman-Grenville¹⁷ Mayer's Dhū al-Qa^cda 10, 902, is found to be the eleventh of July 1497, a Sunday. In contrast, Dhū al-Qa^cda 10, 952, is the twenty-fourth of January, 1545, a Thursday. The latter date, therefore, corresponds to the day of the week given in the text of the Leiden manuscript.

However, like Mayer, I am now faced with a dilemma of which I was ignorant at the time of writing the article 'The Sundial on the West Wall ..'¹⁸ where in footnote number 7 I presented the above evidence; however, I have since been informed that in the untranslated arabic text of the Dhayl it is stated that there were, in fact, three earthquakes, the first partly damaged al-Ashrafiyya from three directions, the qibla, the north and the east, and also its Minaret, this was followed three days later by a second, much stronger earthquake of shorter duration. But my dilemma is that there was a third earthquake precisely four months after the previous ones, it happened on the afternoon of Wednesday the twelfth of Rabī^c I of the year ٩٤٧. Again using Freeman-Grenville's tables I calculated for the two possible years and found that Rabī^c I, 12, 903 is the eight November 1497, a Wednesday and that Rabī^c I, 12, 953 is the twenty-fourth of May 1546, a Sunday.

Thus there are two possible dates for the earthquake, either Mayer's preference 902/1497 which is in agreement with the weekday of the third earthquake/

earthquake, is only fourteen solar years after the completion of al-Ashrafiyya, is still in the Mamlūk period; or the later date of 952 which agrees with the weekday of the first earthquake, is sixty-three solar years after the completion, is after Mujīr al-Dīn's death and is already in the Ottoman period. This dichotomy adds a poignancy to the final comments regarding the question of the date in the article "As the weekday (for the first earthquake) in the later date agrees with that of the text we leave it to others better qualified to discuss the possible implications for the accepted authorship of the Dhayl." Although naturally reticent about the authorship of the Dhayl I am predisposed to the date of 952/1545 because in 1968 I entered the foundation of Khāṣṣaki Sulṭān (Roxelane) (AIJ No. 140)¹⁹ and noted that it had a quantity of re-used stones of good quality and therefore likely to have come from a major building. It was much later on that I considered the possibility that these re-used stones might have been associated with al-Ashrafiyya. (See Pls. II-IV). The visual evidence is overwhelming, no building in Jerusalem, other than al-Ashrafiyya, has decorated double spandrels and the base of one such spandrel is included in the Khāṣṣaki Sulṭān's Collection (which sadly has been plastered over) thus the provenance is a fait établi. What is also encouraging is that the Khāṣṣaki Sulṭān is dated by an endowment deed to the year 959/1552²⁰ only seven years after my preference of 952/1545 as the date of the earthquake. It is well within the realms of probability that a relatively short time later some of the debris should be conveyed three hundred metres to a new building site.

Thus datable architectural evidence supports the earthquake's date of 952/1545 and obviously not 902/1497.

2.00 A DESCRIPTION OF TODAY'S AL-ASHRAFIYYA¹

2.01 Introduction

Located inside al-Ḥaram, al-Ashrafiyya is north of Bāb al-Silsila, the gateway terminating the Old City of Jerusalem's west-east axis. (see figs. 1 and 2). It can now only be a pale image of its early glory before it was ravaged by the 952/1545 earthquake and most recently by one in the 1920's², the result is that the first floor Madrasa is a shell unfortunately deteriorating rapidly under the action of the elements³. But, whatever its pitiful condition al-Ashrafiyya still can raise more pertinent questions concerning its lost architecture than any historical text, and it will more often than not provide its own answers too. In the descriptions which follow, numerous questions and queries will arise, some will be answered immediately, others will have to bide their time until a more appropriate moment or until sufficient evidence has been accumulated, and there will be some alas, which remain unanswered.

2.02 The Ground Floor Plans⁴. (Drawings 1-2)

The arrangement of the ground floor has changed little since they were completed in 887/1482, there still exists the majma⁵ (meeting hall), the Porch, the Vestibule and the grand staircase. The ancient West Wall of al-Ḥaram is, of course, obvious, as is the base of the Minaret at al-Ashrafiyya's extreme south. The riwāq's four piers, with their chamfered corners, incorporated into the final al-Ashrafiyya are identifiable: At the northern most pier the thickness of the wall sections on either side of it differ; my interpretation is that the west section with its window belongs to al-Ashrafiyya's 1st Phase, which from the textual sources is presumed to have been demolished, where the east section indisputably belongs to the final al-Ashrafiyya, but it in turn generates a supplementary question; why is its external surface proud of the pier and joined to it by way of a chamfer? At ground level there seems to be no explanation for this idiosyncrasy, however/

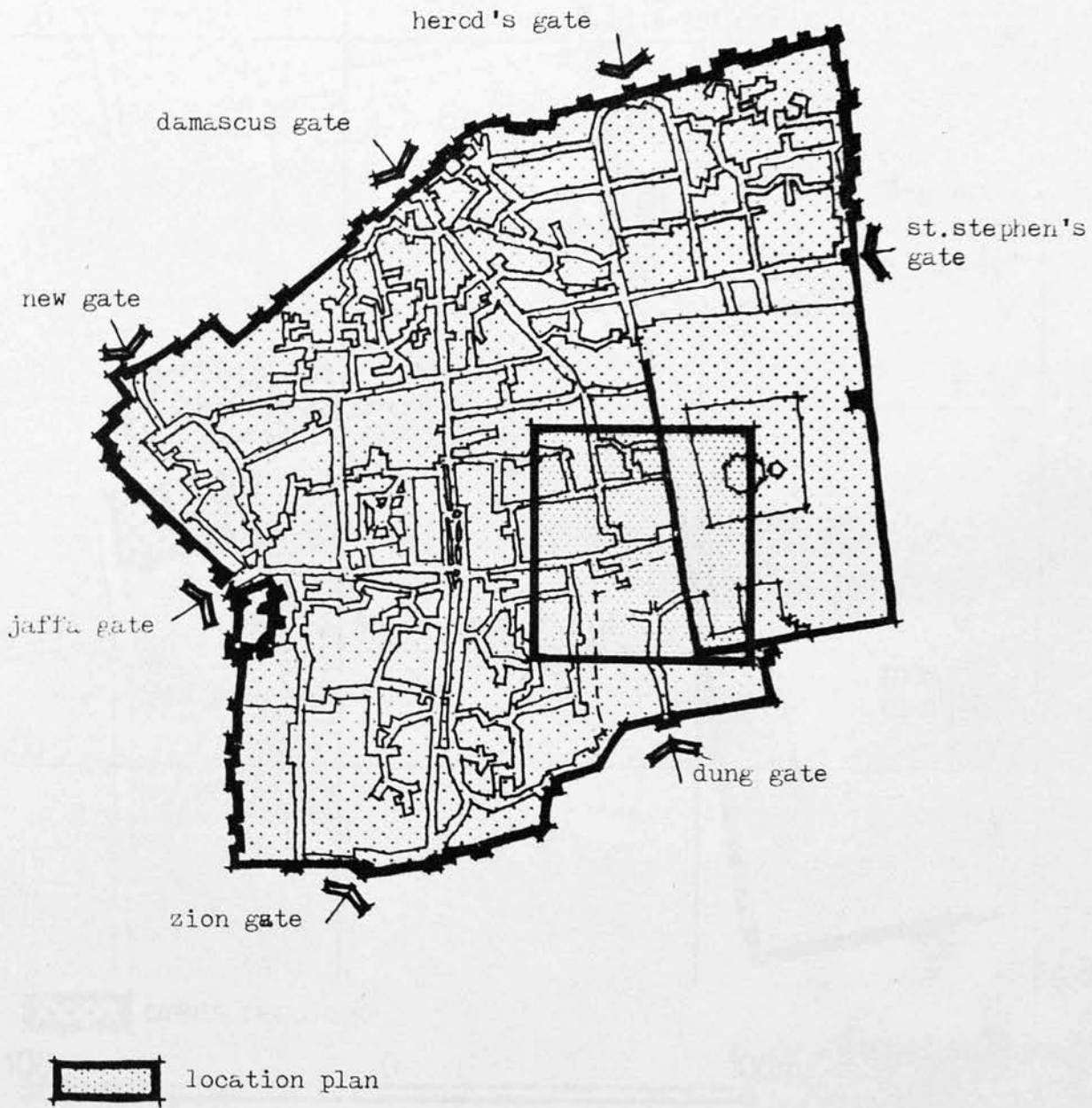


Fig.1. The Old City of Jerusalem.

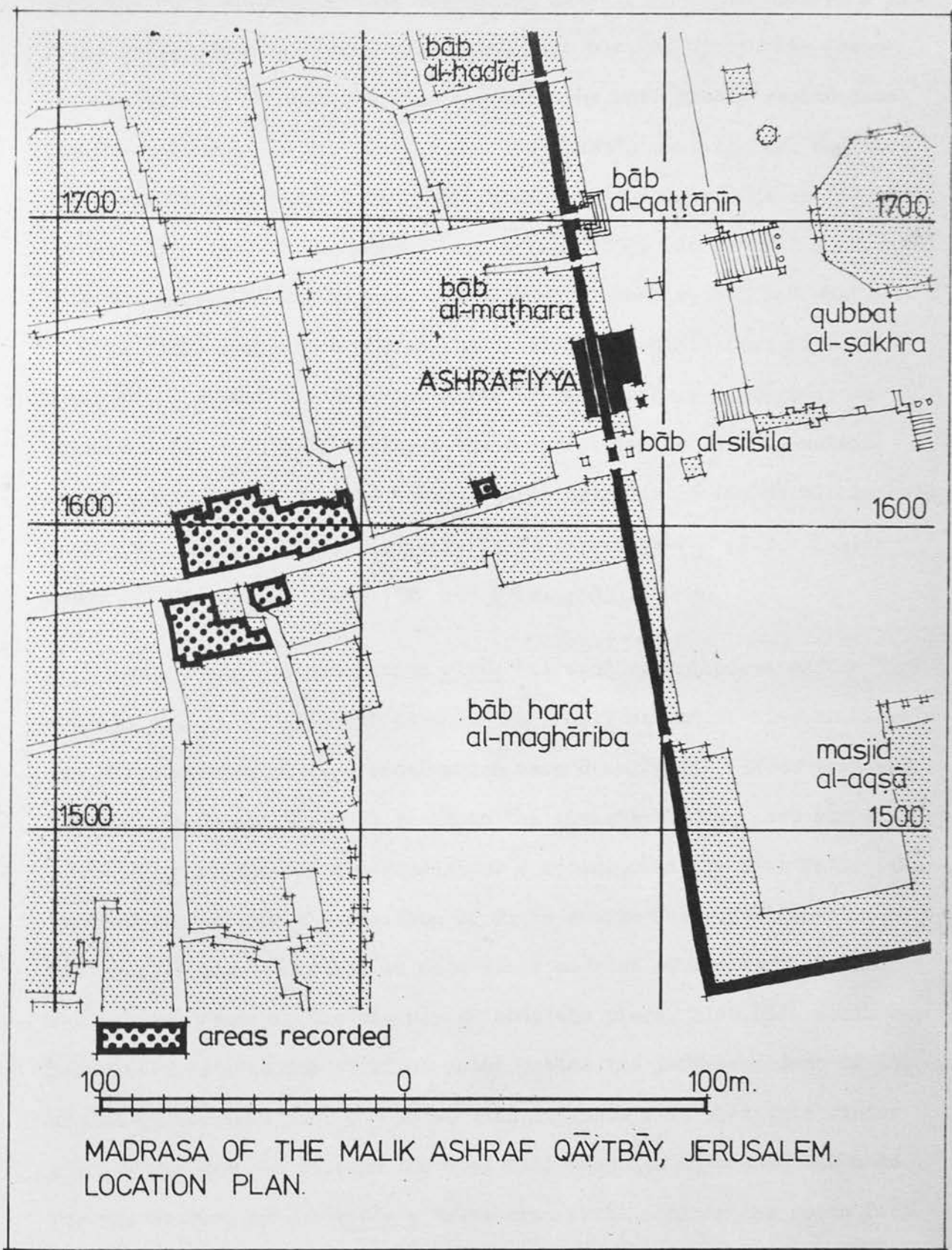


Fig.2.

however the solution may rest with the Madrasa above. I also consider that the wall section housing the mihṛāb dates from al-Ashrafiyya's 1st Phase on two counts: above the mihṛāb is a blocked-up opening (see drawing 11) and if this was once a window the most likely explanation for its existence is that it lit the 1st Phase's meeting hall and that the blocking took place during the final construction; the second count is the appearance of the mihṛāb (see Drawing 85); in general it equates with the mihṛāb in the Madrasa of Muḥammad b. Muzhir, 885/1480-81⁵, (AIJ No. 110) located on the southside of Bāb al-Ḥadīd (see fig. 1). Muḥammad b. Muzhir was Superintendent of the Chancery of Qāyṭbāy and therefore he could have employed the same workmen as did his sultan, and in addition the incised arabesques in trefoliated fields within both niches have no parallels elsewhere in al-Ashrafiyya. (For a fuller study of this mihṛāb see p. 188 and Drawing 85).

In Drawing 2 the pre-demolition riwāq has been superimposed on the present plan. It attempts to show the likely extent of al-Ashrafiyya's 1st Phase and the three arcades which were demolished. Note that the spans P3 to P2 and P2 to P1 continue the riwāq's rhythm; not surprisingly P2 aligns itself on the remains of a springer in the West Wall; the evidence supporting the position of P1 is weaker but I feel that externally there can still be seen stone courses of the sort of texture and cutting found in the masonry of complete piers, also P1's north face lines up with the straight joint beside the left-hand jamb of the window in the West Wall⁶. To me this suggests that when this window opening was slapped through the West Wall adequate allowance was made for the bearing of the riwāq's transverse arch. Along the north face of the Minaret's base are three more straight joints, I do not know why they occur, but could it be that they were associated with the 'narrow and difficult' stair which leads up to the minaret and the Old Madrasa?

The First Floor Plan. (Drawing 3)

Only once and very early on in my research did I climb up to the gallery of the Minaret, and at about the same time I visited the ancillary accommodation above the south īwān of the Madrasa Baladiyya, but as I consider that neither of these areas has a crucial part to play in the hunt for al-Ashrafiyya's architectural form, they may, for the purposes of this dissertation, be ignored⁷. In contrast, the remainder of the first floor is central to the hunt, and unlike the ground floor this has changed dramatically.

The south east corner of the Courtyard is reached after climbing the grand staircase, passing two blocked up windows on the right-hand side and on the left a rectangular doorway also blocked-up eventually to emerge through an arched doorway. Across the Courtyard is a similar arched doorway in a short section of wall belonging to the final phase, behind is the ancillary accommodation. Between the two doorways in the south wall and its three doors, the side doors are arched and the central is similar to the blocked rectangular door at the head of the staircase. Along one side of the Courtyard is the west wall of the Madrasa. In it are the arched doorway, a triple window recess with blocked openings separated from a blocked single window recess by a section of ashlar masonry rebuilt in its upper courses: the line separating the original masonry from the rebuild cuts through a sundial which indicated time in relation to the afternoon prayer (ḥasr). The western half of the Courtyard's north wall has been consolidated and integrated into a modern dwelling⁸, while behind the eastern half is a small open court from which the Madrasa is entered; however, access to this court is only through the Madrasa ^Uthmāniyya's entrance in Bāb al-Maḥara (see fig. 2: AIJ No. 105).

The flagstones used to pave the Courtyard have a strong reddish hue,
the/

the result of heavy veining. I believe they are original since they are laid out in well-defined units approximately 2m. wide running across the Courtyard at right angles to the Madrasa's West Wall, because their surface has a correct relationship with the various door openings and they cannot be an over-lay due to a lack of depth between it and the level corresponding to the riwāq's roof, this relationship is seen in the west-east sections.

My belief runs counter to Mujīr al-Dīn's descriptions of 'white flagstones', he of course may have ignored the veining!

Coming to the small open court a number of irregularly cut steps rise up to a short corridor sheltered by a truncated vault, in its east end there is a rectangular opening with a very slight threshold dropping to the paved and undulating surface of the Madrasa, this obviously post-dates the earthquake. The view is stunning, it is breathtaking, it encompasses the whole of al-Ḥaram; al-Quabbat al-Ṣakhra, al-Jāmi' al-Aqṣā, all the other structures surrounding them, the trees, and even the tranquility of this sanctified place, in the background is the Kedron Valley and the Mount of Olives. Surely of all the staggering views to be found in Jerusalem this exciting visual experience must have been fully exploited by the now destroyed windows along the Madrasa's east wall and to a lesser extent in the eastern halves of the gibla and north walls.

Nowadays the gibla wall terminates at the reveal of the first window east of the mihrāb, and the north wall at the complimentary reveal. A curious feature of this ruined shell is the symmetry produced by the earthquake, the existing wallhead is level except for the rebuilding in the West Wall referred to above and some roughly coursed stonework on top of the wallhead at the south-west corner. I find it difficult to accept that the continuity displayed is the natural result of the earthquake as I know that it includes one section of rebuilding which is the consequence/

consequence of someone's decision, which was the reaction to a set of (unknown) factors. Is it possible that a rehabilitation of the Madrasa was contemplated and that to facilitate this the irregularities caused by the earthquake were evened out? No textual evidence is available to throw light on this problem and so we must leave the wallhead as a curiosity.

Before advancing to the elevations and sections it is an appropriate time to explain my misgivings regarding Tamari's work. In his Ground Floor Plan two errors are immediately perceived, the first is the contraction of the pier at the Porch's south-east corner, and second, the chamfer in the north wall is completely ignored and the same thickness is maintained by him throughout the wall's length. In his First Floor Plan the significant errors are: first, in the Madrasa's West Wall the wall section, separating the triple window and the single window recesses, is illustrated as a later blocking, and its thickness is drawn at approximately 1m. not the actual 0.15m.; the second error is that the external and internal south faces of the qibla wall are drawn in line, this is incorrect since behind the mihrab a chamfered corner reduces the internal wall's thickness. The most misleading of all his errors are the dimensions given for the Madrasa. I have checked and rechecked to assure myself that I am correct whilst Tamari is inaccurate. Although any of the series of measurements could be chosen, two series from the qibla iwān have been selected and are juxtaposed alongside my own results thus:

For the qibla wall,

Tamari	0.80	0.55	1.10	0.55	0.80	1.30	1.10	1.30	0.40
Walls	0.70	0.54	1.26	0.54	0.71	1.46	1.00	1.45	0.31

For the qibla iwān's west wall,

Tamari	0.40	(1.30)	1.10	1.30	1.10	1.30	0.60
Walls	0.30	1.44	1.14	1.44	1.14	1.44	0.30

Little more need be said about Tamari's accuracy.

The East Elevation (Drawing 4)

There are in this elevation three identifiably separate areas; the window and door openings to the majma^c, the great arch to the Porch, and the wallhead at first floor level.

The large rectangular openings to the majma^c are, along with their ablaq surrounds and mouldings, recent copies of openings shown in Creswell's photograph. (See Pl.V). The differences separating the copies from their predecessors are; the modern red stone is considerably lighter than the red stone used in Mamlūk times, the lower courses project beyond the general wall plane and the upper courses sink into the wall. This was caused by the twentieth century builder using a plumb-bob to strike a vertical line on which he would build with the result that his work ran counter to the sloping or bulging wall⁹. At first I was sceptical believing that even as copies, the windows and door they replaced lacked the quality found elsewhere in al-Ashrafiyya, and that they were rather of Ottoman origin sometime after 1545 earthquake. However, this is contradicted by the existence of a similar, unrestored and therefore original door in the North Elevation, and also by positions of the three openings relative to the arcading incorporated into the majma^c; as the centre lines are mutual I feel that if the openings had post-dated the earthquake these relationships might not exist¹⁰. The semi-circular steps in front of the doorway are also copies. The three arched windows are original. Note the primitive engaged column, with stylised base and capital, articulating the northern corner.

Dominating the East Elevation is the great archway leading into the Porch, its ablaq vousoirs are framed by an interestingly detailed moulded archivolt. The arch's extrados is set back from the general wall plane so that the archivolt is negative; but when the archivolt's horizontal member under the intrados is seen, not as a negative moulding but/

but as a more conventional positive impost projecting out of the wall plane below it, the necessary transition is neatly accomplished at the arch's external corners¹¹. The pier at al-Ashrafiyya's south east corner no longer displays the finely detailed and carved geometry of its shaft, the inscription around its neck; or the ribbon and arabesque forms in the capital, they have each been washed away by rain. (PL.VI)

2.04.3 When the wallhead's top half dozen courses are first observed the feature most likely to be seen is composed of a total of 33 joggled stones forming an ablaq string course beginning and ending with red stones, the plain moulding below may also be noticed and traced to either end where it turns upwards. In the north the rising moulding continues uninterrupted to the top of the wallhead, the four ablaq courses to its left will not have been overlooked nor will the fact that they form a vertical straight joint; there is no complimentary ablaq coursing at the south end of this section. A pair of upright red stones, equivalent to two courses high, are seen centred on the white 12th and 20th joggled stones of the string course. Constructed of odd stones some white, some red, the masonry separating these identifiable features all dates from a rebuilding after the 1545 earthquake. Four of the red stones were for a long time extremely puzzling, two of them have hollowed out circular areas and the two had instead a tear-shaped are, they had all in fact functioned as 'silent' links above the apexes of arches¹². To the north of the vertical moulding two straight joints, each of them four courses high and beginning at a level equivalent to the top of the string course, are separated by another area of rebuilding. Finally, all of the courses in the wallhead to the south of the string course and above the great arch are rebuilt. Actually I think that one stone retains its original position, it is directly over the hood moulding's apex and has a circular concave-convex-concave centre, its appearance suggests the obligatory looping of an archivolt at its apex
current/

current in the later Mamlūk periods, this unusual example could be unique to al-Ashrafiyya. The nearby small circular protuberances all date from the rebuilding, what their functions were I know not.

2.05

The South Elevation (Drawing 5)

Again a great arch dominates the elevation, much to my surprise its span is greater than its mate in the east, the illusion of narrowness is provided by the articulation in the pier's west wall and in the Portal wall. Another stone with a circular concave-convex-concave centre sits above the hood moulding's apex surrounded by an overburden of rebuilding which, at its west end, is stopped by a straight joint. This joint rises above the wallhead as a corner setting back from the general wall plane a masonry nib partly consisting of ablaq work, the general wall plane continues for another seven courses above the highest red stone.

2.06

The North Elevation (Drawing 6)

There are two distinct parts to the North Elevation separated from each other by one of the piers of the riwāq which has been incorporated into the wall. In the part under the riwāq exists one large rectangular window with ablaq surrounds bounded by a plain moulding, above is a smaller rectangular window opening complimenting the blocked-up opening above the majma^c's (meeting hall) mihrāb; in my opinion this is sufficient proof that two sections of al-Ashrafiyya's 1st Phase were not demolished by the Christian architect. To the left of the clearly visible pier a chamfer introduces the eastern part of the elevation, about ground level voussoir-type stones can be seen falling towards the original semi-circular steps in front of the doorway. This door has already been commented upon during the description of the East Elevation. There is above it an original arched window opening which was recently unblocked in exchange for a traditional styled geometric stained glass window. Higher up the wall are two straight joints, the western rises above/

above the wallhead in a manner similar to that found in the South Elevation. Between these two joints is an area of rebuild, at its centre is a geometrically decorated oblong stone, and in the same course at either end of it are fragments of a kufesque inscription. One last straight joint remains to be described, it separates al-Ashrafiyya's masonry from that of the Madrasa ^cUthmāniyya's east wall above the riwāq's cornice, the joint is a 0.04m wide gap plugged with cement.

2.07

The Wall to the North of Bāb al-Silsila (Drawing 7)

This wall running between Bāb al-Silsila and al-Ashrafiyya is for much of its length the base of the considerably older Minaret, and so it is only to be expected that a variety of masonry and building phases should be represented. The precise origin of every change is, of course, impossible to find, however some do provide clues to their origins.

The approximately 4m high straight joint defines the junction between the lowest courses of the Minaret's base and those of al-Ashrafiyya; in fact the stones belonging to the Minaret's base prove to be quoins and are therefore evidence of a true corner¹³. The masonry to the north of this joint is, in the main, that of Qāyṭbāy. There are the odd exceptions appearing to conform to the surface textures and dressings favoured in earlier periods, these could be reused from the demolished riwāq or the Old Madrasa. Almost certainly in the slightly recessed length of wall south of the Porch, there is a grouping of some six to eight stones; the remains of a demolished pier?

Returning to the 4m high straight joint, it rises vertically to stop level with the course below the head of the ground floor window lighting the Grand Staircase's second landing, the joint restarts at the long two line inscription¹⁴, moves round it and along its upper edge for 0.20m before rising to about the mezzanine window lighting the sixth landing; this being completed, the joint disappears. Further south/

south a pair of consoles suggest that there was a balcony or 'Jerusalem' window¹⁵ as the northern console occurs beside another straight joint; its presence increased the probability of a balcony or window. Today the joint happens to be the most southerly extent of Qāyṭbāy's masonry. The semi-circular vault seen behind the adjacent area of rebuilding suggests an Ottoman date: it was never inspected by me as it forms part of the complex to the south and over Bāb al-Silsila; interestingly enough, in one of the recessed windows belonging to this complex is the shield of Khushqadum inscribed on a marble or white stone¹⁶.

In the second top course, south of the Porch, exists a water spout indicating perhaps that the present height of the wall is unchanged from the original, or does it belong to the same category as the water spouts found in the rebuilt sections of the East Elevation's wallhead?

Four large rectangular windows retain their original grilles set in timber frames, and their monolithic lintels. In the left hand pair the arched heads to their ingos are visible behind the grilles. The three upper windows have built up sills and two still have the original joggled key stones¹⁷, the third has not and explains why the existing lintel's soffit is decorated by a carved vegetal motif. I have not found any comparative material for this carved decoration (see Drawing 86).

One question arises from the erratic stone coursing; the recognisable rebuilding in the larger areas or the patching of the smaller areas, did the masonry of al-Ashrafiyya's final phase extend as far as the Bāb al-Silsila? From the foregoing description the answer can only be, 'Yes'.

The Porch (Drawings 7, 12 and 13)

It must have become apparent during the descriptions of the East and South Elevations that al-Ashrafiyya's south-east corner suffered the greatest/

greatest damage. The reason is clear, the corner is a large pier carrying the structural loadings away from two magnificently proportioned arches and naturally, since it was the weakest sector in al-Ashrafiyya's ground floor, it gave way under the abnormal loadings induced by the Earthquake. The full extent of the damage and the resultant rebuilding is only perceived on looking up at the underside of the Pordh's ablaq vault: fully 25% of it is completely rebuilt.

2.08.1 The Vault (Drawing 42)

Unlike the original ablaq stone courses emanating from the south-west, north-west and north-east corners, the stone courses in the south-east quarter of the vault are all built in a white stone laid on concentric quadrants centred on the springing point on the pier. This difference is admirably disguised by alternating bands of red and cream paint with fake stone interstices drawn in black paint which are trying to match the zig-zag appearance of the true ablaq vaulting (ironically the true ablaq have been overpainted to blend with the pseudo ablaq which was attempting to copy them in the first instance!) The decorated pointed cruciform vault centre is in situ but was it effected by such destruction? On close inspection the cruciform centre is an extremely clever demonstration of sixteenth (?) century restoration work. Laying undetected behind a cream or khaki paint is conclusive evidence proving that the stone slabs making up the cruciform centre have been removed and then replaced¹⁸.

The first item of interest is the 'curb' running round the cruciform's edges, this has in places fallen down and in others is badly cracked: imagine the original construction sequence; the vaulting started at the four springing points and gradually stone course upon stone course the separate fans came together about a void, cruciform in shape, then the six decorated slabs were placed in their proper order and sealed by the next/

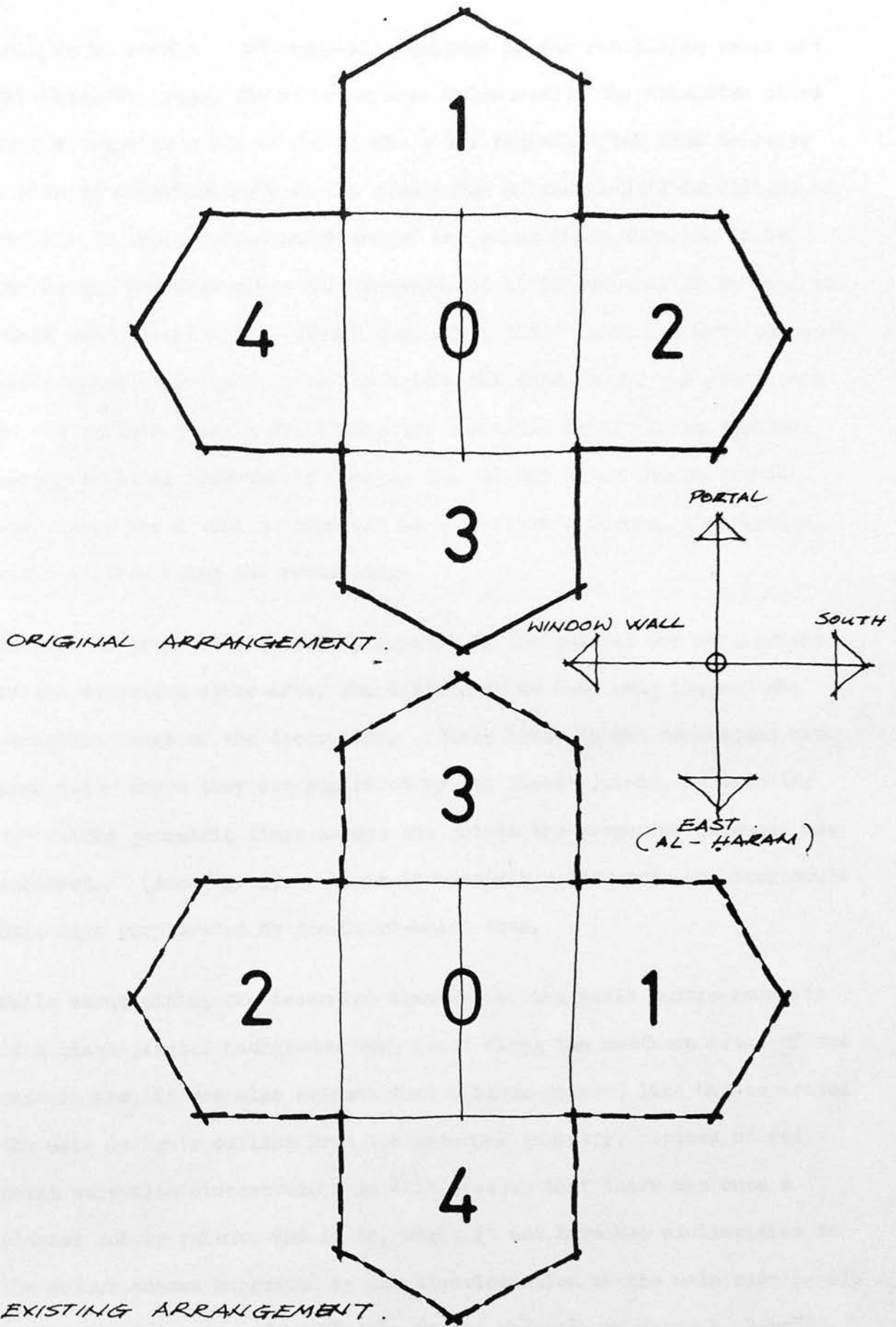


FIG. 3. The Disarranged Vault Centre of the Porch.

next stone course. The sequence followed in the rebuilding could not have been the same, the stone courses which sealed the decorated slabs from above were still in place, there was therefore the need to leave a pointed cruciform hole at the completion of the vault's rebuilding to facilitate the eventual insertion of the slabs which then had to be supported, the curb gives this support but it in turn had to be held in place using metal pins. These pins after three centuries have corroded and consequently expanded to break down the stone curb. I guess that in the vault's present condition, the decorated centre is in greater danger of being irrevocably damaged than it was after the earthquake when there was a real concern for al-Ashrafiyya's future, its physical manifestation being the rebuilding.

If further proof is required in support of the removal and replacement of the decorated slabs after the earthquake we need only inspect the geometric lines of the decoration. These lines do not correspond with each other where they are separated by the slabs' joints, by matching the paired geometric lines across the joints the proper arrangement was achieved. (See fig. 3). It is inconceivable that such an error could have been perpetrated by the Cairo-based team.

While scrutinising the decorated elements of the vault centre remnants of a black painted background were found along the northern areas of the eastern arm, it was also evident that a black painted line had separated the main design's outline from its internal geometry; traces of red paint were also discovered. Am I to presume that there was once a planned colour scheme, and if so, might it not have had similarities to the colour scheme suggested by the discolouration in the main side panels of the minbar presented by Qāytbāy to the Khānaqāh of Farag b. Barqūq some nine months after the official completion date of al-Ashrafiyya?¹⁹

Three out of the original four lozenges still contain flat carved arabesque motives, the eastern lozenge was less fortunate, its absence is obscured/

obscured by a layer of dark red paint.

It was the accepted practice to hang lamps secured to metal rings in an arch's apex or at a vault's centre, such rings do exist below the apexes of the Porch's side arches and although I looked for evidence to show, one way or the other, whether such a ring ever hung below the central point of the cruciform, I still do not know, although it is most unlikely as there is the joint between the central slabs.

2.08.2 The Window Wall (Drawing 13)

At the rear of the Porch's northern side arch and above a bench lies the compartmented²⁰ Window Wall, whose windows give some light to the majma^c. The deep bench rising one and a half courses above the paved surface of al-Haram, includes a moulded nosing which turns upwards through 90° at each end as though it is directing an observer's eye up the arch's narrow abutments to the positive impost moulding and into the ablaq areas of the vault. At the centre of the Window Wall is a recess with a large rectangular gridded window, an oeil-de-boeuf window and decorated rectilinear mugarnas. Between the recess and the intrados of the Porch's northern arch are two side panels and a cycloidal tympanum, each encloses an inscribed shield of Qāytbāy.

One of the features I find unusual is the contrast created between the white stone sill and the ablaq jambs of the gridded window. Normally the sill would extend beyond the opening to finish at the recess' reveals and would, therefore, be one complete course in the composition, but in this instance the sill's length is restricted within the jambs; perhaps the explanation lies in the proportions imposed on or chosen by the architect. The bronze grilles and timber sub-frame are right for the period. Just as the sill's design is unusual so is the unadorned monolithic lintel, because most window lintels at the time were either composite or decorated or both. There are two elements in the compartment above the lintel, the joggled ablaq relieving arch with decoration reserved/

reserved to the white voussoirs and the carved tympanum under it.

Encompassing the newly restored oeil-de-boeuf window are ablaq voussoirs which have reserved any decoration to the white stones. On either side of the windows are vertically set compartmented oblong geometric panels mirroring each other.

The rectilinear mugarnas completing the recess' decorative elements, are heavily coated with the cream or khaki paint, the same paint that was found on the vault. But the 'umbrella' or ribbed cell at the centre of the top course is painted yellow, and in the majority of the other cells remnants of blue paint are visible where the cream paint has flaked. As no additional colours were found while squeezing the mugarnas, I consider that the yellow paint is an attempt to recreate some disappeared gold leaf, and that the blue paint is original since it is used in combination with white paint in the manner found in the rectilinear mugarnas over the Gateway of the Minbar in the Khānaqāh of Farag b. Barqūq.

Turning to the side panels which are outside the window recess, and decorated with inscribed shields picked out in a dark red paint. When squeezing the eastern one it was clear to me that the dark red paint had not been applied with the precision expected of Qāyrbāy's team, this feeling was increased on finding traces of gold, about the size of a pin head, there was also a considerable amount of light red paint, some of it lying below the tiny specks of gold leaf. The conclusion is, the letters and background of the shield were at first gilded all over, eventually this gilding wore off leaving behind its light red coloured bole, this also wore off in time, in fact, by the time of the restoration after the earthquake because the restorers gave a new clarity and definition to the shield using dark red paint; the same paint used for the ablaq vaulting²¹. In the tympanum the third and considerably smaller/

smaller shield is also coated in dark red paint.

2.08.3 The Recessed Portal (Drawing 7)

Framed by a linked moulding this beautiful doorway is one of the artistic masterpieces of Jerusalem, it has great variety and is full of life, it can be passive through its ablaq courses, it can be vigorous as exemplified by the vegetal decoration of the rectilinear mugarnas or it can be strong like its monolithic door lintel. After all the trials and tribulations of al-Ashrafiyya's construction this portal on its own does great honour to the memory of the 'Prince of Builders'.

Beginning the description with the upper surface of the door step we find the remains of a simple design probably composed of black, grey and white marble. On either side of the recess are the required and ever present mastabas or benches (Drawing 52), surrounded by the linked moulding with its variety of links, some of their centres are flat, others are convex and others have a six petalled floral-type star. In the south mastaba's flank the lower left link has the petalled star, the lower right has a vortex, the central link on the vertical moulding is convex and the two along the top are concave. Opposing them on the northern mastaba's flank is one vortex centre directly opposite its twin and all the other centres are concave, none are convex. Thus we find a variety of solutions for one element, so humble that most people would overlook it. This surely is not the result of one man lavishing care on the links in his spare time, to me this is an expression of the care, thought and visual interest found in nearly all of Qāytbāy's monuments and even such a simple detail as the links of a moulding might have been regarded by and appraised by the suffī inhabitants of al-Ashrafiyya. The mastabas' main decorative features are the joggled ablaq areas with trefoliated terminals which are emphasised by the white stone vegetal element sunk into the dark stone, and at its centre a "tear-drop" in turquoise/

turquoise glass paste (this now can only be found in the northern mastaba).

Parts of the ablaq masonry has been indented in the last few decades as a number of the red stones are 'the modern pink' with a roughly tooled surface²² so contrasting with the much darker and yellow veined red stone used by the Mamlūks. This dark red stone was chosen for its colour and it is used throughout Jerusalem, but it is most often laid on cant²³, and so over the centuries this stone has fractured along the lines of its strata: I cannot accept that this was done in ignorance by the masons, they must have recognised what would eventually occur to the stone's mechanism. One explanation is that they may have been getting the red stone from a very thin seam, but as the stones are approximately thirty centimeters high and between ten to fifteen thick, the thickness of the seam would have fallen betwixt the two dimensions. As this dark red stone is found in buildings centuries older than Qāyṭbāy's it must then have been a well established local tradition adopted by the Cairo-team, especially since for a mason trained in Cairo he would not have chosen such a stone simply on the grounds of its dark red if a lighter red was available, because in Cairo what was accepted as a red stone suitable for ablaq construction is actually a florid cream colour.

One fact provided by the recessed Portal has, to my knowledge, only been found in one other Mamlūk building, also in Jerusalem, the Madrasa Resasiyya, 947/1540, "so called because of the lead plates which are used to bond the courses of masonry"²⁴. In al-Ashrafiyya's case the beaten lead sheets 0.002m. thick were only used in the rear wall of the Recess and only up to the underside of the door jamb's brackets. So far I have not thought of a satisfactory answer, nor have I received one from the various lead experts to whom I have spoken.

The well carved inscription crossing the Recess and door opening is the Foundation/

Foundation Inscription which reads 'Ordered to construct this Noble Madrasa, the very great Lord and glorified Prince, the Sultan al-Malik al-Ashraf Abu-n-Nasr Qāyṭbāy, may his victory be glorious! This construction was completed in the month of Rajab I of the year 887.'

(August-September 1482). A characteristic detail is the double fleuron wrapped round the inscription's corners, there are numerous occurrences of this detail in the Mamlūk Period. Note also the more flamboyant fleuron terminals formed by the merging of the red coloured courses running with the inscription.

The brackets at the top of the door jambs are mini-rectilinear mugarnas void of the additional vegetal decoration occasionally added to such brackets. However, their appearance is softened by the up-turned curve of the half-palmettes which stop the concave moulding surrounding the black-greyish coloured granite lintel and the two small arabesque panels flanking it. The arabesque decoration is abnormally small and over detailed to the point that it is difficult to appreciate unless a person stands on the mastabas, and this would not have been considered proper behaviour; a better description might be that it is 'too tight'. At the present time background of both panels is painted black and may, therefore indicate that this was the original state, the arabesque forms, after squeezing, were a very light yellow colour.

The beautiful joggling of the relieving arch demonstrates through its delicacy the amazing skill of the master craftsman, although why a black margin has been painted along the edges of the white voussoirs I cannot imagine. The shallow tympanum is undecorated except for the black paint. Again black paint is found adhering to the backgrounds of the two geometrically adorned panels which flank the relieving arch. On squeezing I became aware of small upstanding circles centred on the geometric inter-stices, although these circles are now black and so are unseen they/

they are not unique, a similar but not identical geometric pair of panels are found in the same relative position at the rear of the portal recess of the Sabīl-Kuttāb of Qāytbāy in Cairo, this similarity extends even to the nodes of the star polygons supplemented by internal elements.

A medium sized grilled rectangular window is set above the relieving arch, it has an uncomplicated joggled ablag lintel the joints of which are picked out in black paint²⁶. On either side of the window are series of rectilinear mugarnas forming stalactites spanning across the rear corners of the Recess at 45° . The individual cells are carved with vegetal elements, but like the mugarnas decoration on the Window Wall, the complete effect has been destroyed by a liberal coating of khaki paint and in the 'umbrella' topmost cell²⁷ a yellow paint. Fortunately, when I was squeezing them more traces of blue and white paint appeared, and as no further colours were noticed I conclude that here was the "establishment's" blue on white colour scheme for the majority of the cells and that gold leaf was reserved for the point of convergence of all the lines and planes of the mugarnas.

Housed by the Portal Recess' trefoiled arch is a joggled and ablag semi-dome sitting on a red base course. The semi-dome exhibits the ubiquitous khaki and red paints and the black painted outlines surrounding the different stones, the the original scheme turquoise glass paste enlivened the central points of the red stones' foliated heads in contrast to the black paste centres of the white stones. In the red base course I first felt with my fingers arrises in the fractured and crazed surface, these I thought had resulted from cutting made by tools not from the breakdown of the stone. My survey notes show that I considered there to have been a group of three curvilinear mugarnas units and that the central unit had radiating lines centred on a point fractionally above the centre of the unit's base. This deduction on my/

my part was helped by the fact that the type of mugarnas cell I have described is common place in other Mamlūk buildings, however the introduction into this Portal Recess was unexpected since all the other mugarnas were rectilinear. My notes also show that I considered that this grouping was repeated at the two 45° axes of the semi-dome and that the remainder of the base course had perhaps a freer vegetal decoration based on evidence to the left of the central grouping where I picked up a carved line curving upwards with a circular form to one side of it (an arabesque head?). To the right of the central group another carved and curving line was found rising from the course's bottom edge. Under the red base course's soffit and along the 45° axis are undecorated red stone lozenges extending from the course's face back to the apexes of the mugarnas 'stalactites'.

Decoration is limited to the white voussoirs of the trefoiled arch, a feature common to the Window Wall, which are over-painted in khaki although this has not totally obscured the blue and white paint below; in the top voussoirs they include a ribbon development on which are traces of red paint, not the dark red colour but the lighter red bole, which was used as the base for gold leaf. Observe how the lower voussoirs turn under the intrados and are shaped to meet the haunch of the half-tympana of the mugarnas 'stalactites' but that the higher voussoirs are restricted to the extrados.

2.09 The Vestibule (Drawings 5 and 8)

The Vestibule separates the Porch and the West Wall of al-Haram. On the inside of its entrance the reveals are chamfered, a Mamlūk characteristic, they continue up the east wall to form a sloping intrados to the arch above the grilled window at the rear of the Portal Recess. The vestibule's rear wall is al-Haram's, in front of it there is a small but long and deep bench faced with vertically orientated stones, and on either/

either side and above the bench the walls rise up to form an arch. A springer which has in the past been part of the riwāq is seen about the centre of the framed al-Ḥaram wall, above is a rectangular opening whose lower plane slopes upwards and away from the Vestibule. What the purpose of such an opening was, or is I have uncovered no clues. At present the opening is heavily streaked with water lines and dirt, these automatically become wet if it rains or if the Courtyard above is washed down, because it now acts as a drain: but this still does not help to provide its original purpose.

In the north and south walls there are arched door openings with ablaq voussoirs enclosed by an archivolt looped at its apex and below each springer; in the apex's loop is a geometric design and in the lower pair are vortexes of half-trefoils. Strangely the stones forming the northern arch's key stone and the southern's key stone and its apex loop seem to have been painted with a black substance, not paint, it has a sheen to it almost like a lacquer's.

I found no paint in the Vestibule's octagonal vault centre or in the lozenges at the cardinal points. There is a probable explanation, the arabesque and ribbon development decorating the centre and the flat carved arabesques in the lozenges were covered by a thick, black and sticky encrustation extending across the complete vault and down the side walls for one and a half to two metres: the cause was a smoking oil lamp hung from the still existing central metal ring.

It will be remembered that Mujīr al-Dīn described the Vestibule's floor as marble, and that in the rear wall was a bench covered in marble (see p. 6 above), there is no existing evidence to substantiate his description. Assuming that a marble surface had been laid on top of the well out and finished flagstones presently forming the Vestibule's floor surface, an allowance would have to be made for the thicknesses of the marble/

marble and for the screed below it, if their aggregate thickness is greater than seven centimetres the marble surface is level with the three door thresholds in the Vestibule; this runs counter to the whole Mamlūk architectural design or detailing tradition especially where it concerns the external doorway's threshold which is always at least five centimetres above the internal floor. If this feature of relative threshold heights had been satisfied the aggregate thickness of the marble and its screed could not have been more than two centimetres. Nor is there any existing evidence to suggest the bench seat was ever covered in marble: in Qāyrbāy's Carene buildings some marble vertical surfaces have been damaged to expose their underlying cement screeds keyed to the wall's masonry by a pitted surface, nowhere in the Vestibule or in any other part of al-Ashrafiyya is there any serious evidence of this form of mechanical keying. Was Mujīr al-Dīn so mistaken, or was he so impressed by the qualities of Jerusalem stone that he likened it to marble? One further possibility arises, there is adhering to al-Ḥaram's west wall the remains of a plastered surface, could it have had a marbled surface?

2.10

The East-West Corridors and the Grand Staircase (Drawings 5, 8 and 9)

In the arched doorway leading from the Vestibule into the ground floor's Corridor the width of the eastern jamb has been increased to allow for hinges large enough to support the weight of a single leaf timber door, such a door when it was open reduced the daylight in the Corridor as it is lit by a narrow grilled window with angled reveals in the east wall. The slightly pointed barrel vault is modified about the door opening by a transverse vault thereby creating a groin vault, the barrel vault then continues westwards until it is in line with the stair's newel wall where a second transformation produces a fan vault with a decorated octagonal centre.

Below/

Below the fan vault and slapped through al-Haram's west wall is a grilled window with ablaq jambs and a white monolithic lintel. The course above the lintel has been cut back to take a joggled stone revetment or even an inscription or epitaph possibly naming the Madrasa Baladiyya's founder, Manklibughā al-Ahmadi²⁸.

A number of features recur at various levels of the Grand Staircase. Vertical straight joints are now visible in al-Haram's west wall and in the north face of the Minaret's base which were plastered over during al-Ashrafiyya's construction. Chamfered corners, with pyramidal bases and angular pointed heads, turn the newel wall at the majority of the landings. The Grand Staircase's pointed barrel vault is exchanged for a decorated fan vault only at the north-west and south-east quarter landings, above the remainder the barrel vault is turned through ninety degrees. Over each landing is a centrally placed square hole for a lamp's metal ring. When the grilled windows at the quarter landings are seen from al-Haram they present a rectangular image, but internally they are all changed into arched recesses.

With the knowledge of the foregoing descriptions, if the existence of paint was to be sought for in the Grand Staircase it would be expected in the decorated centres of the fan vaults; but on the other hand they all had oil lamps hanging a few centimetres below them which could either have burnt off any paints or submerged them under black encrustations, the fact is that these three alternatives all exist. In the geometrically decorated centre at the foot of the first flight there is no evidence of paint; the second landing's centre gives the impression that under its charred and hardened surface, red paint (or is it bole for gold leaf?) adheres to the ribbon development curving over white arabesque forms on a blue background; in the geometry of the fourth landing's vault centre no traces were recorded; and in the final decorated centre above the sixth/

sixth landing there is the likelihood that its arabesque forms were originally white, any colour the background might have is unidentifiable under the encrustations but the chances are that it was blue and therefore in keeping with the colour schemes discovered elsewhere.

Raised up above the floor of the seventh and last quarter landing there is in its north-east corner a crudely finished rectilinear mugarnas 'stalactite' bracket supporting the rear of the Madrasa's Mihrāb, although it confounds my own preconceptions concerning the high qualities inherent in every item made in the name of Qāyṭbāy these unappealing and primitive mugarnas have to be contemporary with al-Ashrafiyya, if not in their workmanship at least in the timing of their insertion. Earlier, on page 27 it was remarked on that much of the upper window, that is the rectangular window without a grille had been constructed sometime after the 1545 Earthquake, and that it included a stone decorated on one side (presently its underside) re-used as the window's lintel. To the west of the mugarnas a pair of blocked up windows, which used to communicate with the Madrasa, have compartmented composite and geometrically decorated lintels, sandwiched between them is a small oblong compartmented panel with an arabesque and ribbon development. None of these decorated areas shows any sign of paint. Opposing the windows in the first floor's Corridor are two openings; the eastern reaches up to the underside of the barrel vault and behind the modern strong metal door it leads on to the Minaret; the second opening is a small blocked up rectangular door, its lintel is surrounded by a moulding which carries down into the jambs as a bracket.

2.11. The Courtyard (Drawing 16)

The Courtyard is entered through an arched doorway consisting of ablaq keyed voussoirs contained in a large archivolt looped at its apex and on both sides below the springings. Sitting above it is a straight joint which/

which was a north jamb and all that remains of a rectangular window, with a keyed composite lintel, that helped to light the first floor's Corridor.

Further north in this the West Wall of the Madrasa is a total of four windows, recessed from the general wall plane in groups of three and one. Both of the recesses have sloping sills rising to a shallow ablaq course in it the stones are keyed to each other by 'noses'. Above are the windows with ablaq jambs ending below the compartmented decorated and composite lintels, in the South Recess there are additional compartmented squares, at the next level are compartmented joggled relieving arches with decorated tympana, and above those are two courses, the lower white and the upper red. In both of the recesses little remains of the relieving lintels and the other 0.10-0.15m thick ablaq revetments above them in their stead is the wall's rubble core. Luckily Creswell took a photograph which managed to record the central window in the South Recess' decorated lintel before it was displaced by the 1927 earthquake and it also enables the panels separating the joggled relieving arches to be reconstructed.

The material used to infill the windows consists mainly of the debris of al-Ashrafiyya, there are large quantities of red stones, some are cut as 'silent links', there are marble facings laid horizontally which, if they could be removed, might furnish us with unusual ornament, there are pieces of carved tympana, but the majority of the material is anonymous.

The southernmost of the triple windows has, in its north jamb, a hole intended for either a grille's metal bar which would be out of character, or the more practical nail needed to secure the timber sub-frame housing the metal grille. At first, this same window forced me to consider the possibility of a safety lintel,³⁰ for I was able to see between/

between the infill's stone and behind the underside of the stone lintel to some rotten timber. Now, this could be one of two things either the decayed safety lintel which was commonly found in Jerusalem in earlier Mamlūk periods³¹ but is uncharacteristic of Qāyṭbāy's period, or simply it is timber debris from a ceiling or other timber element.

In the wall section separating the two recessed areas is al-Ashrafiyya's sundial (fig. 6). It belongs to the category of Islamic vertical sundials known as munharifāt and its markings display the time of day with respect to the beginning of the ḥasr (afternoon prayer) and also the beginning and end of the interval during which it was permitted to perform the prayer³². The article on this sundial attempts to answer a number of questions which warranted consideration but are incidental to my main hypothesis. Is the sundial contemporaneous with the construction of al-Ashrafiyya? What are the markings on the sundial and at what times of day do they display? Does the position of the sundial inhibit its effective use? What is the relationship between the orientation of the sacred compound, al-Ḥaram al-Sharīf and the qibla of Jerusalem?

The Courtyard's north wall is mainly modern although there still remains part of an inscription, vertical and horizontal moulding including vestigial-terminals just outwith the reveals of the vanished recess; the reveals are now identifiable by the straight joints. Whatever information can be gathered today provides the physical dimensions in support of two photographs taken by Creswell before the modern structure was built, they also provide invaluable information about the form, approximate size, and decoration in the vestibule and the corridor leading from this second recessed portal to the Madrasa. For the purposes of clarity and convenience I have redrawn the relevant areas in the two photographs, see figs. 4 and 5³⁴.

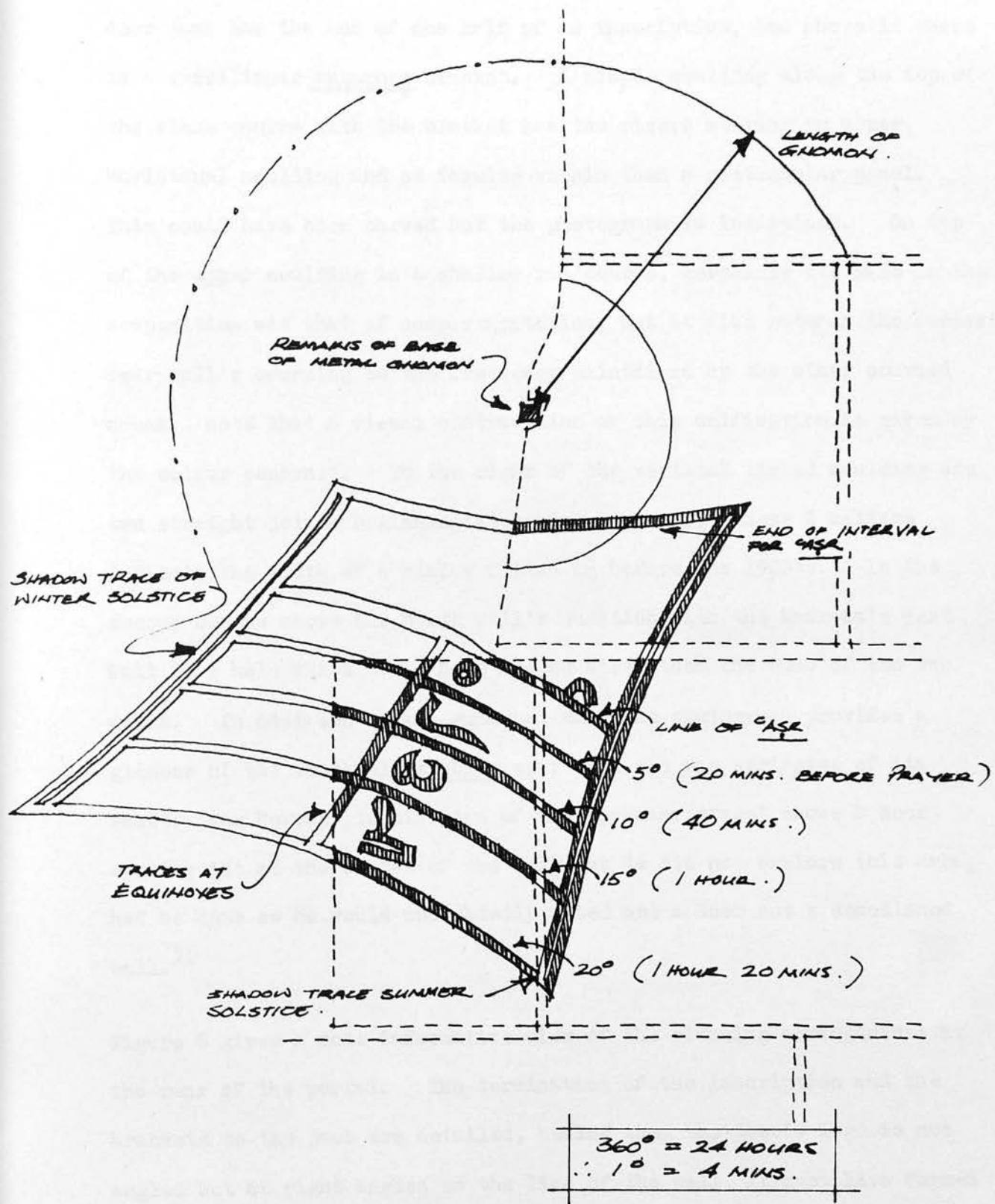


Fig.4. An Explanation of the Parts of the Sundial.

In fig. 4 about half of the portal recess is visible and we can gauge the relative depth of the recess. It may also be observed that the door jamb has the end of one half of an inscription, and above it there is a curvilinear mugarnas bracket. A simple moulding along the top of the stone course with the bracket has two risers meeting an upper horizontal moulding and so forming within them a rectangular panel. This could have been carved but the photograph is indistinct. On top of the upper moulding is a shallow red course, certainly its role in the composition was that of compartmentation, but it also returns the recess' rear wall's coursing to the frequency maintained by the other coursed areas; note that a visual contradiction of this unification is given by the colour contrast. To the right of the vertical linked moulding are two straight joints beginning at course number 9; these I believe indicate the width of a window filled in before the 1920's. In the second course above the north wall's junction with the Madrasa's West Wall is a hole which could have helped strengthen the bond of the two walls. In addition to the external wall the photograph provides a glimpse of the vestibule's ablaq rear wall and the springing of its vault: van Berchem in his plan of the 'premier etage' shows a door opening 'H' at the centre of the wall but he did not explore this area, had he done so he would undoubtedly noted not a door but a demolished wall.³⁵

Figure 6 gives a most informative view of the planning arrangements at the rear of the portal. The termination of the inscription and the brackets to the jamb are detailed, behind them the door's ingo is not angled but at right angles to the line of the wall, it must have formed an arch over the door opening and coincident with its springing is the springing of a fan vault. The vestibule's east wall includes an arched opening with ablaq voussoirs not strictly in sequence it seems. They are/

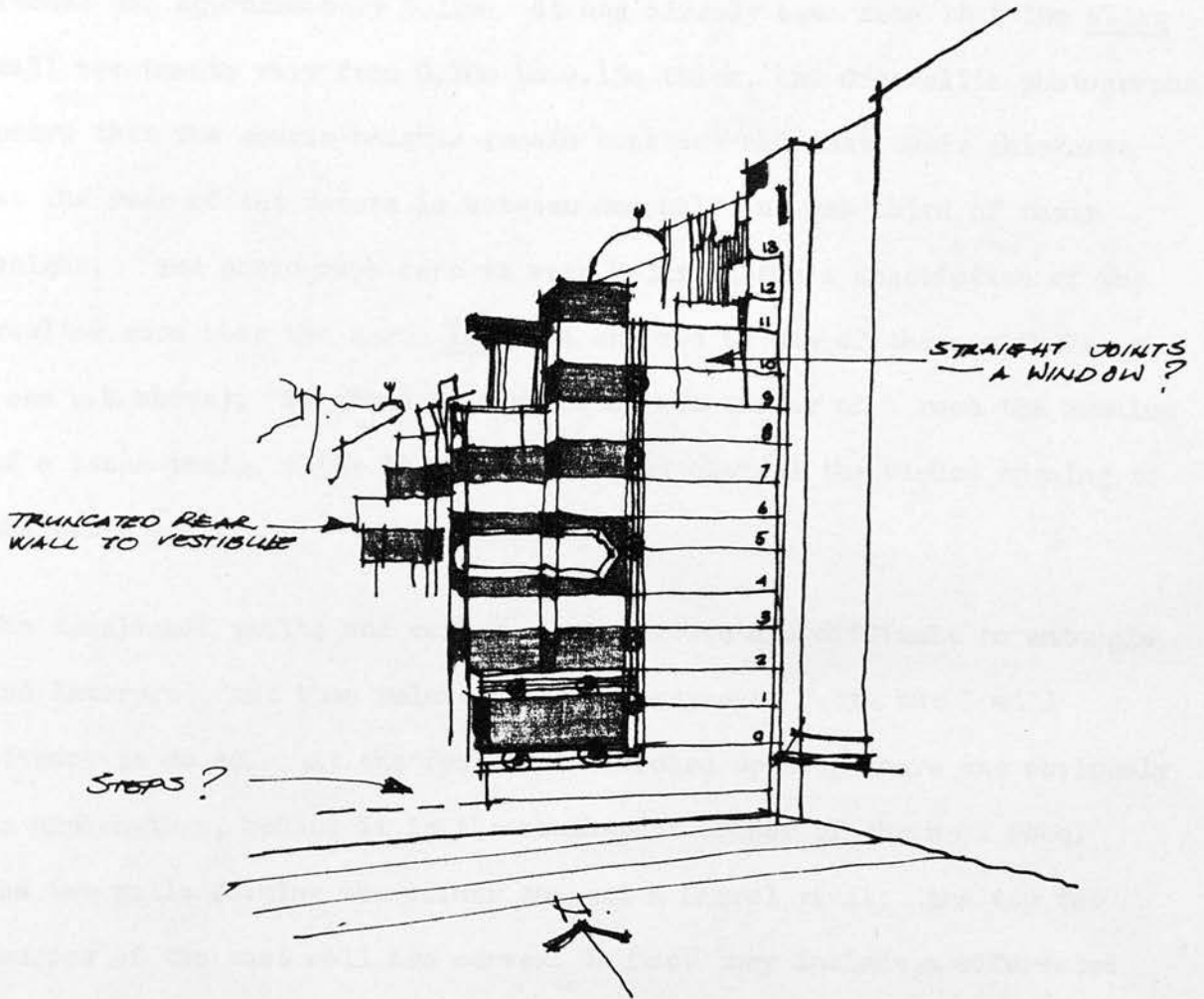


Fig. 5. The North Wall of the Courtyard after Creswell.

are contained by an uncomplicated scotia moulded archivolt; centred above the door is a stone cut down at its middle (to receive a grille in a timber frame?). Clearly, the north wall was recessed, it may even have had a bench at its foot copying the arrangement at the ground floor, however it can be established that the wall thickness at the rear of the recess was approximately 0.12m: it has already been seen that the ablaq wall revetments vary from 0.10m to 0.15m thick, and Creswell's photographs prove that the course heights remain constant and that their thickness at the rear of the recess is between one half and one third of their height. The photograph accords with Mujīr al-Dīn's description of the vaulted room near the north īwān and entered by way of the vestibule (see p.14 above); it shows in the south-east corner of a room the remains of a stone vault, which it must be assumed cleared the window opening to the north īwān.

The demolished vaults and varied masonry above are difficult to untangle and interpret, and then relate it to the surveyed facts but I will attempt to do so. At the rear of the arched opening there was obviously an arched ingo, behind it is the south-east corner of the next room. The two walls forming the corner suggest a barrel vault; the top two courses of the east wall are curved, in fact they include a bifurcated springer over the wall's north-west corner which might indicate a groin vault; the south wall does not deviate from the vertical, but its top courses are obviously scribed to the underside of the lost vaulting, intersecting the scribed line is the vertical face of the topmost stone; this might establish two features, the height of the external window postulated above, and its internal ingo's position. Combined together these features create the strong probability that the room or space through the arched opening had a groin vault, and that beyond it the space narrows to the same sort of width as the arched opening's ingo.

In/

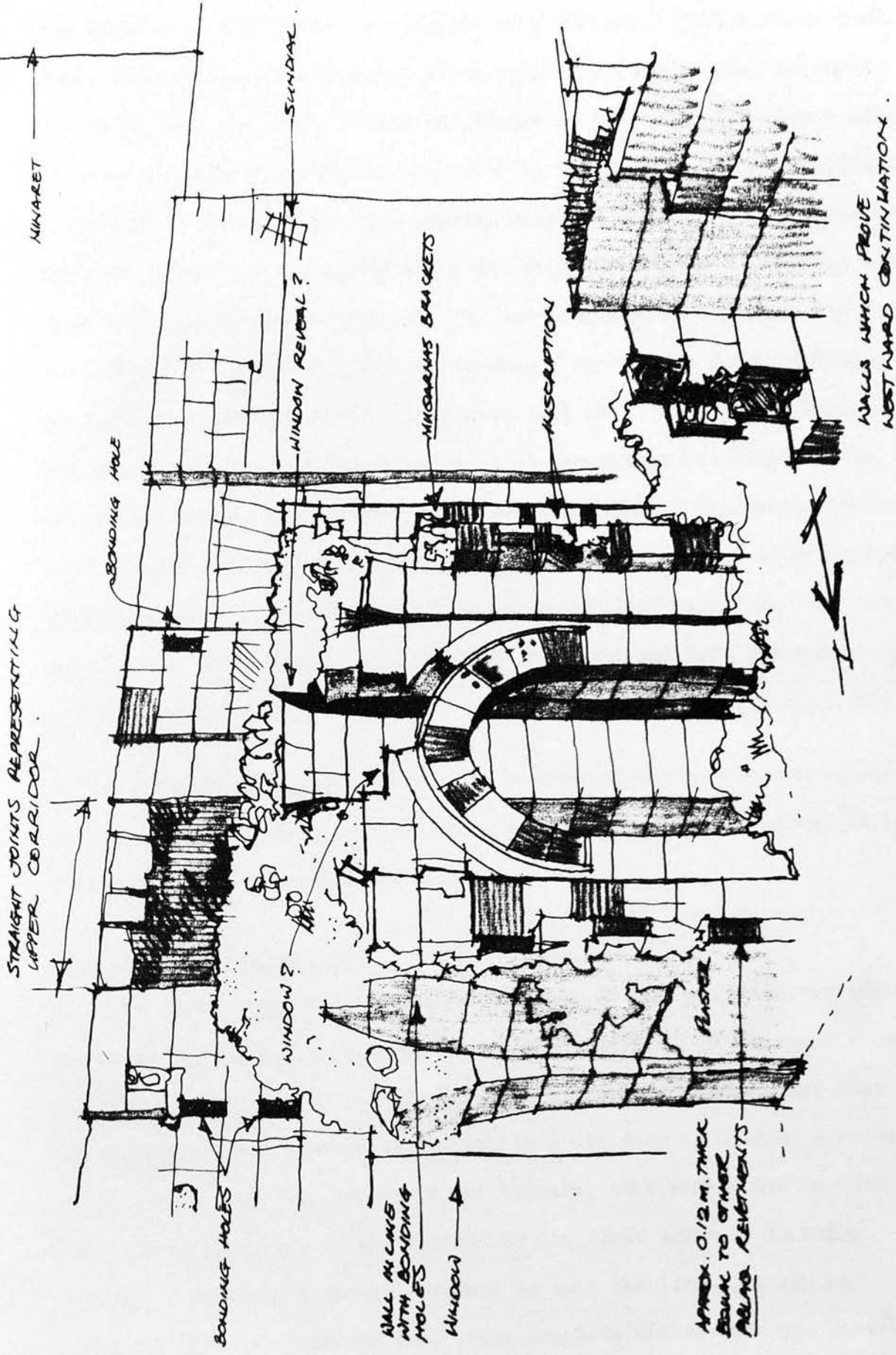


Fig. 6. The Upper Vestibule after Creswell.

In the top courses of the Madrasa's West Wall, over what I presume to be the corridor, are two straight joints with obvious infill between them. These may represent the remains of an upper corridor running at right angles to the West Wall. Over the window to the north iwan are a couple of bonding holes which may line up with the north face of the vestibule's north wall: if they did then there are two reasons for their presence; firstly, having supposed that there was an upper corridor the holes could have been used to locate and bond the corridor's side wall directly above the north face of the wall below, or what I feel to be the acceptable explanation, and that is, that they were left as future bonding holes while the work on the Madrasa's West Wall progressed but there was an unexpected change in al-Ashrafiyya's plan, instead of the typical Carene room spanned by a timber ceiling for some reason that kind of structure was exchanged for the traditional Jerusalem vaulted structure with the result that the 'bonding' holes became redundant and were covered by the vault's overburden.

In the foreground of figure 6 are the remains of another room or space complimenting the space east of the vestibule, this also narrowed at its points furthest away from the vestibule.

.12 The Madrasa (Drawings 7-15)

.12.1 The grey stone qibla wall lost about a third of its length in the earthquake, so that today it ends at the western reveal of the first window existing to the east of the Mihrab, its east cross-section shows four red headers which are seen on the wall's south face as forming a recessed ablaq jamb. Like the others in the Madrasa, this window had an internal arch because the line of the haunch for the first voussoir is still visible. This small detail informed me that the detailing of the arches in the east differed from those complete arches over the blocked up windows west of the Mihrab. I have found no evidence for or against the Mihrab having columns, nor have I found evidence for columns in the pseudo/
49.

pseudo gateway in the Madrasa's north wall mirroring the Mihrāb. I am inclined to the view that there were no columns; some people could dispute this view by arguing that the cutting back of the stones flanking the central niche indicate the existence of columns in the past, but my reply is that these cuts are too crude, and that they are not in the relative positions one would expect to find columns, they are too near the Mihrāb's centre. The shapes of the voussours in the subordinate arch are most unusual, I can think of no explanation for the irregularities of their cutting certainly no sound structural reason, quite the reverse³⁶. The Mihrāb's spandrels are pitted as though they were to be embellished with marble or mosaic, but the areas are so irregular and of such an unfinished appearance that it is hard to credit this to be contemporaneous with al-Ashrafiyya. In between the apex and the wallhead is an inscription running the full length of the wall sitting on a red stone course, over the Mihrāb the inscription is interrupted by a cusped red stone inscribed with the names and titles of Qāyṭbāy, and where the inscription turns at the south-west corner it is again interrupted but on this occasion by a flat carved arabesque 'corner piece'.³⁷

The Qibla īwān's west wall with its three arched window recesses is more flamboyant than the qibla wall. Below the level of the arches' springing is a full red stone course turning into the ingos, above the arches are ablaq voussours enclosed by the red stone compartmentation defining the single and double decorated spandrels. Above the apexes of the arches the red compartmentations meet and form 'key stones' with small circular indentations or 'silent links', since they link together the red stone compartments and by their presence give the key stones dynamism, rather like the looping at the apex of a conventional archivolt does. Surmounting the spandrels is the inscription which has at the/

the centre of this wall a white stone shield of Qāytbāy, and at the ends are arabesque corner pieces.

The īwān's short north wall continues the full red course and the inscription of the west wall until the original masonry is terminated by a rebuild. In its lower stone courses the original masonry continues on a short way and this extension is capped by stones set at a slope.

2.12.2 All that remains of the Madrasa's Sahn is its west wall extending from the Qibla to the North īwāns interrupted by the extant West īwān.

In the southern section, the stonework above the capped extension of the Qibla īwān's north wall is all a rebuild until it is stopped by a vertical red compartmentation heralding the return of original masonry. Dominating the composition of this section is a rectangular opening with its compartmented, decorated and composite lintel and above its compartmented and joggled ablaq relieving arch with a decorated tympanum. Over these is the least obvious of the wall's compartmentations a central recess with a chamfered cill, a joggled ablaq course and flanked by engaged columns which although extremely weathered have vestiges of arabesques on their shafts (see Pl. X). On the right of these compartmented units are two units which define the opening of the West īwān, the lower is the decorated side panel to the curvilinear muqarnas inside the īwān and the upper consists of a linked archivolt isolating four ablaq courses the remnants of this arch's voussoirs, note that their intrados is proud of the muqarnas.

The northern section of the Sahn's west wall reflects all of the elements of the southern section with the important addition of the North īwān's great arch's abutment and west pier replacing the area of rebuild.

There are two compartmented units: the lower is a side panel to the impost's curvilinear muqarnas, unfortunately there is no hope of ever knowing/

knowing exactly the panel's decoration due to excessive weathering, similarly any decoration in the mugarnas cells has vanished beyond recall; the second unit is made up of a linked archivolt framing ablaq voussoirs and so establishing that the great arch was horseshoe shaped and that the intrados of its lowest voussoir is proud of the impost's mugarnas.

2.12.3 Comparatively little effort was expended on decorating the West īwān, however it does contain elements similar to the Qibla īwān's west wall. It has the universal inscription running along the wallhead, its progress interrupted only at the corners of a larger version of the double fleuron seen earlier in the Portal Recess' inscription, but unlike that inscription the fleuron is also used in the form of half a double fleuron to originate and terminate the inscription. The īwān has also the full red course on each of the three walls, in the west wall the course is broken by an arched recess which has, at its rear, the now blocked northern window along the Courtyard's east wall. The diverseness of the decoration of the west wall of the Qibla and West īwāns is found in the spandrels, in the West īwān they are undecorated.

There are, of course, the curvilinear mugarnas imposts and the ablaq voussoirs above them framing the West īwān. On both sides of the īwān, in the third voussoirs are square holes which no doubt housed the ends of a tie-beam: this was actually structurally redundant and was really only of use as a means for hanging the ubiquitous glass mosque lamps.

2.12.4 An austerity is given the south wall of the North īwān by leaving the impost's side panel bereft of decoration and allowing the inscription to abut the red stone archivolt and terminate without any elaboration, there is also the full red course common the the other īwāns.

The west wall has two arched recesses, both are now blocked up although
in/

in the northern blocking an opening has been slapped through the wall to provide light to the modern domestic room on the other side, this wall corresponds closely with the detailing of the Qibla īwān's west wall it being recognised that it is approximately two-thirds the size and that some adjustment had to be made, thus the shield of Qāyṭbāy repeatedly seen at the centre of the inscriptions was not included. There is one detail which should be remarked upon as it does not occur in the Qibla īwān: it is that the decorated northern spandrel turns the corner to continue along the north wall, and therefore we have not only a double spandrel but it is also bent³⁸.

In view of the restraint shown in the qibla wall's decoration and appreciating that at the original centre of the North īwān's north wall the abnormally large arched recess with side niches equated with the size and position of the Mihrāb, therefore it might have been imagined that this commonality required a corresponding reduction in the north wall's decorative areas, but this plainly was not so for we have observed that a double spandrel is bent around the north-west corner to continue the architectural theme. In the inscription band above the pseudo gateway is a cusped red stone with the names and titles of Qāyṭbāy. Within the pseudo gateway is a wide and noticeable straight joint which has been remarked on earlier in 2.06. - The North Elevation (see pp. 25-26). The masonry to the west of this joint belongs not to al-Ashrafiyya but to its northern neighbour, the Madrasa ^cUṭhmāniyya, and the line of this wall is not parallel with the face of the north wall of al-Ashrafiyya's North īwān. However, this was disguised behind the stone tympana of the two western alcoves and I imagine timber shutters, these also concealed shelving set into the horizontal channels which are still visible in the stone reveals of the three alcoves, that is including the pseudo gateway. The present window at the rear of the central alcove is modern.

The/

The eastern cross-section on the north wall is similar to that of the gibla wall, there are three red coloured headers which formed an ablaq jamb to a window, but there is the addition of the full red course stopping short of the headers and there is also the fundamental difference that the north wall is considerably thicker than the gibla. I have wondered about this unexplicable difference in thickness: was it due to the presence of the Madrasa ^cUthmāniyya, and if it was why was it that a more orthodox straight joint produced by a direct abutment of al-Ashrafiyya's north wall against the existing south wall of the ^cUthmāniyya was not chosen in preference to the more complicated, or at least a longer hidden straight joint; or there is a second possibility, was it that the existing south wall of the ^cUthmāniyya was utilised by and incorporated into al-Ashrafiyya's north wall in support of the vanished superstructure; or was it due to some attempt to create a special relationship between al-Ashrafiyya and the Sabīl of Qāyṭbāy? An answer can be found which combines the first two alternatives: if an orthodox straight joint had been used the north-south dimensions of the Madrasa would have been shortened with the consequence that by incorporating the ^cUthmāniyya's wall the maximum length of the Madrasa could be obtained; this still leaves unexplained the discrepancies in the thicknesses for if this had been the real explanation the respective walls could have had the same thickness and had this thickness been that of the gibla wall there would not have been any requirement for the chamfer and change in thickness in the north wall of the majma^c below.

The question of some relationship being created to combine in some way al-Ashrafiyya and the Sabīl is difficult to assess. It is within the realms of probability that the Sabīl was along a 45° axis taken from the north-east corner of al-Ashrafiyya, but this can be seen to be wrong by simply standing at the corner of the present Madrasa's shell and looking towards/

towards the Sabīl, and anyway this is not a view which was possible when the Madrasa was complete. Thus the Sabīl exists at a sufficiently near distance to al-Ashrafiyya to be accepted as an accessory to it, so bringing al-Ashrafiyya nearer to the practice current in Cairo where madrasas were combined with sabīls; but as the sabīl in al-Ḥaram is not physically joined to al-Ashrafiyya its position within the Syrian madrasa tradition is maintained.

2.13 The Minaret

2.13.1 This structure is considerably older than al-Ashrafiyya and its predecessor the 'Old Madrasa' and as the site of a minaret it may originate in the Umayyad period, but whatever its precise age the Minaret has always lead an independant existence in spite of it being incorporated into al-Ashrafiyya to establish Qāyṭbāy's new foundation in the tradition of Cairo madrasas which, in the main have their own minarets.

It was restored under Malik Nāṣir Muḥammad b. Qalāūn by the amīr Ṭankiz in 730/1329-30³⁹ who had the previous year built his own Madrasa Tankiziyya⁴⁰ outside Bāb al-Silsila. Although the question is not formally asked by van Berchem in his commentary, was this an attempt to join the Minaret to the Tankiziyya in the Cairo manner? Van Berchem concludes that there were either economic and practical reasons or that it was out of respect for the historic and sacredness of the Minaret and the side of Al-Ḥaram that they were not conjoined. Three hundred years later the Minaret's independence is still recognised as being integral with al-Ḥaram's functions rather than as an adjunct to al-Ashrafiyya by Evliya Tshelēbi, who visited Palestine twice, in 1059/1649 and in 1071/1670-71. He wrote:

"(The Minaret of) the Madrasa Sulṭāniye at the Bāb el-Mutawaḍḍa is best, it has a minaret with three stories (sic) which is one hundred and thirty feet high. The humble writer ascended it and enjoyed a complete view over the whole town Besides these three (al-Ghawānima, Bāb al-Asbat, Bāb al-Silsila) there are no other minarets in the Ḥaram area. Never have the mosques of el/

el-Aqṣa and that of the Holy Rock any minarets. The Islamic call to prayer is recited from the heights of this latter minaret, as it is near the town." 41

Today the call to prayer is still heard from the Minaret's gallery, unhappily the muezzin singing from on high has been replaced by batteries of loudspeakers, thus after many centuries the independent purposes of the Minaret and its generations of muezzin have now bowed to the electronic equipment of modern man to provide exactly the same calling simultaneously from all of al-Ḥaram's minarets: I am thankful that the muezzin is retained instead of being substituted by a recording.

2.13.2 A description has already been given for those visible parts of the Minaret's base in Sections 2.07 and 2.10 where it formed part of the wall to the north of Bāb al-Silsila and formed one of the walls of the Grand Staircase, so the following will concentrate on the freestanding square shaft rising above the base and the present wallhead level of al-Ashrafiyya.

The first register is introduced by a fillet or lintel string course directly below centrally placed ogival headed lancet windows on the east, north and west faces. Over these windows on the south, east and north, but not the west, are large chiselled-out circular areas which obviously had some special purpose. When I first considered them I thought that they had held ablaq roundels similar to those on the minarets of the Khānaqāh Ṣalāḥiyya 820/1417 and the Mosque of Afdal ^cAlī c.870/1465-66⁴², but when I came to study the (golden) tripartite shields of Qāyṭbāy in the Window Wall under al-Ashrafiyya's Porch I revised my ideas with regard to the appropriateness of simply decorated ablaq roundels in such a context replacing them in my mind's eye with the sumptuous golden shields of Qāyṭbāy. Later when I imagined the likely height of the completed Madrasa I realised that the northern circle would have been totally obscured, and so I no longer looked to Qāyṭbāy for an explanation; the/

the circles had to be earlier. I then considered Khushqadum especially after Burgoyne had spied the small shield inscribed on a marble building stone in a first floor window recess only a few metres to the south: it could logically have belonged to him because the northern circle would have been visible from the courtyard of Khushqadum's madrasa, 'the Old Madrasa' built over the riwāq in the shadow of the Minaret, the eastern circle would have acclaimed to all in al-Ḥaram of Khushqadum's association with it. However, I have one objection to this possible solution, why were the shields of such grand proportions if, as we are led to believe, his madrasa was unimpressive?

Having drawn a blank in the 9th/15th century I turned to the previous one, in which, of course, the Minaret was restored under Malik Nāṣir Muḥammad in 737/1336-37. The 'restoration' was the reconstruction of the earlier minaret by replacing it with a new construction on top of the ancient base, thus Nāṣir Muḥammad had every right to be proud of the new foundation and to publicise it using great circular shields.⁴³

If we can settle on Muḥammad Nāṣir as the originator of the circular recesses in the Minaret of Bāb al-Silsila's sides; I would be inclined to lay the blame of their demise on Qāyṭbāy, a man adept at finding some means of adding his name to the earlier foundations of others and whose ⁹vivillance in this matter would have demanded their removal because they would have detracted from, or at least conflicted with, his own new and magnificent al-Ashrafiyya and its incorporation of the Minaret.

There was one outside chance that the shields bore the cup of the Amīr Tankiz, as examples are found within the recessed portal of his madrasa beside Bāb al-Silsila and in his caravanserai or bath Khān Otuzbir but there is the great difference that the latter complexes were constructed with Tankiz's own money while the Minaret was ordered by the sultan.

This/

This could also supply the reason for the separation of the madrasa and the Minaret.

The second register up the Minaret's freestanding shaft begins at a mugarnas type string course badly eroded in the north face. In each of the four faces are similar window recesses flanked by a variety of re-used crusader marble columns and capitals, at the recesses' centres are ogival lancet windows with chamfered external reveals. Along the top of the recesses are curvilinear mugarnas, there seem to be two variations, one used on the north and south faces and the other on the east and west. At about the same level the stone work changes in character, it becomes patchy and the horizontal joints dislocated and irregular. There are on each of the Minaret's faces in the third or fourth course above the mugarnas the forms of one or two mugarnas units encroaching on the dislocated masonry: these suggest that there was a gallery corbelled out on mugarnas 'stalactites' and not the varied and sometimes ugly consoles of the present gallery. Mujīr al-Dīn's Dhayl notes that the minaret was damaged in the 1545 earthquake (see pp 15-17), I contend that it demolished the upper registers of the Minaret and its gallery. The existing gallery is Ottoman and it appears in the earliest close-up illustration of al-Ashrafiyya and the Sabīl of Qāyṭbāy taken in 1880. (See Pl. XI)⁴⁵. As I was able only on one occasion to climb the Minaret I am not in a position to be at all definite about the chronology of the shaft's reduced square surrounded by the gallery, nor of the penultimate octagonal register with its blind trifoliated headed windows, but I doubt whether the octagonal is original if the other Mamlūk period minarets in Jerusalem are accepted as comparative models: the Minaret al-Ghawānima (c.707/1307-08) has a square at the centre of its gallery, as do the pair of minarets belonging to the Khānaqāh Ṣalāhiyya and the Mosque of Afdal ^cAlī which flank the Church of the Holy Sepulchre.

There/

There is the contemporary pictorial evidence published by Bernhard of Breydenbach in 1486, (See Pl. I). This attained an uncommonly high standard of accuracy and from it the proportions of the Minaret of Bāb al-Silsila can be judged alongside and paired minarets of the Church which are sufficiently detailed to show that the galleries' octagonal registers stop above the awnings just as they do today. It must be apparent that the gallery construction would have followed al-Ḡhawānima's rather than that of the paired minarets.

Positive photographic proof exists to show that the present circular register and the lead covered dome, which looks most authentic and matched the pre-1956 restoration dome of the Qubbat al-Sakhra, must be early 'British Mandate' ! Creswell's photograph (Pl. VIII) illustrates an earlier stone dome which, along with its circular base had replaced an Ottoman 'witch's hat' sometime after 1880. In Figure 7.a comparison is made of the types of terminal beginning with a typical Mamlūk one which might have graced the Minaret.



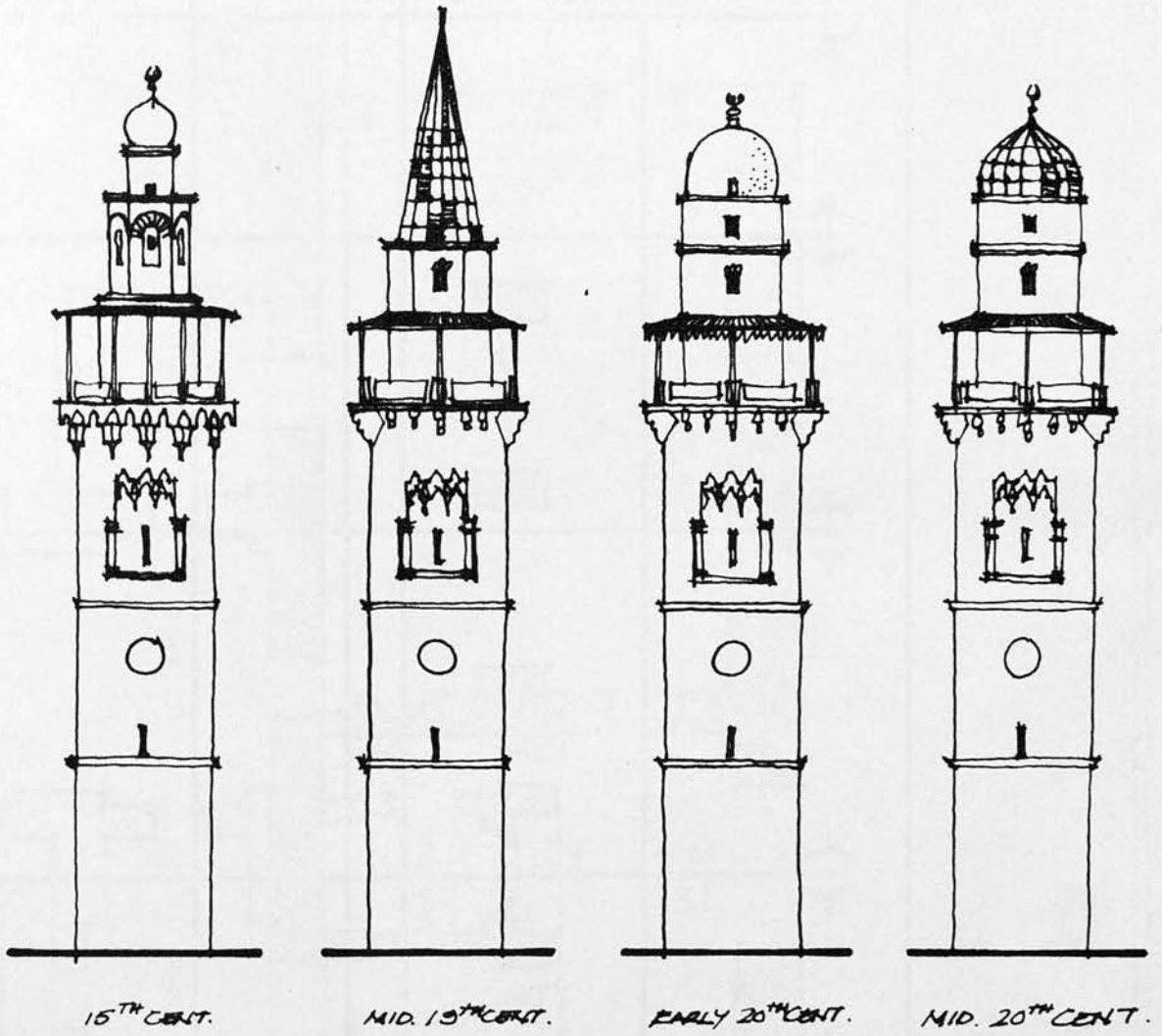
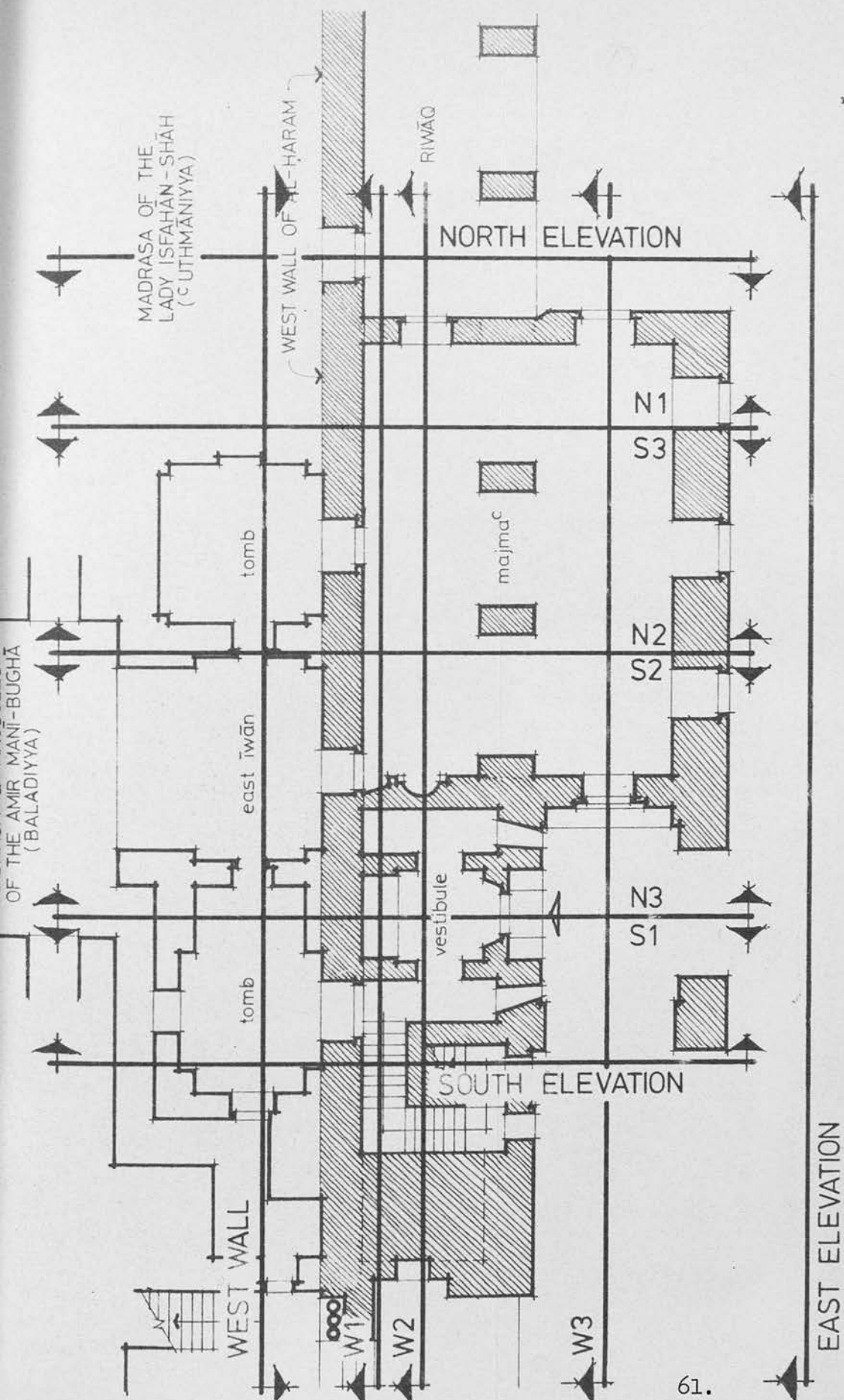


Fig.7. The Minarets of al-Ashrafiyya.



GROUND FLOOR PLAN

MADRASA OF MALIK ASHRAF QĀYṬBĀY, JERUSALEM.
ELEVATION AND SECTION LINES

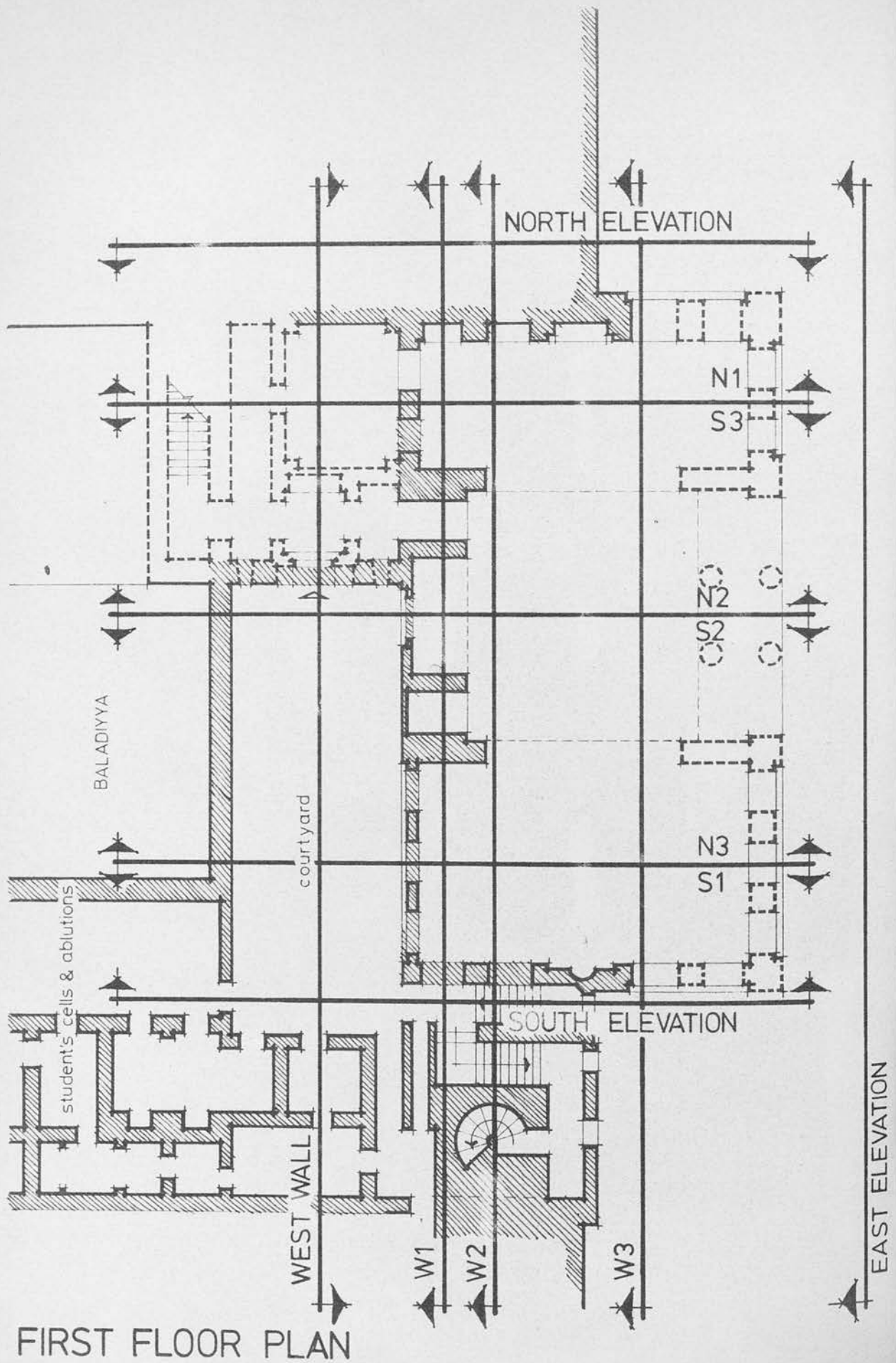
DEPT. OF ARCHITECTURE
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIF.

3.00 A RESTORATION OF THE PHYSICAL FORM OF AL-ASHRAFIYYA

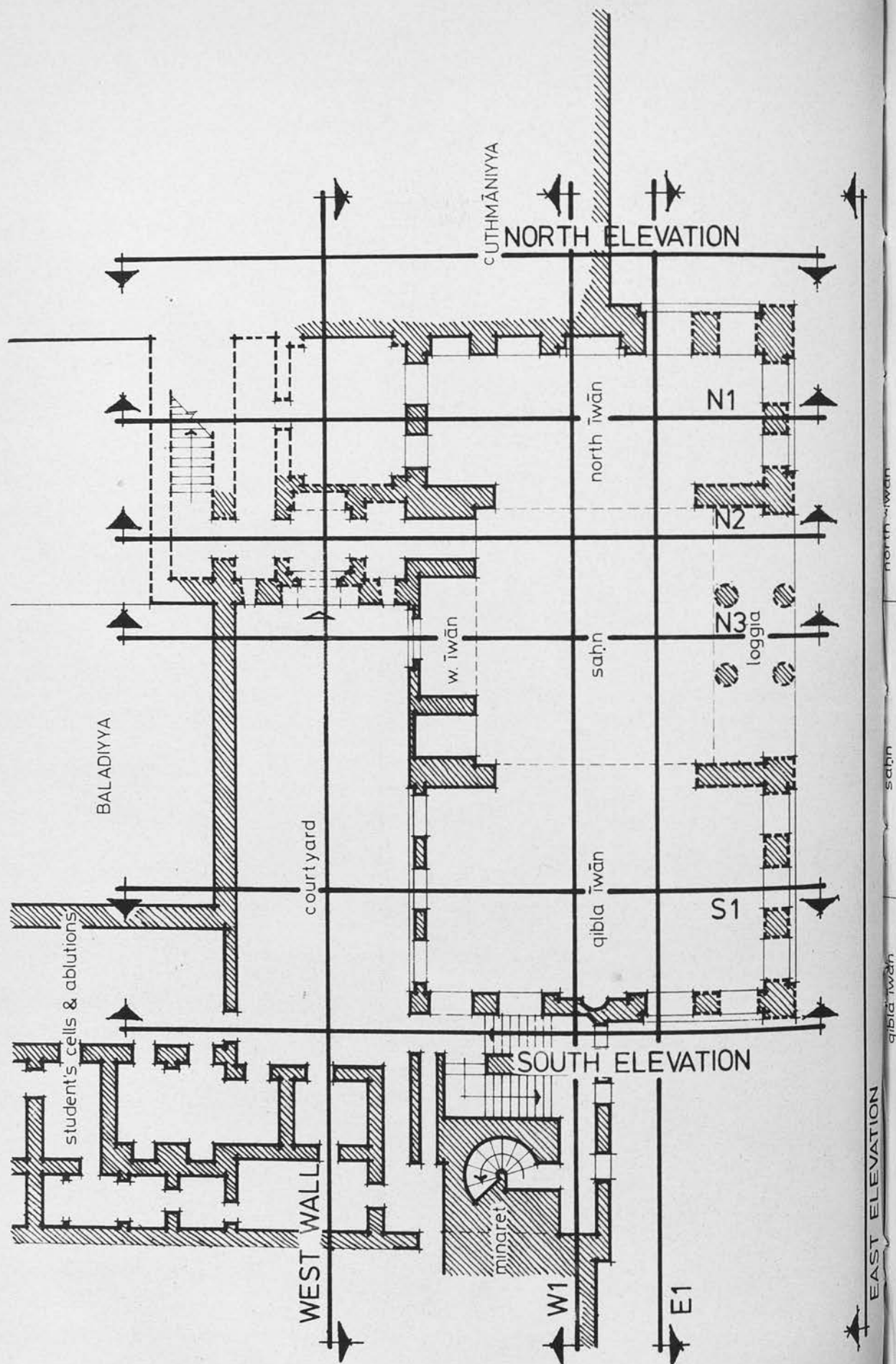
3.01 Introduction

In the foregoing description of al-Ashrafiyya it was obvious that the Ground Floor areas were unchanged while those of the First Floor were ruins: this leads to the two questions fundamental to the task I have set myself. Firstly, is there sufficient material evidence in the First Floor areas to enable a theoretical reconstruction of al-Ashrafiyya? The second is more a supplementary question. If there is the necessary evidence can it be presented in a logical design sequence, perhaps emulating the design procedures of the Christian architect? My answer to both questions must be a conditional 'Yes', on the basis that scholars are continually emphasising the inherent unity of Islam and its arts and on the presumption that it does exist, what better context could there be for divining this quality than in the contribution to the Third Shrine of Islam of Sultan Qāytbāy 'The Prince of Builders'?

Often this unity is discussed in terms of an aesthetic or philosophical relationship to Islamic theology, or if it is concerned with specified visual characteristics it is expressed in generalities. Only occasionally is this unity sought for in a visually closed context, that is a setting contrived by the wits of men which had first to be imagined and then created by craftsmen. They undoubtedly took cognizance of the theological constraints and strove to find a physical syntax compatible with the requirements. Unfortunately the generalised references to unity may only prove that unity is present in the Islamic macrocosm they can hardly prove if unity is all encompassing extending down to the microcosm, if it does not at what point on the macro-micro scale does unity end? Some might argue that even to consider this possibility is futile and that of course unity is all encompassing, I on the other hand intend to prove that unity in some guise exists at all levels of architecture and its associated decoration instead of accepting another's generalisations./



FIRST FLOOR PLAN



FIRST FLOOR PLAN

generalisations.

Relying solely on my own eyes I feel that a unifying ingredient forms part of the architectural creations in the same time-space setting, they exhibit characteristics which promulgate feelings of comfort, of recognition, of anticipation, in fact the whole gamut of human emotional reactions to artifacts, including the negative emotions. Referring back to my conditional answer 'Yes' this unifying ingredient is the crux of any restoration, it could be used to translate the historical descriptions of al-Ashrafiyya into a three dimensional model without any knowledge of the physical sizes of al-Ashrafiyya, such a restoration is open to dispute, it would be as meritorious as any other restoration. I believe that I, as a trained architect, can apply my experience to the study of the architectural evidence of Qāyṭbāy's Cairo buildings, which belong to the identical time-space setting as al-Ashrafiyya, and in combination with the devastated walls of the First Floor now reduced to approximately a quarter of their surface area arrive at the unique restoration. It is with reluctance that I admit to having an impossible ambition, it is that I will be able to discard my twentieth century thoughts and exchange them for those of the Carene Christian architect living in the late fifteenth century beginning with the moment in 886/1481 when he entered al-Ḥaram invested with regal authority and the sultan's commission to transform the existing meagre foundation into one commensurate with its status as a madrasa bearing the name of the all powerful sovereign.

3.02

The Site

The location of the site is superb, it lies between the two most frequented gates of al-Ḥaram, the Bāb al-Silsila and the Bāb al-Qaṭṭānīn, and it could hardly be closer to the focal point of the sanctified enclosure, the magnificent Quabbat al-Ṣakhra. From every standpoint it/

it is a prime site which, with feeling and imagination, could be developed advantageously. There is one slight drawback, the combined areas of the riwāq's roof bounded by the Madrasa ^Uthmāniyya in the north and the Minaret in the south, and the roof of the Madrasa Baladiyya's eastern iwān cannot contain the large structures considered the norm in Cairo. (See Figs. 9 and 10). Since the Old Madrasa had already been extended to the areas beneath the riwāq it might have been possible to accommodate the proposed functions of the new foundation above and below the riwāq if the size of the new work was inclined towards the Jerusalem standards instead of Cairo's.

If a madrasa designed to Cairo standards was to be fitted on the site then the problem of the restrictions had to be overcome. A way was seen but it meant a drastic decision involving the breaking of one of the traditional regulations imposed on every building sited along the west and north boundaries of al-Ḥaram: It was that no structure was allowed to extend beyond the building line defined by the cornice of the riwāq and thereby dislocate its ancient circumambulatory function.

Even assuming that the locals had objected to this overthrowing of tradition the architect had the weight of royal authority backing him, so that once he had had the notion to extend the area of the riwāq's roof eastwards it was no longer worth arguing over. With nothing in the vicinity to stop this eastern extension a full blown Cairo type madrasa could be planned for with impunity. (See fig. 11).

It must have been recognised that if this extended site was designed to produce the optimum effects the architectural traditions of Cairo madrasas would be broken, because unlike the traditional Cairo madrasa al-Ashrafiyya's Madrasa would not start at ground level but be raised up to riwāq roof and so would need the addition of a new architectural feature, a Grand Staircase and processional way. Had this elevated solution/

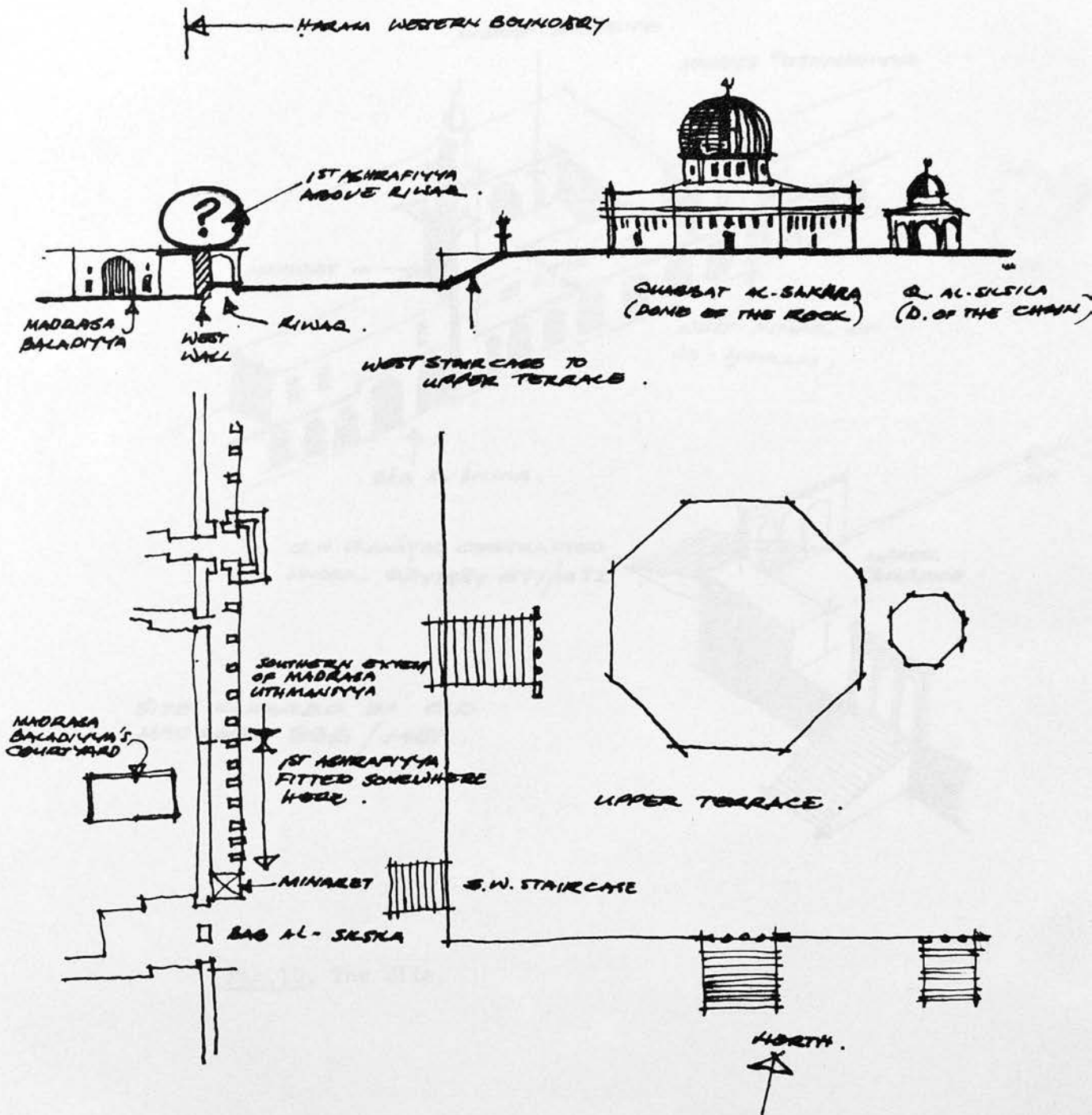


Fig.9. Al-Ashrafiyya's Site Limitations.

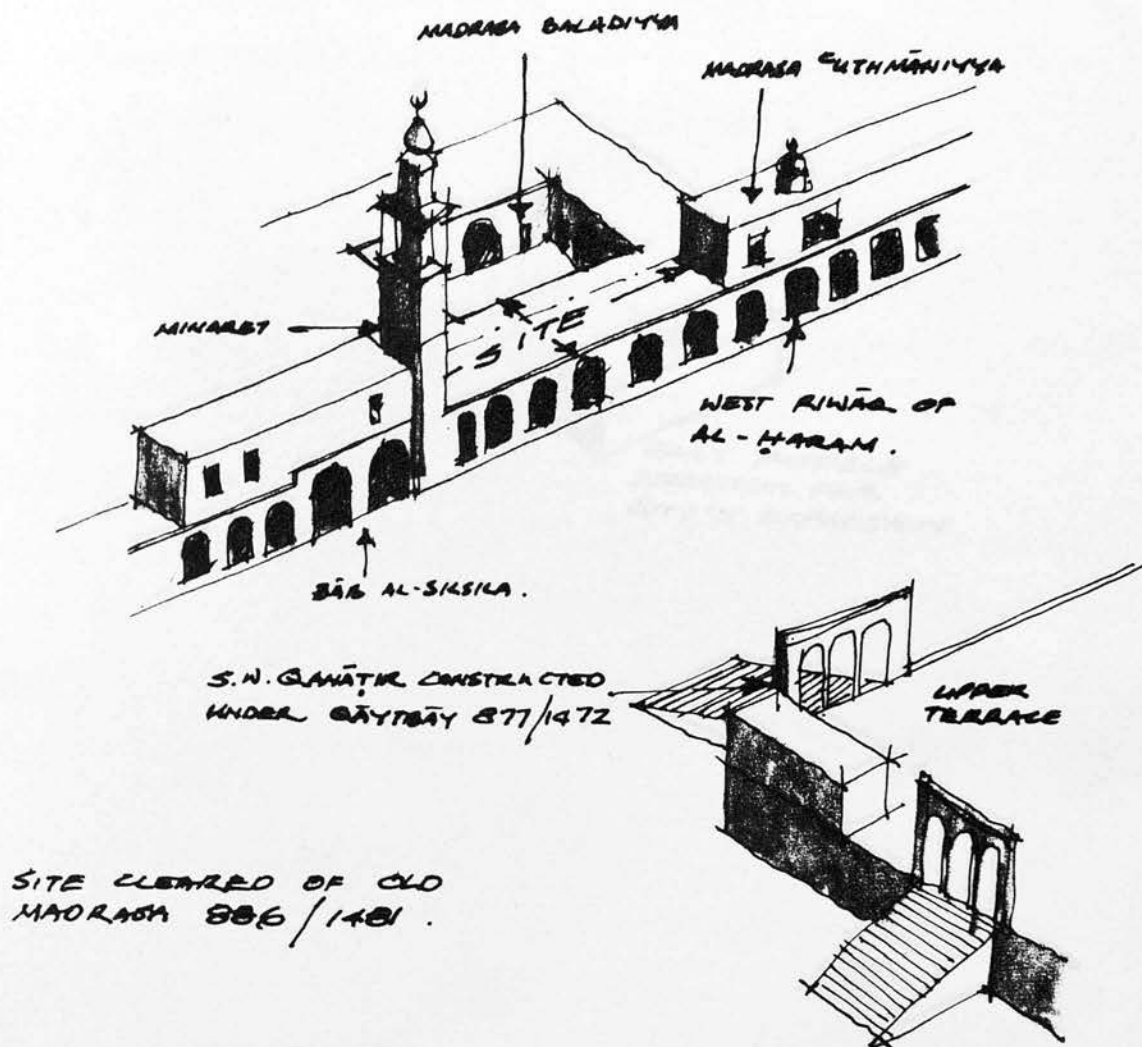


Fig.10. The Site.

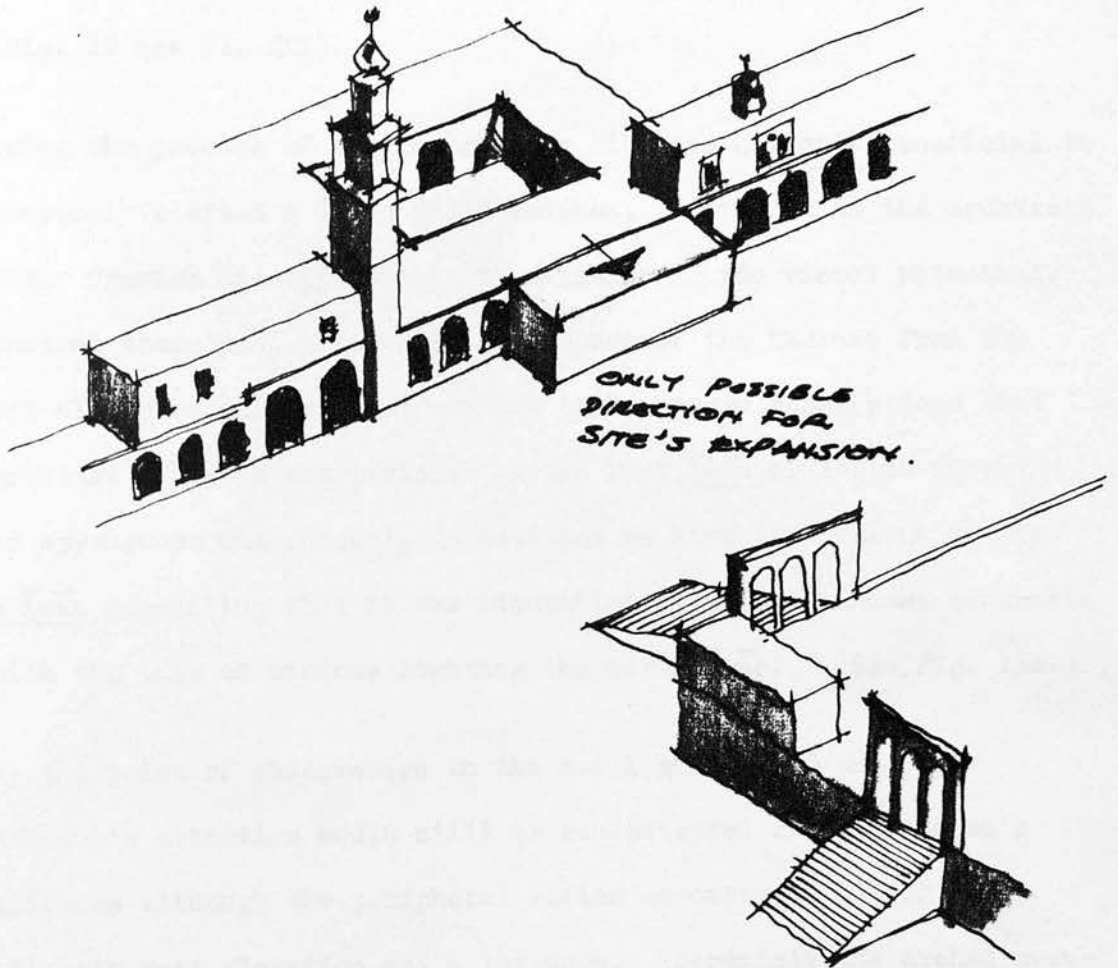


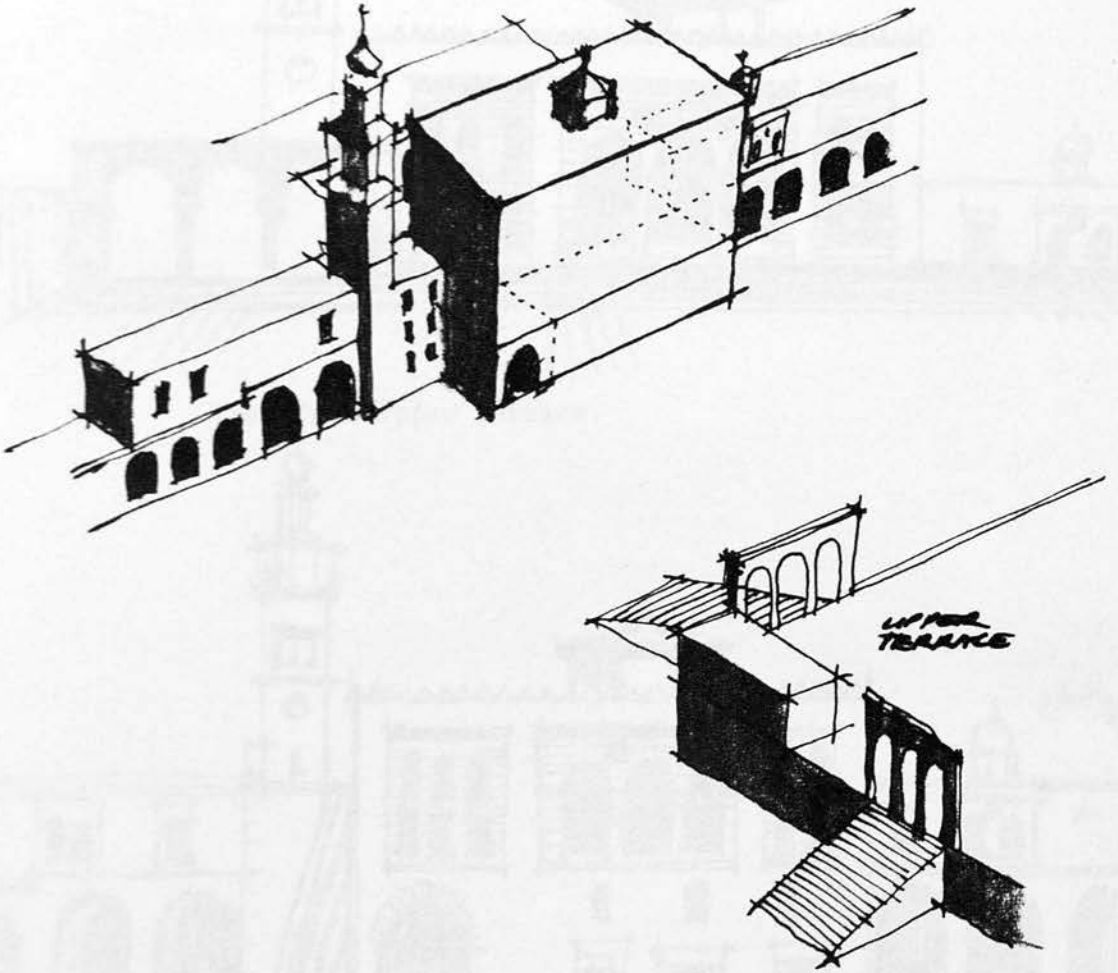
Fig.11. The Extended Platform.

solution not been found and the new Madrasa been built directly on ground level all that might have been visible from the south door of the Quabbat al-Ṣakhra would have been in the region of the madrasa's wallhead, instead, al-Ashrafiyya's complete Madrasa is visible due to the riwāq's roof being fractionally higher than the level of the Upper Terrace. (See Fig. 12 and Pl. XIII).

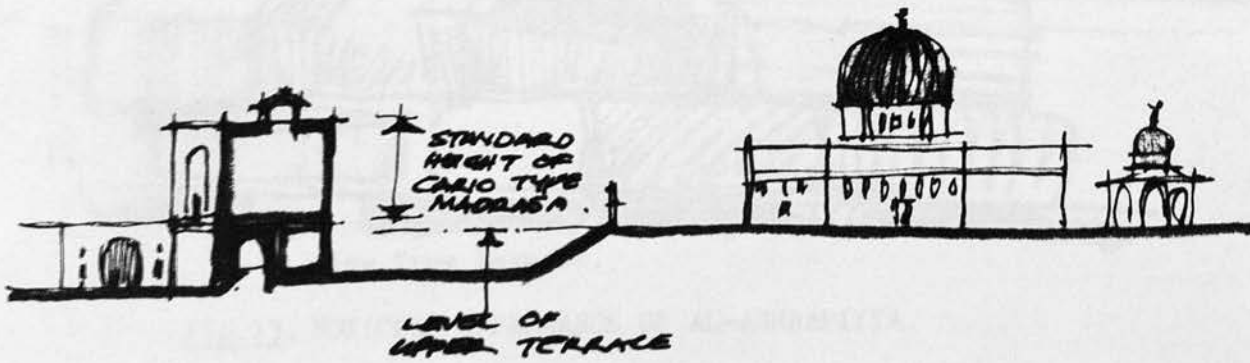
Resolving the problem of the restrictive site was not only beneficial to the proposal to erect a Cairo sized madrasa, it offered to the architect a greater freedom and opportunity to maximise the visual potential. The central theme was, of course, the impact of the Madrasa from the Quabbat al-Ṣakhra and we know from the contemporary descriptions that the greatest emphasis was lavished on the East īwān or loggia whose arched appearance was unusual, in addition we have the remains of the Qibla īwān suggesting that it was identified by triple windows contrasting with the pair of windows lighting the North īwān. (See Fig. 13a.)

Moving the point of observation to the small parapet of the Upper Terrace one's attention would still be concentrated on the Madrasa's magnificence although the peripheral vision encompassed all of al-Ashrafiyya's East Elevation and a lot more. Certainly the arched opening framing the deeply recessed entrance side lit by a second arch would have been included; there might also be an awareness of a third elevational element wishing to escape attention, but at the same time it is indispensable to the elevation's totality providing a certain solidity to the composition. (See Fig. 13b). Therefore the East Elevation has three divisions; the elevated Madrasa, the grand archway, and the restrained majma^c each treated in a different manner to stress their personalities and relative importance in the consciousness of the architect.

Presumably/

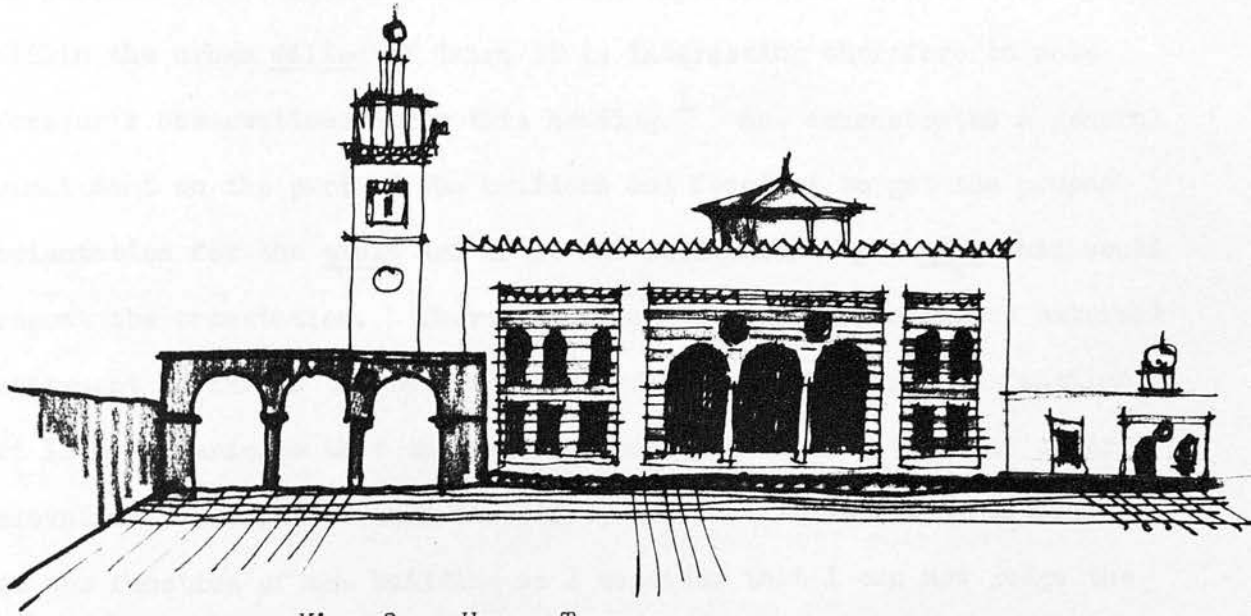


a) Al-Ashrafiyya's Volume.

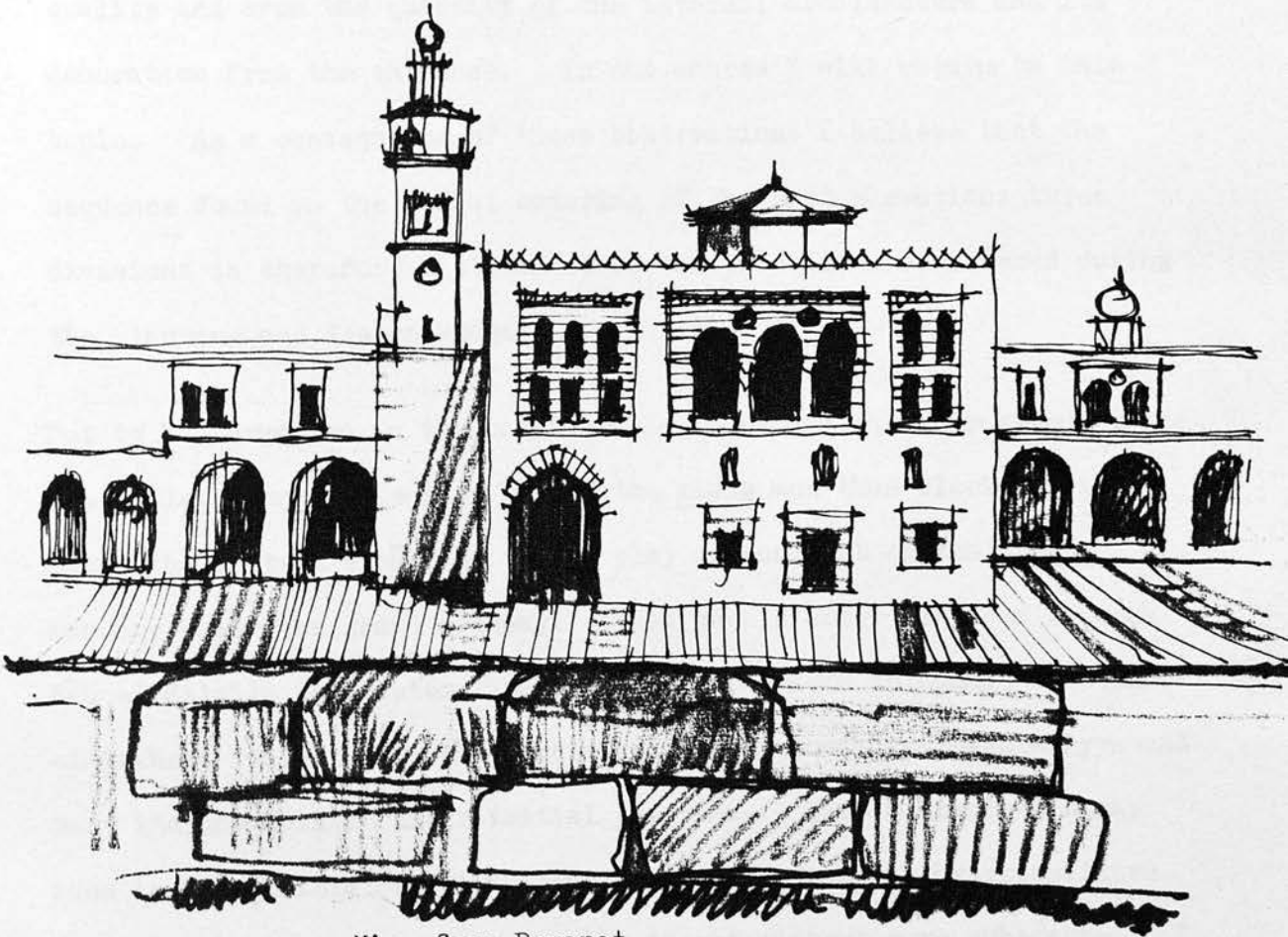


b) Topographic Features of Site.

Fig.12.



View from Upper Terrace.



View from Parapet.

Fig.13. NOTIONAL APPEARANCE OF AL-ASHRAFIYYA.

Presumably the architect was au fait with the practices and the 'conflict of secular and religious considerations expressed in architectural plans' within the urban milieu of Cairo it is interesting therefore to note Kessler's observations under this heading.¹ She demonstrates a general commitment on the part of the builders and founders to get the proper orientation for the qibla and if it was accompanied by a sahn this would repeat the orientation. There was also the need to provide an external statement to inform the passersby of the building's religious function. It is my experience that the entrance contributes more than any other elevational element to this statement, and that it does not just relate to the function of the building as I consider that I can now judge the quality and even the quantity of the internal architecture and its decoration from the entrance. In due course I will return to this topic. As a consequence of these observations I believe that the sequence found in the visual ordering of the East Elevations three divisions is therefore a statement of the priorities considered during the planning and design stages.

Not to be forgotten is the considerable townscape value provided by the South Elevation's extension beyond the riwāq and thus blocking views along the Western Riwāq and to the play of sunlight on the ablaq masonry below the grand archway. When people enter al-Ḥaram through Bāb al-Silsila they automatically turn to the left to admire the Quabbat al-Ṣakhra; in doing so they are also turning towards al-Ashrafiyya and many include this in their initial panorama. Such a suggestion may seem to be a little over indulgent coming from someone hypersensitive to al-Ashrafiyya's existence, but it is not without some substance. I have watched over the years thousands of tourists coming for the first time to this sacred area, some are unfortunate and are given twenty to thirty minutes to enjoy and inspect the sights, the fortunate majority with a more relaxed itinerary can spend time standing just inside the gate marvelling/

marvelling over the beauties they behold, a large number specifically photograph what is still remaining of the South Elevation and some may come right up to it before continuing their approach to the Upper Terrace. Imagine how much more impressive the pristine al-Ashrafiyya was?

3.03

The Design of the Madrasa

In the knowledge that the site's west-east dimension can be increased without hindrance if a platform is built, the crucial dimension is switched to the north-south measurement fixed by the Minaret and ^cUthmāniyya. This measurement had to be capable of entertaining the Cairo sized Madrasa and the means of access from ground level. At about this stage in the design's feasibility studies the decision must have been agreed upon to retain and incorporate the mihrāb beneath the riwāq which had been built for the Old Madrasa's majma^c in the new and enlarged majma^c under the platform extension.

Supposing that the final design was reached in a way comparable to its modern equivalent a considerable time would have been required, and presumably along the road numerous solutions were thought of, adapted, revised and revised again or discarded until the sumptuous design was achieved and now only hinted at by its shattered remains: there is no method available to ever recreate or discern from al-Ashrafiyya what designs were rejected but if there were it would provide a splendid insight. Instead I must be satisfied with discovering what took place after the sketch design was agreed.

First of all the plan of the Madrasa has to be reconstructed; this is simply done as the Qibla and North īwāns each have more than fifty per cent of their plans extant, however the East īwān is totally lost other than the ablaq masonry visible in the East Elevation's wallhead, and the contemporary sources remark on its arches and columns, features which could/

could not have been duplicated by the West iwan. (See Drawing 17).

I visualise the process after agreement as being similar to that of the Kilāniyya; there the width of the gap site generated the complex's elevational treatment. (See Appendix B). In the case of al-Ashrafiyya the plan takes priority over the elevational treatment but the site dimensions remain to generate the design. Somehow a dimensional unit was arrived at that could provide within the site limits the proportions for an ideal Madrasa, maybe the unit was found through trial and error but I suspect it is more likely that it was through some regulated and accepted method. Whatever name was given this mode of measurement in Mamlūk times, it is equal to 7.20m because: i) the depth of the Qibla iwan from the great arch's south extrados is 7.20m., ii) the overall width of the Madrasa, including distortions, equals 14.39m which is equal to twice 7.20m., if the discrepancy of 0.01m. is disregarded, iii) the depth of the North iwan plus the intrados of its great arch and the thickness of its north wall is 7.25m., a discrepancy of 0.05m which is less than a one per cent error. As these dimensions play a significant role in the placing and the arrangement of the Madrasa's parts it is logical to continue with 7.20m. and investigate whether other relationships dependant on this Generating Unit (GU) can be uncovered.

3.03.1 Establishing the Primary Geometry (Drawing 18)

Beginning at the visual centre of the Madrasa which would have been the centre of the Sahn (S), a circle with a radius equal to GU is drawn and inscribes a double hexagon 1-12. By producing the lines 6-8 and 12-10 they intersect at M and form an equilateral triangle 12, M, 6, with sides twice GU.

The depth of the Qibla iwan is established by constructing a square with sides equal to the GU along the axis SM where M is the mid-point of one of/

of the square's sides, the centre of the square Q_1 is also the centre of the Qibla Iwān and Q_2 defines the Iwān's north wall, observe that the span of the great arch coincides with the square's side with the mid-point Q_2 , and so it too equates with the GU (there is a discrepancy of 0.12-0.14m. but this could be explained as an allowance to enable the mugarnas imposts to project 0.06-0.07m).

To find the width of the intrados used in the Sahn's great arches across the faces of the Qibla and North Iwāns a square is constructed joining the intersections (1-2, 1-3), (3-5, 4-6), 6-8, 7-9) and (9-11, 10-12), this dictates the Sahn's south wall and therefore the intrados of the great arch to the Qibla Iwān, the square also provides the face of the Sahn's north wall and the centre lines of the west and east walls.

At point N, the mid-point of the Sahn's north wall, if a semi-circle with a radius equal to the GU is drawn to cut the produced axis M-S-N the external face of the Madrasa's North Elevation is indicated.

To discover the internal depth of the North Iwān a circle is described about point 3, with a radius equal to 3-N, the north wall is tangential to this circle. This may be checked arithmetically: it has been shown that S-3 equals 7.20m. and if the north south dimension of the Sahn is taken as the measured 9.05m. which does not exactly concur with the Sahn's geometric square, then $(7.20 - \frac{1}{2} \times 9.05) \times 2 = 5.35m.$ compared to a measured depth for the Iwān of 5.40m., the difference is perhaps attributable to the Sahn's north wall face not coinciding with the theoretical square.

The above constructions establish within a proportional system the width of the Madrasa and the salient points along its north-south axis which mark the depth of the Qibla Iwān, its great arch, the Sahn, the northern great arch, the North Iwān and finally the thickness of the north wall,
in/

in addition the centres of the Sahn's west and east walls were discovered. In the feasibility studies at the outset of the design process the site's north-south measurement was fixed by the Minaret and by ^cUthmāniyya, how then do these constructions fit into the site limits? (This is, of course, ignoring the obvious point that it is seen to fit). The two are compatible, although there is still outstanding the access area joining the Madrasa to ground level and the thickness of the qibla wall: by measurement the combination of the grand staircase's two flights and the newel wall plus the thickness of the western half of the qibla wall equals 4.52m. which compares admirably with half of the Sahn's geometric square of 4.525m. taken along the north-south axis. This may be represented graphically by producing the sides of the Sahn's geometric square lying parallel to the SM axis out to the north face of the Minaret where the intervening distance forms the diameter of the semi-circle whose circumference coincides with the point M. Effectively this combination pushes half of the Madrasa's north wall on to the roof of the Madrasa ^cUthmāniyya, and is the explanation for the direction and length of the straight joint queried on p.26 above.

.03.2 The Detailed Geometry (Drawing 19)

Having established the existence of the primary geometry for the Madrasa the search can be extended to the identification of the more detailed relationships.

The Sahn

The actual corners of the Sahn have not yet been positioned, they are when the mid-points of the following segments are coupled together to intersect with the Sahn's north and south walls: for the north west corner segments (12-1) with (2-3); for the north east corner (3-4) with (5-6); for the south east corner (6-7) with (8-9) and lastly the south west corner (9-10) with (11-12). Although it is unnecessary to know the/

the actual angles of these lines when using the point joining method it is of passing interest that they are all at 45° to the SM axis.

The External Window Recesses.

The recess depths of the external windows in the Madrasa's west and east walls are found by coupling the mid-points of the segments (11-12) with (12-1) and (5-6) with (6-7) respectively.

The Qibla iwān

In the Qibla iwān the proportional system extends to the Mihrāb, to the triple windows and to the paired windows flanking the Mihrāb.

In common with the reveals of its flanking windows the width of the Mihrāb's wall section is defined if from the mid-points of the segments (8-9) and (9-10) lines are drawn parallel to SM. The width of the Mihrāb's niche is one third of the wall section's width.

In the iwān's sides the triple windows are conventional, and without actually measuring the majority of Mamlūk window openings they belong to a type based on a canon specifying the basic proportions and the ratio of void to solid. This canon may also have specified the upper and lower limits of the dimensions because I have sensed the same physical sizes in Jerusalem, Cairo, Damascus and Aleppo.²

Keeping in mind that the Qibla iwān is to be expressed on the exterior the designers had to find a satisfactory method of adapting the conventional window type to the iwān's north south measurement so long as its ratios and dimensions remained within the canonic limitations. In my first thoughts on this design aspect I assumed an inconsistency in the relative widths of the side abutments and the abutments separating the existing windows as they did not have a simple one to two ratio.³

Before embarking on geometric constructions to prove the assumed inconsistency is illusionary, the known features should be summarised; the/

the positions of the gibla wall's northern surface the the great arch's southern extrados and their external projections, also the depth of the external recess is known.

- i) With the rear of the recess as the base line construct lines at 30° to intersect at W_1 .
- ii) About W_1 construct a hexagon with one side coinciding with the line which defined the span of the great arch, the resultant figure indicates the internal face of the īwān's side wall as well as the position and width of the central window. (The measured width of this window opening is 1.44m. which is a $1/5$ Gu, Gu = 7.20m)
- iii) Constructing a second hexagon about W_1 (to produce a double hexagon) and by constructing on the north and south identical and tangential hexagons the positions of the two side windows are found along with their widths. With regard to these constructions two points need to be stated; in the two outer hexagons where the lines at 45° (dotted on the Drawing 19) intersect with the inscribing circumferences they coincide with the previously established north and south walls of the īwān, the second point may be chance, but the measured thickness of the side wall is the same as the width of the great arch's intrados.

The gibla wall's paired windows are found by keeping the same window opening and the same abutment at the corner as the side wall while narrowing the separating abutment to allow a 'good fit', this 'good fit' may have been the equivalent of a specific measurement recognised by al-Ashrafiyya's designers.

The North īwān

Only the thickness and position of the īwān's north wall has so far been determined. If a square is enclosed by the circle centred on point 3 the northern extrados of the great arch is found; note that the mid-points of segments (2-3) and (3-4) coincide with the square's sides parallel to the SM axis. Producing these parallel sides to intersect with/

with the īwān's north wall the width of the pseudo gateway's wall section in common with the reveals of its flanking alcoves is defined. This 3.79m. wide wall section mirrors the 3.76m Mihrāb wall section. The paired windows and alcoves flanking the pseudo gateway were fitted into the north wall just as their counterparts had in the Qibla īwān. The paired windows in the side walls amend slightly the construction of the Qibla īwān's triple windows.

The Sahn's west wall and the West īwān.

As a preface to the following geometric constructions I must stress that compared to my previous efforts they are weak, but that they are the only constructions which satisfy the existing features, the main fault is the use made of the rear wall of the external window recess as the basis for an internal planning arrangement.

The known features are: the east face and the centre line of the Sahn's west wall, the rear wall of the external window recess, and the Madrasa's east-west axis. With this information the full width of the arch's intrados can be drawn and its western extrados used as the base line for two adjacent squares separated by the east-west axis and bounding the īwān's south and north walls and the rear wall of the window recess, the combined squares giving the īwān and the recess' widths.

In the Sahn's west wall the abutments to its central arch are interrupted by door openings, their various points are found by circles with a diameter equal to the opening width of the Qibla īwān's triple windows. This, it will be remembered equalled $1/5$ of the Generating Unit and so the radius of the latest circles must equal $1/10$ of the GU which is upheld by the actual measurements of the abutments.

.03.3 A Summary

Once more I feel it incumbent on me to state that the dimensions were initially/

initially not gathered with the sole purpose of proving a proportional hypotheses, they were supplementary to an analysis of al-Ashrafiyya's decoration. Notwithstanding I am convinced that a proportional system was relied on by the architect and his team, in the knowledge of the three dimensional harmonies similar systems had given the buildings of Cairo built by Qāyṭbāy and his chief officers of state, and I would contend that even without further enquiry the existence of the system has been proved. However, if there are lingering doubts these should be totally dispersed by the next section where the proportional system is transferred from the First Floor to the Ground Floor.

3.04 The Design of the Entrance Areas

As an attempt to continue the proportional system used in the Madrasa the generative double hexagon's circle and the points of M and Q_2 have been transferred to Drawing 20, enabling direct comparisons between them and the relative positions of the Entrance areas. Point Q_2 indicates that the general arrangement and size of the areas is dictated by the Qibla iwān, Q_2 was on the line of that iwān's north wall and it now falls on the line of the Entrance's north wall; the other delineations are apparent, the lines of the East and South Elevations and the grand staircase's north face are common to the iwān, and not to be ignored is the ancient west wall of al-Haram.

I admit to being perplexed over the primary geometry used to define the Entrance's axis of symmetry, if it was based on the Q_2 line the two plans are united by a common base line. But, rather than impose the notion of the Q_2 base-line the logical starting point for the ground floor was the centre of the vaulted Porch.

3.04.1 The Porch

Utilising again the $1/5$ GU radius circle which controlled the design of the/

the First Floor's windows, a circle was drawn from the centre of the Porch (P_1) to enclose a double square. This figure, the double square, was initially chosen because it reflected the dynamic lines of the Porch's vault. On completion it was clear that one of the squares had some relationship with the window recess in the north wall. It was then revealed that the distance between one of the apexes of the second square and the line of Q_2 or the general wall plane of the north wall could be established using two interlaced $1/10$ GU radii circles identical to those controlling the First Floor's doors and that it equalled $3/10$ GU. The interlaced circles also related to the east archway's north abutment lining through with the outer edge of the Portal's moulded frame and with the projections of the arch enclosing the north or Window Wall. Similarly at the double square's opposite apex a further $1/10$ GU radius circle positions identical elements, however here the sequence is unsatisfactorily, it does not extend on for the full south archway's intrados. The cause of this disturbance could be looked for in the design of the free standing pier, but I think it is more likely to rest in the extra thickness given the eastern half of the Qibla Īwān's qibla wall to accommodate external recesses for its windows.

The double square centred on P_1 had other properties; along the Entrance's axis hexagons inscribed by $1/5$ GU radius circles and placed on the double square's opposing sides orientated north-south have centres connecting with the vault's east and west boundaries. The hexagon centres on D_1 provides the width and depth of the Recessed Portal and the width of the door opening in its rear wall.

3.04.2 The Vestibule

From the external arrises of the door opening lines at 45° are constructed to intersect behind the opening. This point of intersection is the internal face of the rear wall. Another $1/5$ GU radius circle is/

is now described which, in addition to giving the width of the Vestibule, positions its centre V_1 . This construction can be substituted by constructing a $1/10$ GU radius circle tangentially to D_1 hexagon's side and enclosing the new circle in a square which, if jointed to an identical square, has as its centre V_1 . Whatever the method used, ultimately the vaulted area of the Vestibule is found to be the enclosing square of a $1/5$ GU radius circle centre on V_1 . The subdivisions of this figure define the door openings in the side walls.

A new construction phase is begun when the pair of lines defining the south door are produced to intersect with the produced line of the Porch vault's southern boundary. From these intersections one more square with sides equal to $1/10$ GU can be constructed to give the width of the East-West Corridor. On the square's side nearest the Porch a second square is constructed to define the Corridor's eastern extremity. Along the opposite side of the first square a $1/5$ GU square is constructed, about its centre S_1 is the inevitable inscribed double square generating a $1/10$ GU square which defines the corridor's western end and the width of the Grand Staircase's first flight. This same construction may be repeated at all the subsequent quarter landings but especially at those with decorated vault centres.

3.04.3 Summary

An impression that the network describing the proportional system is more concentrated than its equivalent in the Madrasa is due to the Entrance's smaller components and therefore an increase in the number of lines required by the network's geometry, but this in no manner effects the dimensional values used, they are still the fractions of the Generating Unit found in the Madrasa.

Recognising and being conversant with the mechanics of the system frees the/

the eye allowing it to rove across the network forming new proportional relationships that perhaps lead on to other aspects. For example, the rear wall of the Portal Recess lines up with the eastern extremity of the east-west corridor, or the Recess' side walls line up with those of the Vestibule, both observations have a relevance to the building practices of Mamlūk times because variations on this entrance arrangement appear in innumerable structures.

3.05 The Geometry underlying the openings of the Courtyard

3.05.1 The Triple Window Recess (Drawing 21)

I disclosed earlier in a footnote that the geometry controlling the external elevation of the triple window recess became the basis of the geometry used to plan the Qibla iwan's side walls, thus the actual mechanics of the geometrical construction are already known. (See pp. 77-8 above) but in the elevation they extend to new elements not found in plan.

Centred on W_1 is the inscribed hexagon 1-6 with a radius equal to $1/5$ GU. The window jambs follow the lines 1-3 and 4-6 which equal the height of eight ablaq courses. If the lines 2-4 and 5-3 are produced to intersect with their opposites in the side windows the nose of the recess' chamfered sill is found, for example, 2-4 in the central window intersects with the equivalent of 5-3 in the left hand window: this intersection occurs on the central axis of the separating abutments. Once a second hexagon is centred on W_1 its top apex coincides with the underside of the lintel. The difference between this point and the line 6-1 is filled by a red stone compartmentation.

Continuing the orientation of the second hexagon this construction can be expanded vertically in three columns starting with the lowest apexes at W_1 . The important points that appear are: the course joint separating/

separating the lintel's upper compartmentation from the joggled relieving arch and the next point is the course joint along the top of the relieving arch's upper compartmentation.

In the right hand window its hexagon has been subdivided using hexagons and hexagrams to illustrate that the four small circles inscribing hexagons near the centre are interrelated, and because these selected circles are used in the geometries underlying the Courtyard's other openings.

3.05.2 The South Door in the West Wall (Drawing 21)

The door opening, its voussoirs and archivolt are surrounded by the hexagon 1-6 inscribed in a circle with a radius equal to $1/5$ GU when the door's threshold is tangential to the circle.

The height of the opening is found by a square topped by an equilateral triangle. The radius of the arch equals $3/5$ of its span and the springing line is the fifth course above the threshold; all of the intervening courses relate to the column of interlocked circles. This column defines the inner corner of the voussoir's joggling and the upper apex of the archivolt. When these points are rotated about the arch's centres they provide the centre of the lower archivolt's loops with the produced diagonals of the square, and the outer edge of the archivolt whose thickness is defined by the space separating the hexagon's diameter 5-2 and the springing line. Measuring the diameter of the top loop of the archivolt between the two halves of the loop the distance is found to be a repetition of the distance separating the two centres of the arch and must thus equal $1/5$ of the opening's width.⁴

Notice that apex 5 of the hexagon coincides with the side of the triple window recess.

3.05.3 The East Door in the South Wall (Drawing 21)

As the stone coursing is identical to those of the South Door in the West Wall they have been removed from the figure to simplify it. Had they been retained the column of small circles would have extended up to and including the keystone. Basically the lancet arched opening is composed of two equal circles, the lower is enclosed by a square and the upper inscribes a hexagon. The centre of the upper is also the arch's central point and the circumference is followed by the arch up to the 60° apexes of the hexagon thereafter the arch's apex is tangential to the circle.

3.05.4 The Central Door in the South Wall (Drawing 21)

The stone courses of the previous openings are repeated once again up the jambs of this rectangular opening. The two equal circles within the larger ones are the same as those controlling the East Door and the widths of both openings are the same. In the larger circle a hexagon has been drawn to provide the opening's jambs and threshold. Surrounding the circle is another hexagon whose upper apex defines the lower edge of the lintel's moulded frame; if the points at the intersections of the lines radiating at 45° from the figure's centre (dotted in the drawing) with the sides of the hexagon are extended vertically the outer edges of the lintel's moulded frame are given. Utilising the three points recently defined in the construction of two squares (dotted in the drawing) the overall height of the lintel including its frame is found, the frame's bracketed terminals having already been found by the top side of the smaller hexagon. The width of the moulded frame is governed by the difference between the upper apex of the larger hexagon and the next point up the column of small circles. There is an alternative method to find the frame's width; if two adjoining $60^\circ/30^\circ$ rectangles are constructed along the top side of the smaller hexagon with/

with their shorter sides equal to the radius of the column's small circles and therefore equal to one course height, the combined measurement of their longer sides matches the distance separating the inner edges of the frame's sides.

Inside the framed lintel there are two stone courses, the lower approximates a normal full course unlike the upper course which is considerably thinner than the norm. The centre of the splaying of the joggled keystone is found at the mid-point of the smaller hexagon's top side, whilst its curved soffit is centred precisely one course lower. Observe that the extremities of the curve are directly above the inner faces of the jamb brackets. One final comment is required: from the last centre lines at 60° will intersect with the corners of the opening's lintel and jamb brackets.

3.05.5 Summary

At the drawn scale of 1:20 fractional errors in the placing of an ink line or the centre of ink bows can go undetected until some point of reference is arrived at. I have consistently guarded against such errors but a number may have passed my vigilance but not I think the divergence at the sides of the Recess. This divergence is a one to two per cent error in my proportional system from the actual structure, which has been dramatically deformed by the earthquakes. Even if this divergence is considered the proof that my system does not apply to al-Ashrafiyya I offer as counter proof the many more occurrences where the theoretical and the actual converge.

In the above studies I think the notable discovery is the proof that a tripartite relationship exists between the proportional system's geometry in plan, exemplified by the side walls of the Qibla iwān, and its use in the system's geometry controlling the elevational treatment of the same wall, and thirdly the relationship between the proportional system's/

system's geometry and the heights of the stone courses. Presently I am unable to expand my findings to cover all Mamlūk buildings but it is an attractive idea that by measuring the average course height in any one building its proportional system and mode of measurement will be manifest.

3.06

The Geometry underlying the Porch's Vault

Prior to my discovery of the common geometric units found in the Courtyard's openings and the First and Ground Floor Plans I assumed the Porch's pointed cruciform vault centre and its associated lozenges were found by joining the corners of the (visibly) square vault to the mid-points of the opposing pair of sides. Later I realised that if this simple solution was the complete answer then the vault's design was a 'one off' restricted to relationships within the vault area and not outside it. The consequence of this would have been that the plans of the Portal Recess and the Window Wall would also have been 'one offs' only related to each other by their physical proximity, their ablaq masonry and painted mugarnas, the last two features appearing in the majority of Qāyṭbāy's structures and so of little import in the context of geometric cohesion. This mistaken idea was demonstrably untrue as seen in Drawings 19 and 20.

Attempting to reproduce and extend the proportional solution arrived at in Drawing 20 at a drawn scale of 1:20 rather than the former 1:50 plan is complicated by the increased possibilities for graphical inaccuracies. This inherent inaccuracy already identified in the commentary on the Courtyard opening's geometry must be borne in mind when considering any proportional system or study which is trying to recreate the unknown but assumed notions of a long deceased architect. In this specific case, the Porch of al-Ashrafiyya, allowance has to be made for the distortions caused/

caused by the earthquakes although this was partially combatted by close attention to the accuracy and fluctuations found in the actual site measurements. Indeed had photography been chosen for reasons of speed in preference to dogged measurement, there would have been many distortions difficult to separate from those caused by the photographic process or by structural distortions, added to which of course are the perspective effects of a multi-dimensional subject like a fan vault. Obviously photogrammetry would be the only quick recording method and even it has its drawbacks and limitations.

3.06.1 The Position of the Vault Centre

The first step at the scale of 1:20 is to start at P_1 which is the central point of the vault found by the intersections of the diagonals from the corners of the impost mouldings: happily this intersection does coincide with the centre of the pointed cruciform even though it was taken down and then replaced, the diagonals are not at 45° because the square is actually a trapezium. From P_1 with a radius equal to $1/5$ GU describe a circle to enclose a double square or octagonal star 1-8. It may be chance that the square 2-4-6-8 coincides with the corners in the 1st and 2nd top abla courses, when it is remembered that the centre and its surrounding courses were renewed. Similarly, the square 1-3-5-7 seems to relate to the 3rd top course on the side nearest the Portal. If the intersections of the double square or the re-entrant angles of the octagonal star are joined to their opposites the widths of the cruciform centre are approximated.

3.06.2 Relationships of the Arches and Window Wall to the Vault Centre.

These elements in Drawing 20 were shown to be easily achieved. In the case of the South Arch it begins at the centre of a circle with a $1/10$ GU radius which is tangential to the central circle at point 6, the line of/

of the main arch is found by inscribing a hexagon within the $1/10$ GU circle.

For the relationship of the plane of the Window Wall and the Vault centre two intertwined circles with radii equal to $1/10$ GU are constructed tangentially to point 2, they provide the theoretical lines of the arches which are at right angles to the outer edge of the Portal's moulded frame and the projections of the Window Wall's enclosing arch.

3.06.3 Relationship of the Portal Recess to the Vault Centre.

As was illustrated in Drawing 20 the Portal Wall's distance from the vault's centre was determined by a hexagon with one side mutual with line 3-5 and which was inscribed in a circle with a radius equal to $1/5$ GU, the circle's centre is D_1 and lies on the Portal Wall's general plane. An alternative method for placing D_1 is to consider it as an isosceles triangle equal to the $1/5$ GU and created by dropping lines perpendicular to line 3-5 from the intersections of (3-7, 2-4) and (5-1, 4-6) to the points 9 and 14 from which arcs are described to intersect at D_1 . This is an example of the apparent close ties existing in the double square or octagonal star and the hexagon as it shows clearly how one figure can be made to create the other within the same circle or as here in a second circle.

With point D_1 defined, its circle and hexagon 9-14 can be completed to establish the width of the Recess 10-13. In Drawing 20 the equivalent of line 11-12 coincided with the rear wall of the Recess but due to the increased scale this is no longer true as it lies some 0.05m behind the wall surface, but the length of this line does define the width and position of the door opening. Observe that by joining points 9-11 and 14-12 they coincide with the width of the Portal Recess' semi-dome and that a semi-circle coincident with the pair of lines and centered on D_1 does not follow the curve of the semi-dome, for it to do so the centre would/

would require to be relocated on the wall plane between the moulded frame. This slight deviation from my theoretical geometric construction might have been caused by either an error of craftsmanship or in my own survey, but on the contrary I believe that neither are at fault as this relocation of a semi-dome's centre is compatible with what I consider to be one of the canons of Mamlūk architectural design: the centre of a portal recess is never on the general wall plane across the front of the recess, it is either outwith it or within it. This holds good for every Mamlūk portal in Jerusalem.⁶

Further examination reveals that this relocated centre is not the only one required by the design, in fact it is very much the minor centre, the major provides the axis for the rectilinear mugarnas, the lozenges and associated vaults. To find this major centre D_2 a return must be made to P_1 where a square is constructed with two of the sides being the centre's diagonals $5-P_1$ and $3-P_1$ and the other two sides intersecting at D_2 , the sides of the completed square $5-P_1-3-D_2$ equal $1/5$ GU. If the sides $3-D_2$ and $5-D_2$ are produced to intersect with the tangents at points 10 and 13 at E and F the internal corners of the Recess are defined. Using E and F as centres and a radius equal to the distance from these centres to the points of intersection along the circumference of the smaller circle of D_1 , if arcs are drawn to cut 10-E and 13-F they give the depth of the Recess. Regard the intersections on the small circle's circumference, they are the points of convergence for the side vaults composed of the lozenges and mugarnas, it will also be seen that the lines of the vaults form a square with the Recess' side and rear walls and that the lines joining E and F to those intersections are the diagonals of the vaults' squares: thus the relationship between the side vaults and the depth of the Recess may be expressed as $\sqrt{2}$.

3.07 The Geometry underlying the Window Wall (Drawing 23)

If/

If there is to be unity in al-Ashrafiyya's design, the geometry underlying the plan of the vaulting of the Porch should be transferable to the elevational elements such as the Window Wall along the Porch's north: on the assumption that there does exist this type of transferable geometry Drawings 20 and 22 indicate that the elevational elements are related to a square inscribed by a $1/5$ GU radius circle. Before embarking upon the proof of this theory one or two general remarks are needed: in al-Ashrafiyya's original design procedures once the stage was reached, when a design for the Window Wall was being contemplated, a number of the overriding decisions would have already been made, decisions which I can only guess at, because they related to the now devastated East Elevation. Even though I have described the East Elevation's Great Archway as separate from the Elevation's wallhead which is representative of the Madrasa's elevational treatment, the Great Archway most certainly would have been considered alongside the Madrasa's treatment and this is what controlled the height, the span and form of arch; these defined features in turn have a bearing on the height to the underside of the Porch's vault, and the vertical positions of both the Window Wall and the Recessed Portal which are 'hung' from the impost or springing of the Great Arches and the Vault. It should also be made clear that a slight deviation from the $1/5$ GU radius circle was found, the radius used in the Wall's design being larger (compare in Drawing 23 the dotted circle which equals the $1/5$ GU).

From the springing of the vault construct a square ABCD with sides equal to the wall's length so that it sits on the bench seat which extends the full length. Directly below the central point of ABCD construct a square 1-2-3-4 with sides equal to half the length of the former square and with its centre at W_1 , this square gives the width of the window recess. When the square is inscribed in a circle and added to to create a double square or octagonal star polygon with points 5-6-7-8; this provides/

provides the jambs of the grilled window at the intersections of the diagonals 1-3 and 2-4 with the sides 5-6 and 8-5. The centre line 9-10 of the compartmentation along the top of the grilled window's monolithic lintel is approximated by the rotation of diagonal 2-4 about point 2, this equals $\sqrt{2}$ or the width of the window recess. If this angle 1-W₁-4 is utilised in the formation of a square with point 13 as the fourth corner, this corner is the zenith of the curve separating the tympanum from the joggled relieving arch. The radius of the curve is centred on the mid-point of the line 4-1 and the arc lies between the diagonals of a 60°/30° rectangle constructed along 4-1.

The 60°/30° rectangle 4-1-12-11 defines the horizontal axis of the joggled relieving arch and if on this axis an inscribed double square is constructed to duplicate the earlier figure of 1-8, the line 14-15 demarcates the first and second registers of the mugarnas. The lines joining the intersections (19-16, 15-11) with (16-17, 12-14) and (17-18, 11-15) with (18-19, 14-12) approximate the inner edges of the oeil-de-boeuf window's side panels, these same lines reflect the width of the grilled window below. On producing the lines 1-13 and 4-13 to line 16-18 if from their intersections vertical lines are drawn they form the outer edges of the side compartmentations of the mugarnas. From points 11 and 12 lines at 30° intersect with the circumference of the oeil-de-boeuf which when considered as the mid-point of the lowest side of a square centred on W₂ more detailed constructions can be embarked on.

At the upper double square's angles of egress below the central axis 16-18 the lower edge of the deep compartmentation course below the Window Wall's side panels is found, the top line is found half way between line AD of the primary square and the diameter 16-18. The centres of the shields of Qāytbāy in the side panels are tangential to the points 16 and 18 occurring at the intersections with the 45° lines emanating/

emanating from the point defined by the broad compartmentation's top line and the reveals of the window recess. The centre of the third shield in the Wall's tympanum is approximated if the following square is constructed, 15-W₂-14-20.

3.08

The Geometry underlying the Portal Wall (Drawing 24)

The plans of the Portal Vault (Drawing 20 and 22) indicated that a hexagon inscribed by a $1/5$ GU radius might act as the generator for the elevational treatment of the wall and its recess, and like the Window Wall the initial design decisions were made in the light of previous agreements on the general height and proportions of the Porch, its Great Archways and vaults. Similarly, the first construction of the Portal Wall is the hanging of a square ABCD from the vault's springing line, but which unlike the Window Wall's square it has sides precisely equal to $2/5$ GU.

On constructing the square ABCD the side BC is located at the level of the door opening's threshold and the upper edge of the lowest horizontals of the linked and moulded frame enclosing the Recess Portal's composition. Centred on D₁ a circle with a radius equal to $1/5$ GU is drawn tangentially to BC and to describe the hexagon 1 to 6. The chords 1-3 and 4-6 define the jambs of the opening, while points 2 and 5 define the reveals of the Recess. The height of the opening is found by the square 7,8,9,10 centred on D₁ and constructed along BC. At points 2 and 5 circles are described with radii equal to $1/10$ GU (i.e., half the larger circle's $1/5$ GU radius.): a further circle is introduced which is tangential to 4-6 and having point 5 on its circumference therefore its radius is $1/20$ GU. It will have been realised that the horizontal axes of these circles pass through D₁ and lines up with the lower edge of the inscription, the height of the inscription is found by the method shown about point 2 where the last circle of a radius $1/20$ GU is substituted by two tangential/

tangential circles each with radii equal to $1/4.0$ GU, thus the height to length ratio of the inscription along the rear of the Recessed Portal is 1:2. Centred on point 6 a third congruent circle provides the length of the inscription outside the recess, if a tangential square is drawn and its diagonal rotated a $\sqrt{2}$ rectangle is created which has one side coinciding with the line AB. The centre lines of the linked frame's verticals are also discovered by rotation, about D_1 with a radius equal to D_1-10 describe arcs. The height of the pair of mastabas is formed by drawing an arc centred on point 8 with a radius equal to its distance from the door jamb and repeating the operation centred on the jamb, the intersection equates with the height and it seems that the vertical axis from this intersection joins the axis of the links in both horizontals of the frame. The extremities of the line 11-12 of the small moulding above the door's monolithic lintel lie on the 45° lines emanating from the 'true' corners of the frame beside B and C.

Along 9-10 construct a square 9-10-13-14 centred at D_2 and inscribed by a circle with a $1/5$ GU radius. By dividing the line 13-14 into thirds and constructing three squares 14-15-16-17; 16-17-18-19; and 18-19-20-21, with centres 16 and 19 and radii equal to the sides of the squares describe arcs in the outer squares, these conform to the lower arcs of the trifoliated head of the recess. The form of the semi-dome is arrived at by constructing a further $1/5$ GU radius circle centred on D_3 and tangential to D_2 with an inscribed hexagon 21-13-22-23-14-24, the chords 21-22 and 23-24 give the width of the semi-dome which reflects the width of the door opening below, the two centres for the extrados are discovered on either side of D_3 by a radius of $1/20$ GU; the radii of the semi-dome are equal to the radius of the trifoliated head's lower arcs.

Obviously the general dispositions of the elevational elements could be deliberated upon with a consequential increase in the number of construction/

construction sequences and an expansion of the interrelationships, however I consider that the basic divisions required at the sketch design stage have been worked-up sufficiently to allow the remaining design procedures to continue until the actual detailing of the elements is required.

3.08.1 Dimensional Controls.

When I first attempted to apply a proportional system to the Recessed Portal I was ignorant of the mode of measurement now recognised by the expression of the Generating Unit equal to 7.20m., at that time my calculations were based on the width of the vault's square. In the first stages this module was the 4.35m. span of the eastern Great Archway and it was discovered that the 0.18m. wide linked and moulded frame was one twenty fourth of the module, it was also discovered that the length of the right hand side jamb's inscription was one sixth of the module, a most attractive result if the width is accepted as 0.725m. rather than the 0.72m. shown on Drawing 17, as it may be visually multiplied by six to equal the module in concert with the geometric explanatory drawing. But now that the principle of the GU has been accepted by me I must pose the question, whether or not this mode can be successfully applied to the Recessed Portal. An answer is attempted in Table 1 below, it must be read with the knowledge of the meter equivalents to the following GU fractions: 1 GU = 7.20m.; $1/5$ GU = 1.44m.; $1/10$ GU = 0.72m.; $1/20$ GU = 0.36m.; $1/40$ GU = 0.18.; $1/50$ GU = 0.144m. and $1/100$ GU = 0.072m.

TABLE/

TABLE ONE

Element	Measured Dimension in Meters	Nearest GU in Meters	Summation of GU fractions
The average unrestricted stone course heights at jambs.	0.27m.	0.288m.	1/25
Door opening's width.	1.50m.	1.51m.	1/5 + 1/100=21/100
Inscription to right hand jamb.	0.72m.	0.72m.	1/10
Recess' width.	2.96m.	2.95m.	2/5 + 1/100=41/100
Vault measured along East.	4.36m.	4.32m.	3/5
Vault measured along Portal Wall.	4.45m.	4.44m.	3/5 + 1/50=31/50
From Ground level to Portal's apex.	7.55m.	7.56m.	1 + 1/20=1 1/20
From Ground level to Vault.	7.67m.	7.69m.	1 + 7/100=1 7/100

The above Table may suggest a crudeness when the smallest GU equivalent allowed is 0.07m.; it is inconceivable that 0.07m. was the standard dimension but I consider it acceptable on two accounts: it would be surprising if at the sketch design stage the accuracy required was more precise than 0.07m. when playing with the possible broad compositions or combinations; it is also evident that by using 0.07m. (which as one per cent of the GU) it shows how infinitesimal the aberrations are.

3.08.2 A Summary.

It is clear that there is evidence to prove that the Portal Wall was conceived using a combined geometrical and dimensional system, which because it includes the heights of the stone courses could be applicable to the survey techniques in Mamlūk buildings. This fact of the standard heights of the unrestricted stone courses suggests that they might be measured in units of five so forming a dimension readily converted into the specific building's mode of measurement and its generating unit, with the proviso that the relationships of al-Ashrafiyya are not unique.

I will go further and propose that the elements of any Mamlūk doorway were selected from a stock of 'building blocks' which could be utilised to build a tall doorway or a squat doorway. (See Appendix D.)

3.09 The Geometry underlying the Vestibule (Drawing 23).

In the Ground Floor Plan showing the Detailed Geometry (Drawing 20) it was found that an inscribed double square conformed to the Vestibule's square central area, but when it is translated at a larger scale the $1/5$ GU radius circle (shown dotted) extends beyond the central area. In the Section through the Vestibule, if this circle is drawn tangentially to the paved floor its centre V_1 may be used by a smaller circle which is tangential to the central area's sides as well as the threshold of the arched opening. The height to the Vestibule's vault centre is approximated by two and a half times this circle.

By inscribing a square points 1 to 8 the arched opening's jambs are simulated if vertical lines are drawn at the extremities of the apothemes of the square 8-2-4-6 (which are also the diagonals of the square 1-3-5-7): had this last construction been carried out in the $1/5$ GU circle the divergence between the actual and the theoretical jambs would have been eliminated. More of the opening's features are defined when the hexagon 8-9-10-4-11-12 is inscribed, the archivolt's outer edges are given when point 8 is joined to points 10 and 11 and where the lines so formed intersect with the double square's diagonals 1-5 and 3-7 in the springing line of the arch.

Centred on V_1 a column of 'stone course' circles with their mutual intersections on their 30° axes (which are the equivalent of inscribed hexagons, one example being provided at the centre of the rectangular window) generally relating directly to the course joints: the threshold; the centre of the archivolt's horizontals; the sill of the $60^\circ/30^\circ$ window/

window and its head; and finally the apex of the vault, and the soffit of the octagonal vault centre.

The radius of the arch is not constrained by the proportional system, it is equal to $3/5$ of the span; likewise the radii of the vault are $3/5$ of its span.

3.10 The Underlying Mode of Measurement (Drawing 25)

Endeavouring to uncover all of al-Ashrafiyya's design skeleton a word is required about the Generating Unit and its mode of measurement. In the drawings 21-24 double squares or hexagons were inscribed by circles with radii equal to $1/5$ GU. it needed little effort to see and understand how they underlie the disposition of the architectural elements but it was less easy to realise and abstract from the networks the derived measurements. To redress this imbalance Drawing 25 'Derivatives of the $1/5$ Generating Circle' sets out the basic subdivisions of the inscribed squares and hexagons, applying the internally derived measurements first as the radii of circles visually expressing the interrelationships, and secondly along a line imitating a measuring rod's divisions.

Figure [1]: In the subdivision of the double square the consecutive parallel sides of the concentric squares are in the proportion of $1:\sqrt{2}$ (i.e., the ratio of a square's side to its diagonal), and the alternate parallel sides are in the proportion of $1:2$. These different ratios are borne out by the related circles.

Figure [2]: A single hexagon is inscribed by the circle with concentric hexagrams touching the mid-points of the sides of the hexagons. Notice in this construction that the height of the hexagon does not equal the diameter of the circle, they are in fact related to each other by the ratio $3:2$. The explanation of this ratio is understood if a right angled triangle is imagined with its hypotenuse equal to $2r$ (the diameter/

diameter of the inscribing circle) and one side equal to r (the equivalent of a hexagon's side) therefore by Pythagoras' Theorem the third side equals $r\sqrt{3}$. The heights of the hexagons are progressively halved being in the ratio of 1:2, a fact easily verified by the related circles.

Figure [3] : Again a single hexagon is inscribed and its diagonals are progressively reduced in the ratio of 1:2.

Figure [4] : Here a double hexagon is inscribed, if it is anticipated that the number of subdivisions will be increased compared to the previous two figures, and that the derivatives will be in the same ratios as those of Figure [3], a glance at the Related Circles of Figure [4] shows that the first thought was correct, there being an increase in the number of subdivisions, but the second anticipated relationship is incorrect. The fact is that although I have chosen elementary subdivisions all the relationships in Figures [2] and [3] are included in Figure [4] and there are still relationships outstanding.

In Figure [4] observe the irregular pentagonal interstices formed by the produced apexes of the concentric hexagons; in other circumstances such interstices could mislead a viewer into thinking that this was a pentagonally rather than a hexagonally inspired design.

3.11

Design Precedents.

The Historical Sources gave details of the general appearance and the planning arrangements including such items as the number of windows or the feature made of the Loggia. We know that now the majority of the Madrasa has vanished leaving only sufficient evidence to allow the main areas of its plan to be completed with confidence, but not the Loggia or East iwan, nor is there any means whereby a precise indication of/

of an overall height can be gathered, if we disregard the evidence of Bernhard of Breydenbach's illustration of the Quabbat al-Ṣakhra with al-Ashrafiyya in the background (Pl. 1). Thus I am forced to scour Mamlūk buildings for design precedents, a task, I suggest, simplified by the inherent unity of Mamlūk architecture. It will surely not be impossible to discover parallels on which more prognostications rely.

Immediately on recourse to CIA van Berchem provides one possible solution to the problem of the treatment of the Loggia, it is the arcading to the Mosque of Abū Bakr Muzhir's sahn in Cairo, but my investigations cannot stop here as there are still too many undefined details.

My theory so far has been that there is a geometrically influenced proportional system which somehow or other does relate to the heights of the stone courses. If this is valid, I would expect that an investigation would show that the number of stone courses which are combined together to form an architectural element might remain fairly constant unless there was a fundamental design change. In the following tables a selection has been made of the seven most common architectural elements to be seen in Cairo's Mamlūk buildings of the 9th/15th century in addition to their relevance to al-Ashrafiyya.

A perusal of the tables shows a consistency in the number of stone courses in each of the sub-elements of the seven architectural elements studied. This is not surprising, rather; such a simple factor as the size and scale of the elements should have been blatantly obvious to me as the real foundation of the viewing public's adulation of Mamlūk architecture from the outset of my interest in the subject, without such a foundation where might the necessary qualities of recognition and appreciation originated?

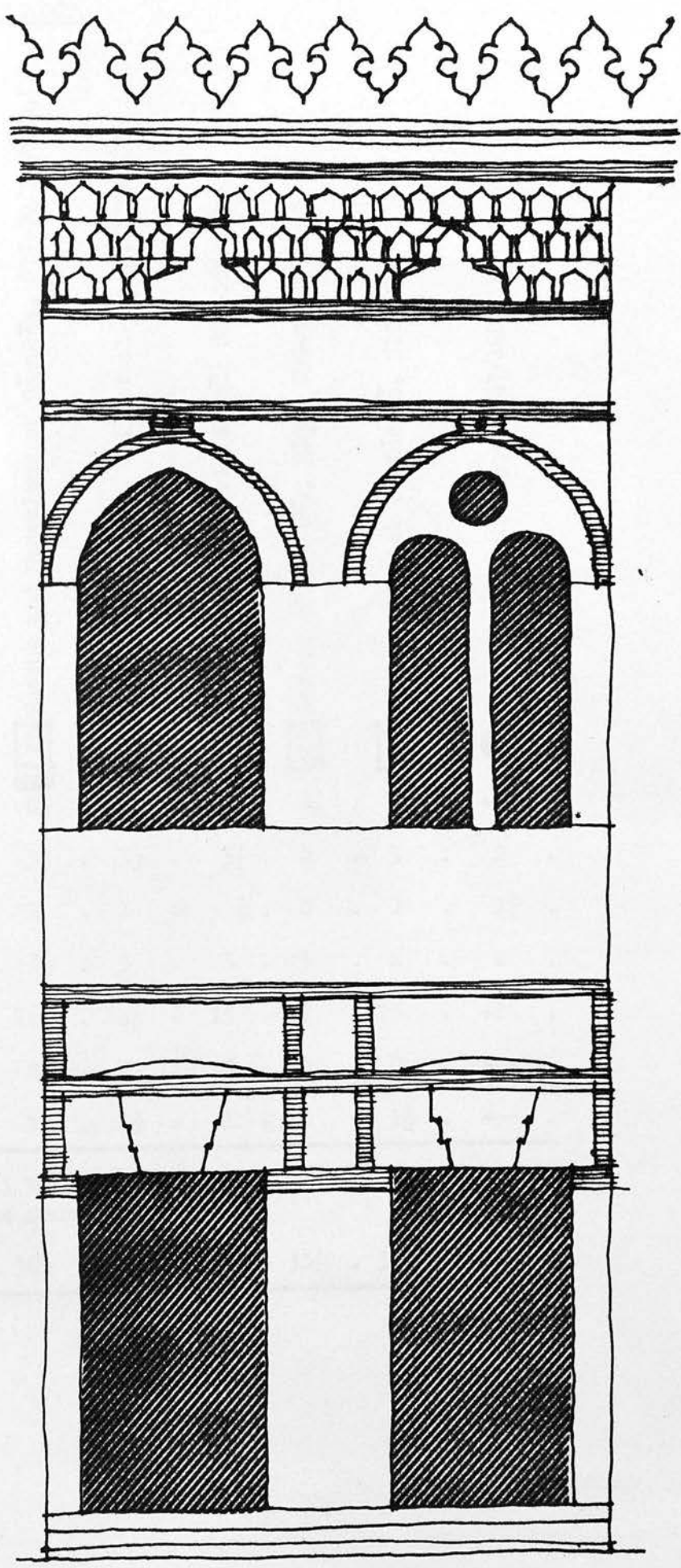
The buildings were chosen for a number of reasons; firstly, they had to fall reasonably near the period of Qāyṭbāy's reign; secondly, they were preferred/

preferred if they exhibited more than one of the elements to enable some cross referencing; and lastly, they had to appear in the two thousand plus detailed photographs I took in Cairo and which now are placed in my own archives in Scotland. These chosen buildings are placed in chronological order except al-Ashrafiyya, it appears at the extreme right-hand side of each table. Because these tables are more of a 'rule of thumb' than a precise description of the elements and the sub-elements the horizontal compartmentation is represented by half courses in preference to a more accurate assessment of a third or a quarter. In the tables a number of signs are used to expand the numerical information: a 'question mark' shows that the sub-element's existence has not been verified for some reason, and 'addition sign' has two meanings, one is that it is partly obscured, the other is that it has been reduced in some manner; a 'triple dash' refers to a demolition.

1

	192	Zawiyat Fayrūz, 830/1426-27												
	182	Mosque of Sidi Madyan, c. 871/1466												
	125	Mosque of Bardbak, c. 865/1460												
	127	Mosque of Tamim ar-Rasafi, before 876/1472												
	199	Mosque and Mausoleum of Qaytbay, 877-79/1472-74												
	223	Mosque of Qaytbay, Qal'et al-Kabsh, 880/1475												
	129	Mosque of Genem al-Bahlawan, 883-916/1478-1518												
	114	Mosque of Qagnas al-Ishaqi, 885-86/1480-81												
	211	Mosque of Azbak al-Yusufi, 900/1494-95												
	161	Tomb of Timurbay al-Husayni, Beginning 10th/16th												
		Madrasa al-Ashrefiyya, 887/1482												
A	1½	1	2	2	2	2	2	2	2	2	4	1		
B	6½	6	8	7	8	8	8	8	8	8	5	8		
C	5	5½	5	5	5	5	5	5	5	5½	4	5		
D	5	0	2	0	4	6	0	3	4½	4½	2	+2		
E	5	5	5	4	6	5	4	5	5	5	4	---		
F	6	3½	4½	3½	4½	5	4	5	4½	3½	3½	---		
G	1	1	2	2	2	2	1	3	2	0	---			
H	3	3½	3½	3½	4	3½	4	5	+3½	4	---			
J	1	1	1	1	1	1	1	2	---	1	---			
Total No. of Stone Courses														
	34	24½	33	28	36½	37½	29	38	+35	27½	+16			

2



J
H
G
F
E
D
C
B
A

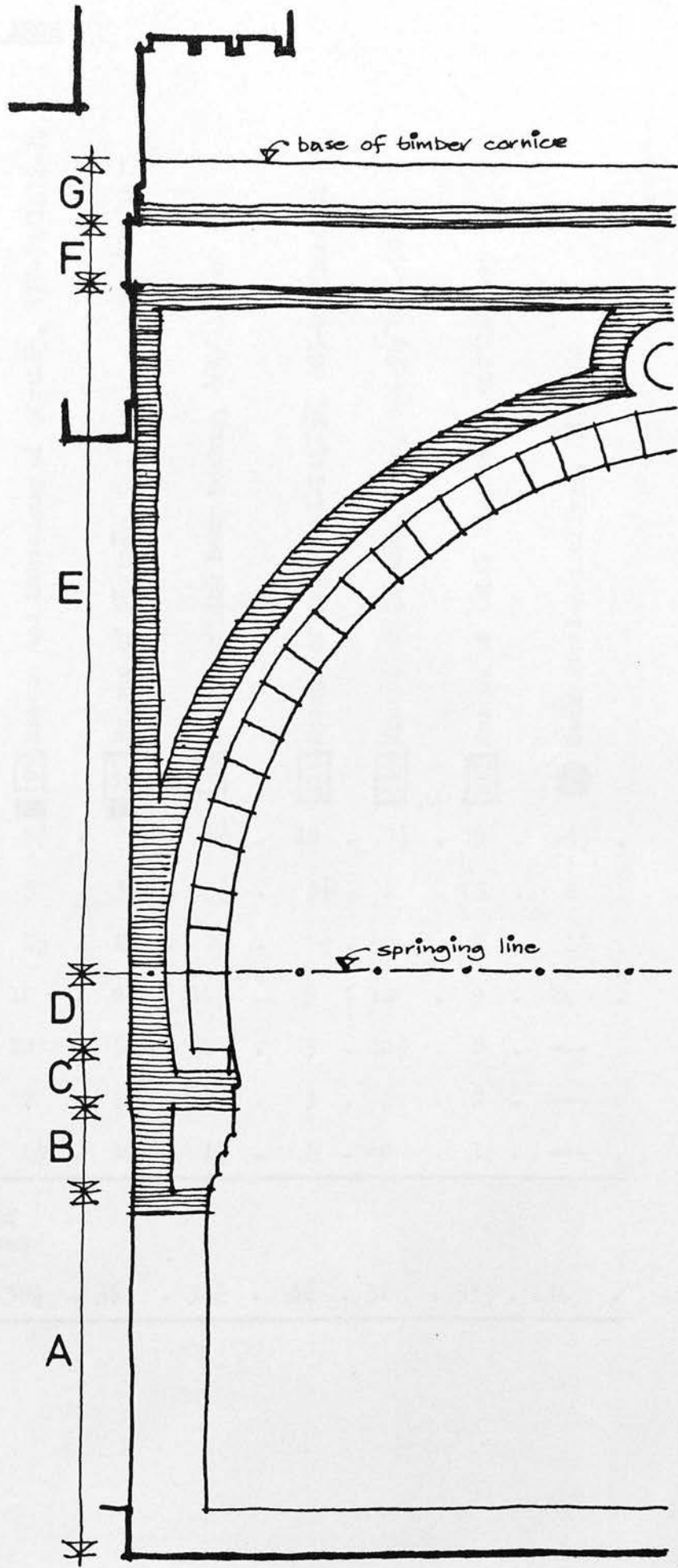
RECESSED EXTERNAL WINDOW

1

②

	99	Mosque and Mausoleum of Qaytbay, 877-79/1472-74					
	123	Mosque of Qaytbay, Cal. ^o et al-Kabsh, 880/1475					
	114	Mosque of Qagnas al-Ishāqī, 885-86/1480-81					
	119	Mosque of Qaytbay, Rōda, 886-96/1481-90					
	211	Mosque of Azbak al-Yūsufī, 900/1494-95					
	●	Madrasa al-Ashrafīyye, 887/1482					
A	$8\frac{1}{2}$	$8\frac{1}{2}$	10	$7\frac{1}{2}$	9	$+6\frac{1}{2}$	
B	3	$3\frac{1}{2}$	$3\frac{1}{2}$	2	3	2	
C	1	1	$\frac{1}{2}$	0	1	$1\frac{1}{2}$	
D	$3\frac{1}{2}$	5	3	3	4	2	
E	$16\frac{1}{2}$	$14\frac{1}{2}$	15	17	13	+2	
F	2	2	3	2	2	---	
G	$1\frac{1}{2}$	$1\frac{1}{2}$	1	0	$1\frac{1}{2}$	---	
<hr/>							
Total No. of Stone Courses							
	$36\frac{1}{2}$	36	36	$31\frac{1}{2}$	$33\frac{1}{2}$	+14	
<hr/>							

3



SAHN GREAT ARCH

2

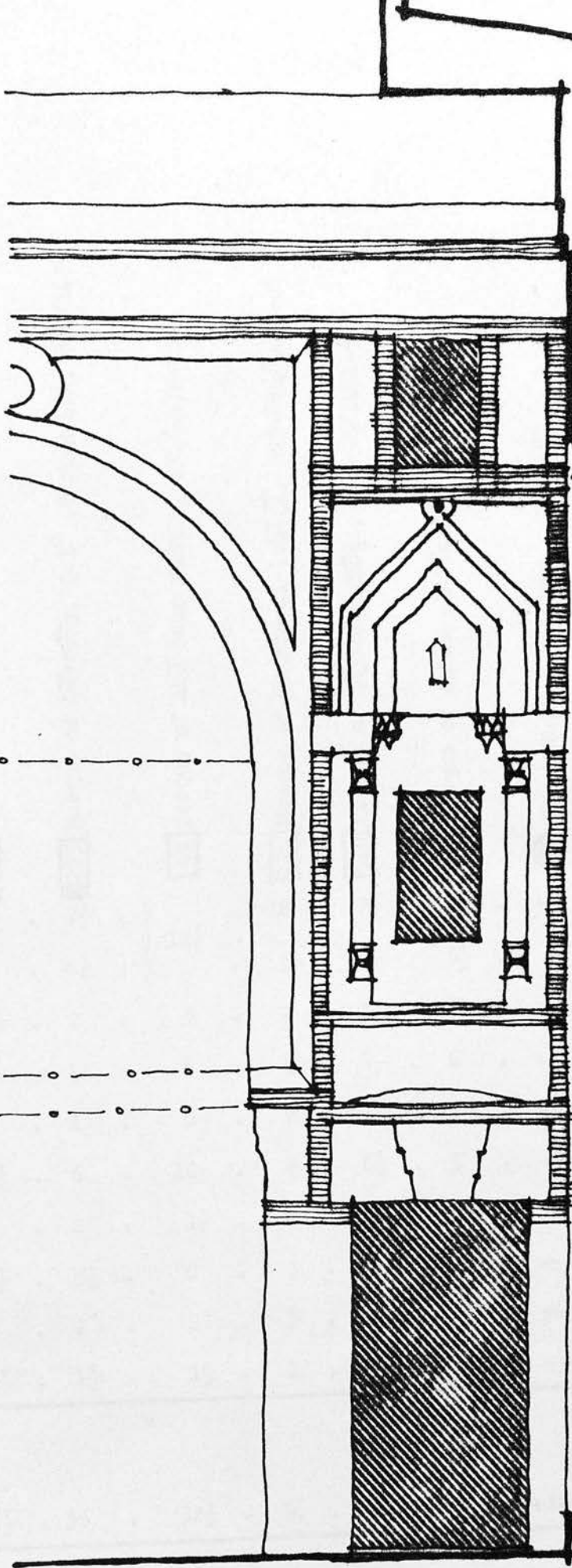
3

	82	Mosque of Sīdī Madyen, c. 871/1466										
	99	Mosque and Mausoleum of Qāyṭbāy, 877-79/1472-74										
	223	Mosque of Qāyṭbāy, Cal. ^c et al-Kabsh, 880/1475										
	49	Mosque of Abū Bakr Muḥzir, 884/1479-80										
	114	Mosque of Qaḡmās al-Ishāqī, 885-886/1480-81										
	519	Mosque of Qāyṭbāy, Rōda, 886-96/1481-90										
	211	Mosque of Azbak al-Yūsufī, 900/1494-95										
		Madrasa al-Ashrefiyya, 887/1482										
A	8	8 $\frac{1}{2}$	8 $\frac{1}{2}$	8 $\frac{1}{2}$	10	7 $\frac{1}{2}$	9	+6 $\frac{1}{2}$				
B	4	3	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	2	3	2				
C	2	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$	$\frac{1}{2}$	0	1	1 $\frac{1}{2}$				
D	3	10	8	14 $\frac{1}{2}$	9	10	9	+4				
E	6 $\frac{1}{2}$	10	8 $\frac{1}{2}$	0	9	10 $\frac{1}{2}$	8	---				
F	2	2	2	2	3	2	2	---				
G	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1	0	1 $\frac{1}{2}$	---				
Total No. of Stone Courses												
	26	36 $\frac{1}{2}$	36	32 $\frac{1}{2}$	36	32	33 $\frac{1}{2}$	+14				

SAHN SIDE ARCH

③

A B C D E F G



SAHN SIDE WALL

④

A B C D E F G H I J K

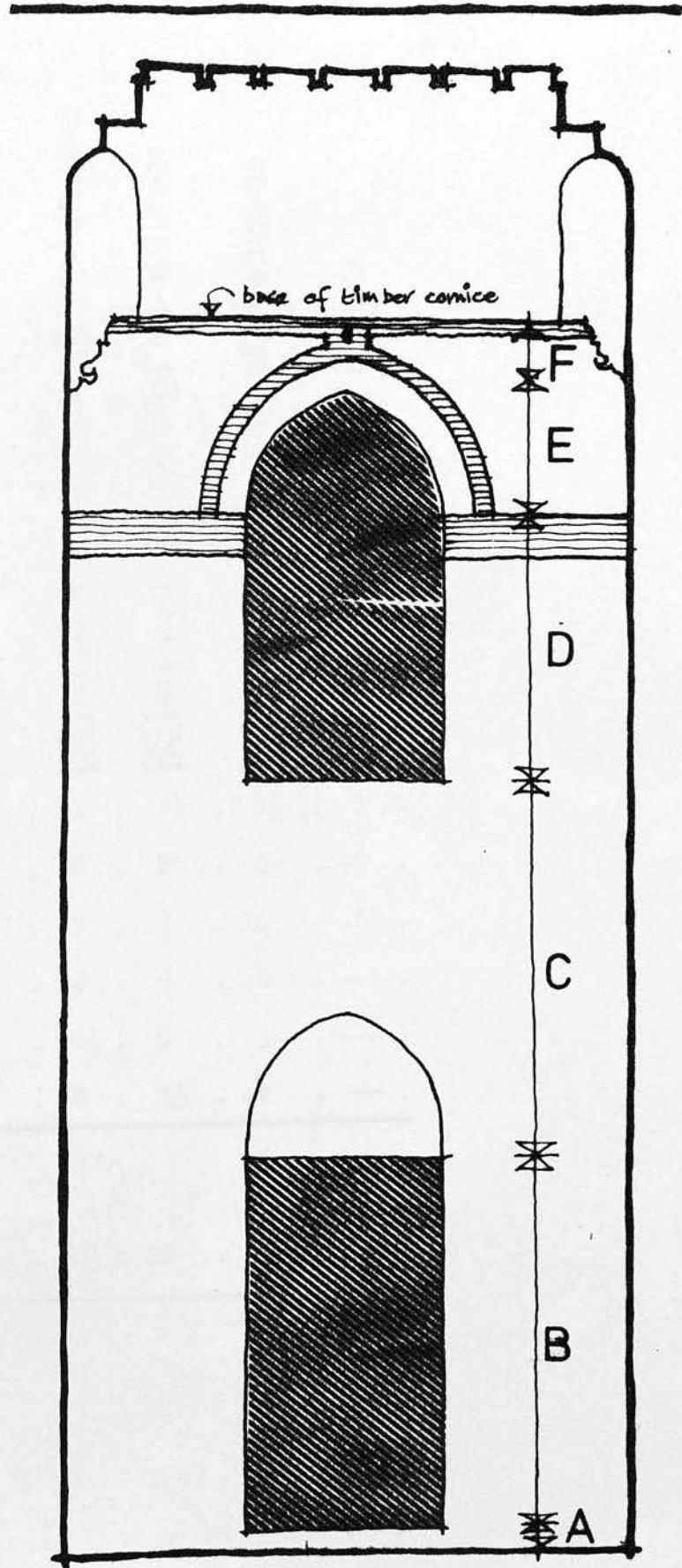
5

223 Mosque of Qaytbay, Qal'at al-Kabsh, 880/1475

Madrasa al-Ashrafiyye, 887/1482

A	.	$1\frac{1}{2}$.	?	.
B	.	9	.	+8	.
C	.	10	.	$+6\frac{1}{2}$.
D	.	5	.	---	.
E	.	1	.	---	.
F	.	5	.	---	.

Total No. of Stone Courses	.	$30\frac{1}{2}$.	$+14\frac{1}{2}$.
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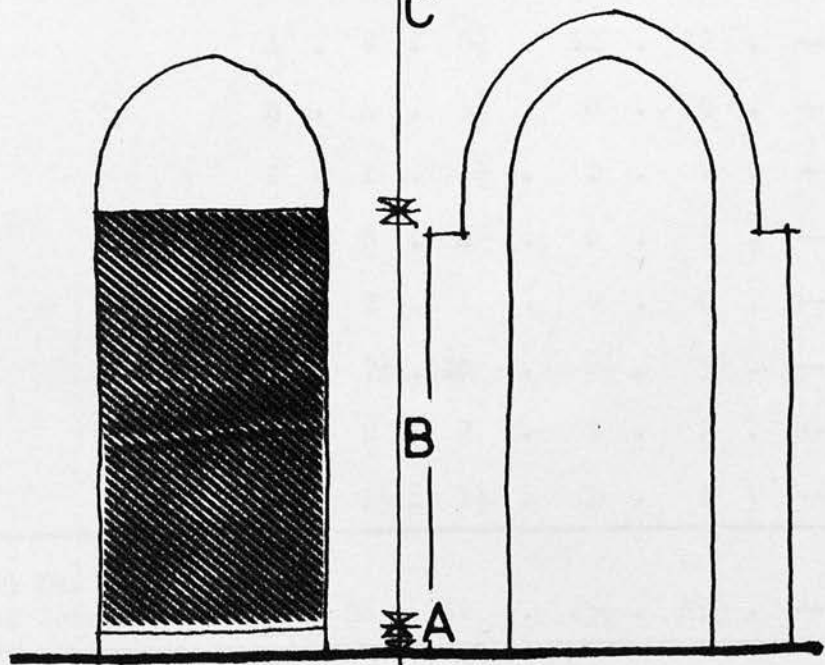
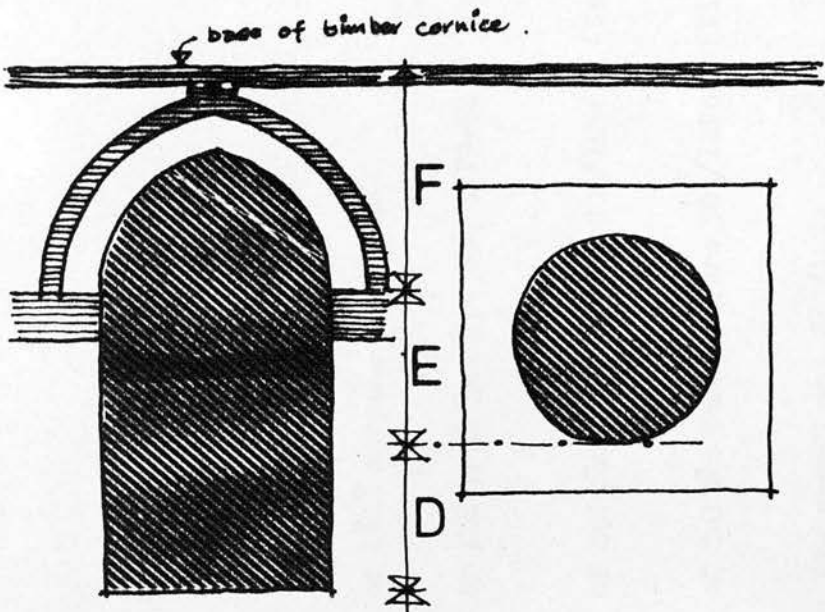
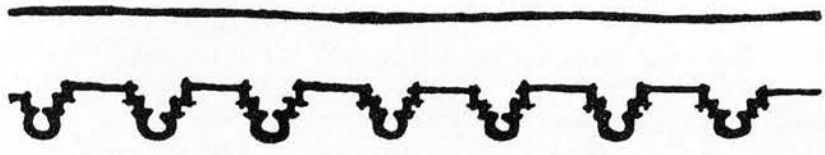
SIDE ĪWĀN WALL

⑤

6

	99	Mosque and Mausoleum of Qaytbay, 877-79/1472-74				
	223	Mosque of Qaytbay, Cal ^c et al-Kabsh, 880/1475				
	114	Mosque of Qagmas al-Ishraqi, 885-86/1480-81				
	519	Mosque of Qaytbay, Rode, 886-96/1481-90				
	211	Mosque of Azbak al-Yusufi, 900/1494-95				
	●	Madrasa al-Ashrafiyya, 887/1482				
A	2	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	1 $\frac{1}{2}$?
B	8	9	8	8	8 $\frac{1}{2}$	+9
C	9	9	9	7	10	6 $\frac{1}{2}$
D	3	4	6	6	0	---
E	3	2	6 $\frac{1}{2}$	0	5	---
F	4 $\frac{1}{2}$	4	0	5 $\frac{1}{2}$	+?	---
<hr/>						
Total No. of Stone Courses						
	29 $\frac{1}{2}$	29 $\frac{1}{2}$	30 $\frac{1}{2}$	28	+25	+15 $\frac{1}{2}$
<hr/>						

7

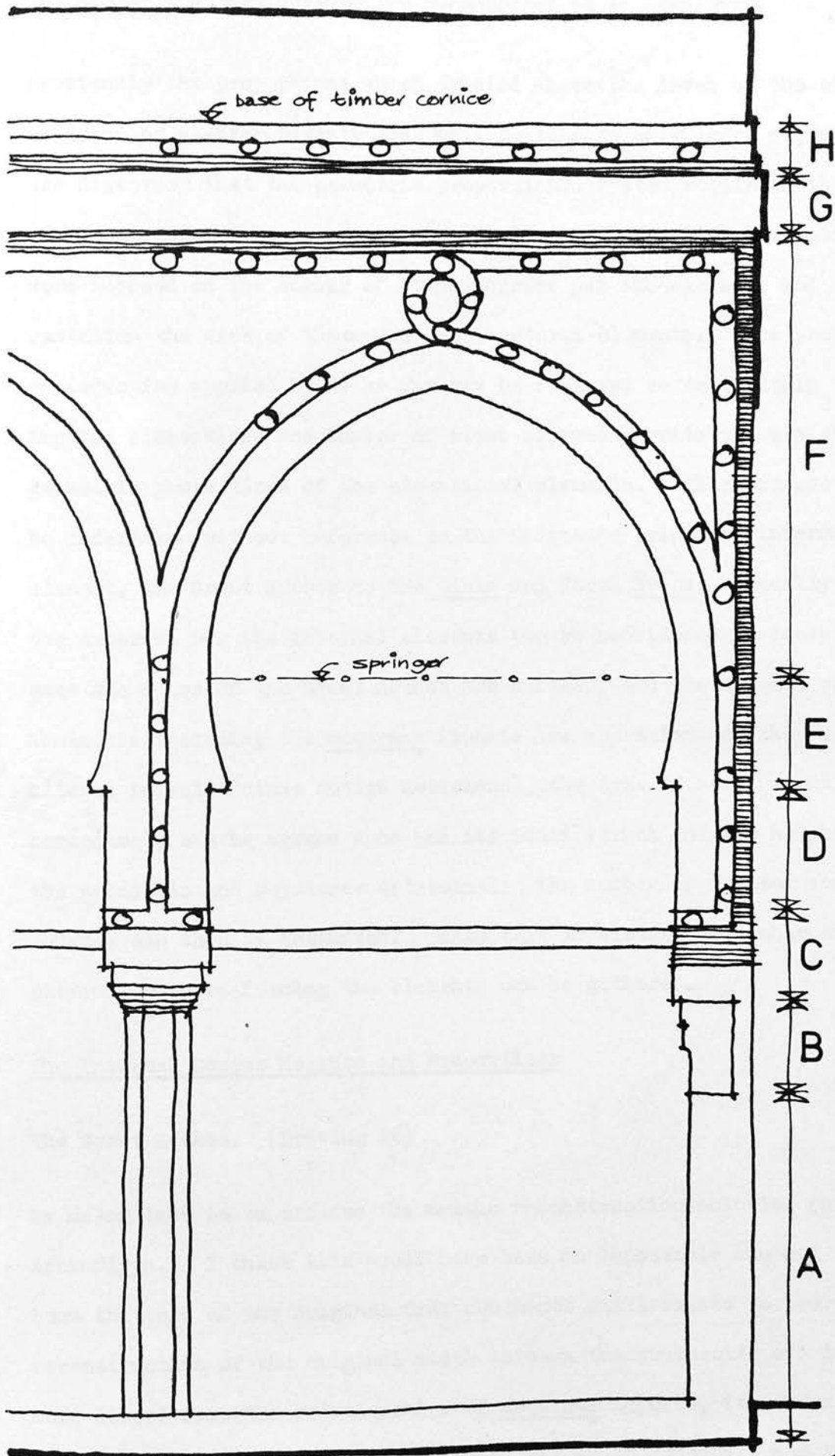


QIBLA WALL

6

7

		82	Mosque of Sidi Madyen, c. 871/1466									
		49	Mosque of Abu Bakr Muzhir, 884/1479-80									
		239	Mosque of Sultan Shah, before 901/1496. (Central arch)	a								
		239	Mosque of Sultan Shah, before 901/1496. (Flanking arches)	b								
		●	Madrasa al-Ashrafiyya, 887/1482									
A	.	8	.	8½	.	12	.	12	.	---	.	
B	.	4	.	3½	.	0	.	0	.	---	.	
C	.	1	.	1½	.	2	.	2	.	---	.	
D	.	0	.	4	.	0	.	3	.	---	.	
E	.	2	.	1	.	0	.	0	.	---	.	
F	.	7½	.	10	.	8½	.	5½	.	---	.	
G	.	2	.	2	.	2	.	2	.	---	.	
H	.	1½	.	1½	.	1	.	1	.	---	.	
<hr/>												
Total No. of Stone Courses		.	26	.	32	.	25½	.	25½	.	---	.
<hr/>												



SAHN COLONADE

7

Previously the proportions which existed above the level of the extant wallhead of al-Ashrafiyya's West Wall could only be guessed at, now with the discovery that the geometric proportional system regulates the height of unrestricted stone courses and with the knowledge that limitations were imposed on the number of stone courses per sub-element, and also by extension the size of the common architectural elements. The processes of deduction applied by me so far may be reversed so that within the imposed limitations the number of stone courses provide the vanished geometric proportions of the elevational elements. This process cannot be undertaken without reference to the Madrasa's principal internal element, the Great Arches to the Qibla and North iwāns: actually neither the external nor the internal elements can be considered in isolation; so once the spans of the Great Arches are defined, and the heights of their abutments including the mugarnas imposta are approximated (they may be altered to suit future design decisions), the type of arch (normally a horseshoe), can be agreed upon and its radii struck and the height of the spandrels and keystones determined: the number of related stone courses can then be estimated. With this knowledge the number of external courses forming the elements can be gathered.

4.01 The Internal Course Heights and Proportions

4.01.1 The Great Arches. (Drawing 26)

My major task is to produce the unique reconstruction solution for al-Ashrafiyya. I think this would have been an impossible aim had it not been that one of the original four abutments still exists to provide a reconstruction of the original width between the abutments, and in a more direct form the relationships of mugarnas imposta, its compartmentation, its moulded and linked archivolt, its ablāq voussoirs and its springing/

springing line. These relationships can be correlated with the existing elements in the Sahn's west wall, the doors, the lintels and ablaq joggled relieving arches and the recesses with engaged columns. All these existing relations are essential to the unique solution, otherwise the equivalent relationships found in other madrasas would mislead due solely to their own unique interpretations of the them. Of course I have had to refer to them all but there are two pertinent examples, [99] the Mosque and Mausoleum of Qāyṭbāy, 877-79/1472-74 (Pls. XIII-XV) and [223] the Mosque of Qāyṭbāy at Qal'at al-Kabsh 880/1475 (Pls. XVI-XIX); al-Ashrafiyya seems to have been an amalgamation of both rather than its exact contemporary of [519] the Mosque of Qāyṭbāy on Rōḍa island 886-96/1481-90 which is too plain to provide comparative material.

Referring back to Drawing 14 the stone courses of the West Wall can be projected across the Madrasa's site as shown in Drawing 26. It must be assumed that the relative floor levels of the Sahn and the iwāns are consistent with contemporary practice, and that they also maintain the normal relationships with the external door's threshold and the external window sills. Following this assumption their positions can be placed in section; observe that these assumed positions do not happen to coincide with the stone courses, they very rarely do so in other buildings.

I believe that I can place more accurately the iwāns' floor level since in the Mosque and Mausoleum's great arch illustrated by Hauteceur I found that there was a ratio between the width across the abutments to the height to the underside of the linked archivolt of 2:1; I also found that it was possible to divide the height into three and then add a third to the height to come level with the great arch's springing line; and from the point two thirds up the height an arc could be described to find the centre of the three fifth radii arch. (See Fig. 14.). Thus in al-Ashrafiyya/

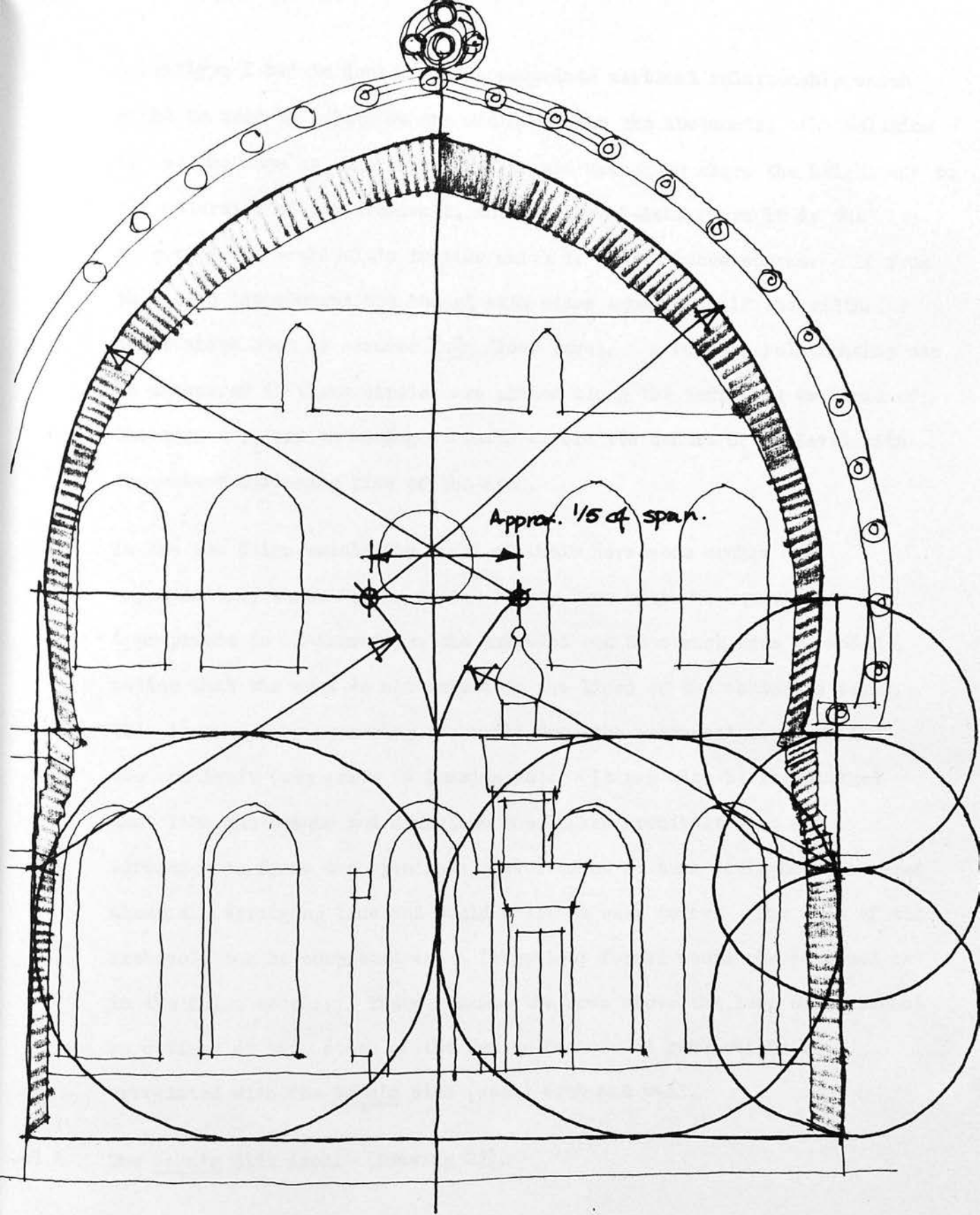


Fig.14. Proportions Underlying the Great Arches in
the Mosque and Mausoleum of Qāytbāy.

Ashrafiyya I had to look for an appropriate vertical relationship which might be seen to relate to the width between the abutments; the solution is not the same as that of the Mosque and Mausoleum where the height was to the underside of the archivolt, instead, in al-Ashrafiyya it is the height to the archivolt's topside which is also a stone course. If from this line two squares are 'hung', with sides equal to half the width, the lower sides meet my assumed Iwān floor level. A further relationship can be uncovered if three circles are placed along the left hand vertical of the square O_1 and on adding a fourth circle its centre O_3 is level with the extant springing line of the arch.

In the two Cairo models the radii of their horseshoe arches are approximately three fifths of the spans, thus with the equivalent appropriate to al-Ashrafiyya the extrados can be struck from R_1 and R_2 , notice that the arcs do not extend to the lines of the abutments below, this is caused by measuring the radii from the extrados' nosing below the archivolt (see arrow in Drawing 26). It can also be established that like the Mosque and Mausoleum the linked archivolt does not bifurcate to frame the spandrels, had it done so this would have occurred about the springing line and would still be seen today. The line of the archivolt can be completed and a large loop formed above the keystone as in the Cairo models. There remains the area above the loop which cannot be defined at this stage of the design because it requires to be correlated with the Sahn's side (west) arch and wall.

4.01.2 The Sahn's Side Arch. (Drawing 27).

The height of the side arch if it is to conform to the Cairo models must equal the height of the Great Arches, and like them it will have radii equal to three fifths of the span. Thus its form is easily found by co-ordinating these dimensions, we can guess that this arch was not horseshoed. Regarding the side arch's archivolt there is no available evidence/

evidence to indicate whether or not it bifurcated, but in both the Cairo models there are large loops above the keystones.

4.01.3 The Sahn's Side Wall. (Drawing 27)

The devastation on the Sahn's side wall stops not a course too soon, because it provides evidence of a recessed alcove flanked by engaged columns (refer back to Drawing 8). In all of the contemporary madrasas in Cairo this recess had at its rear a grilled rectangular window, and therefore it can safely be proposed that windows of this nature existed in al-Ashrafiyya. In table 4, on page 108, the number of stone courses forming sub-element 'C' (the distance between the relieving arch and the window sill) varies by one hundred per cent and could, therefore, affect the height of the side wall by making it two courses too small or too large, providentially in the existing top courses of both recesses vertical joints occur in positions compatible with window jambs; I propose that one course of both windows still exists and that it was built up when the wallhead was levelled off after the Earthquake. This being the case the sub-element 'C' compares well with the two and a half courses of the Mosque and Mausoleum and precisely with the two courses of the Mosque. Further support is given by the fact that in this often seen detail the sill of the window is generally level with the top of the bases of the engaged columns. (For a detail see Pl. IV).

The height of the window, sub-element 'D' can be taken as four courses equalling those of both Cairo models.² Between the window and the keel arches in both models is an ablaq joggled lintel one course high, sub-element 'E'. The decorated mugarnas keel arch in the Mosque and Mausoleum is six and a half courses high compared to the Mosque's six courses. Improbable as it may seem, after the disastrous earthquakes, I have found evidence of keel arches in the window blockings in the guise of 'silent links' which could only have formed the zenith of a keel arch

(see/

(see Drawing 88, for a second example see Pl. II): also in the parapet separating the Courtyard from the Madrasa Baladiyya in its rebuilt areas there is a mugarnas element with three registers within its 0.31m. height, this I surmise came from the base of the keel arch (see Drawing 85).

At this point in the reconstruction I must reverse my tactics and work downwards from an undefined point in space if I am to be able to choose between six and a half courses or in the six courses offered by the Cairo models. Presently the reconstructed Sehn's side arch is taller than the side walls, this discrepancy is not evened out by adding the combined heights of the side wall's sub-elements 'G' and 'H' of either of the models, in the Mosque and Mausoleum the height is five and a half courses and in the Mosque it is seven and a half. But yet again essential evidence was uncovered in an area of rebuild at the top of the North Elevation (refer back to Drawing 6) where there are the remains of a geometric panel.

This panel exhibits with only minor alterations, the same design as is used to adorn the large side panels flanking the upper windows in the Mosque's side walls, compare the Drawing 88 and Plate XVIII. This coincidence of the identical design enables me to confidently place the discovered panel on either side of al-Ashrafiyya's upper window, thereby establishing the window's height. On introducing this panel into the reconstruction it is immediately apparent that the detail used in the Mosque and Mausoleum cannot apply, there is not sufficient difference between the present heights of the reconstructed side arch and side walls if the compartmentation forming the window lintel is to abut the archivolt's large loop. On the other hand if the solution suggested by the Mosque is tested and the compartmentation at the lintel level is carried over the loop of a bifurcated archivolt then al-Ashrafiyya's side wall can accommodate the panel. As a result of this option/

option being adopted al-Ashrafiyya then follows the Mosque and Mausoleum's example by not including the sub-element 'Q' and instead having a six and a half course high keel arch.

Returning briefly to the design of the Great Arches, the upper compartmentation is carried over its archivolt's loop in the manner of the Mosque's great arches.

4.01.4 The Sahn's Wallhead Inscription.

This feature appears in both of the Cairo models³ and I am assuming that a similar feature existed in al-Ashrafiyya, but, even if my assumption is acceptable, there is still the question, just how similar was al-Ashrafiyya's inscription?

There are already the grand Koranic inscriptions of the Qibla, north and west īwāns which in a design context are comparable to the shorter inscriptions of the Mosque and Mausoleum reserved to the Qibla īwān⁴ and one wall of the opposing īwān⁵. No similar inscription exists in the Mosque at Qal⁶ et al-Kabsh other than a very short inscription above the mihrab⁶. Is, therefore, the greatly elongated inscription of al-Ashrafiyya a decorative substitute for the construction inscriptions of the Cairo sahns? In my opinion this was so, since there is evidence which lends itself to this theory in the rebuilt area at the top of the North Elevation.

On either side of the geometric panel, previously described, but apart from it, are two stones that can only have formed part of a kufesque inscription. (Drawing 88). In one stone the lower quarter is eroded, in the other it is the upper quarter that is missing; they are thus reciprocal allowing their original designs to be reconstructed to provide an overall height which may then be added to the reconstructed walls of the Sahn.

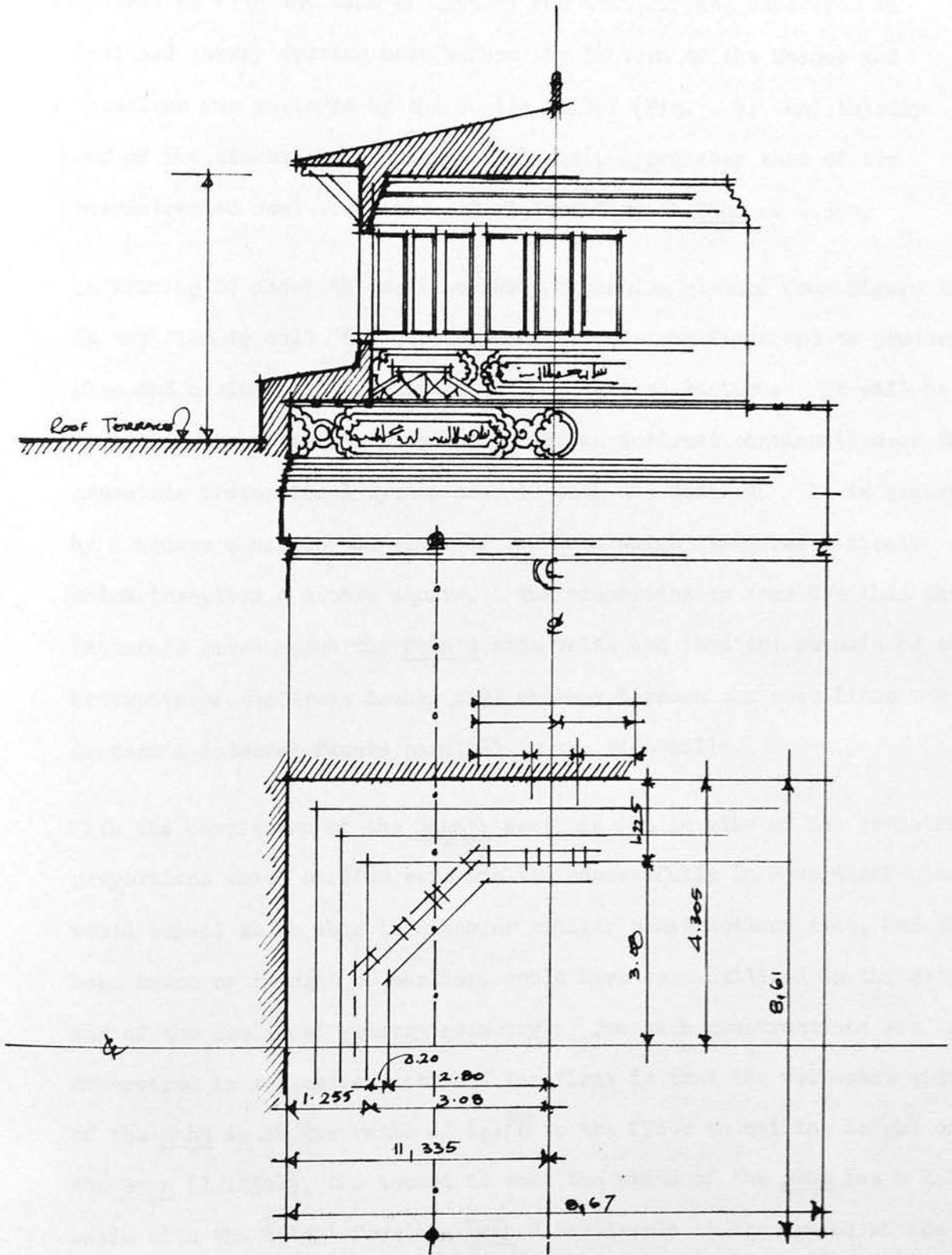
When/

When I first saw these stones on which are the letters la or llah I could not be certain of their provenance or of their date as they were obviously reused to make good the North Elevation sometime after the devastating Earthquake. In addition one student of epigraphy indicated to me that I might be right in assuming they came from another structure in or about al-Haram, and also the epigraphist was uncertain whether the letters would appear for purely decorative reasons in the context of a madrasa. Since then I am in the happy position of knowing that a similar kufesque inscription in stone forms part of the recessed entrance to [49] the Mosque of Abū Bakr Muzhir 884/1479-80 (see Pl. XX), this mosque is only three years older than al-Ashrafiyya. Later, I observed in the Mosque at Qal^c et al-Kabsh an even closer parallel, but here it is painted Kufesque inscription along the narrow timber cornice below the ceiling (see Pl. XIX). In the light of my reconstruction of al-Ashrafiyya's Sahn the position here could not be improved upon.⁷ As a result I am convinced that the two stones belonged to the inscription around the Sahn's wallhead; in fact there is nowhere else in the jig-saw of al-Ashrafiyya that they can logically go!

Along the top of the kufesque inscription would have been another red stone compartmentation and over it a linked string course similar to the string courses existing in the two Cairo models. With this addition the height of the Sahn's walls up to the underside of the timber cornice is completed with a total number of thirty four stone courses, a figure near enough to the two models.

4.01.5 The Sahn's Octagonal Lantern.

I take the lantern of al-Ashrafiyya to have modelled that of the Mosque and Mausoleum of Qāyṭbāy, on three accounts: firstly, the lantern of the Mosque at Qal^c et al-Kabsh is not sufficiently rich in ornament; secondly, I/



"Mosque de Kaitbay du Desert: Avant Projet."

I was fortunate to be allowed by Dr. Abdel-Tawab of the Centre of Documentation in Cairo to sift through their archives for things associated with the time of Qāytbāy and this sifting uncovered an unsigned survey drawing made before the lantern of the Mosque and Mausoleum was restored by the Comité c.1897 (Fig. 11); and thirdly one of the dimensions of the sahn, 8.61m., approaches that of the reconstructed west-east width of al-Ashrafiyya's Sahn of 8.54m.

In Drawing 26 above the section the information gleaned from Figure 14 is modified to suit the circumstances of al-Ashrafiyya and to produce the plan and ultimately the section of the restored lantern. It will be seen that the geometric construction is an indirect continuation of the geometric proportional system used to plan the Madrasa. It is generated by a square equal to the width of the Sahn which describes a circle which inscribes a double square. The properties to note are that the lantern's eaves match the Sahn's side walls and that the reveals of the abutments of the Great Arches fall mid-way between the eave lines and the lantern's internal facets parallel to the side walls.

With the completion of the Sahn's sections and in view of the geometric proportions which earlier were applied successfully in a vertical plane I would expect to be able to discover similar constructions that, had they been known or thought of earlier, could have been utilised in the establishing of the sections' primary geometry. Two such constructions are to be discovered in my reconstruction: the first is that the west-east width of the Sahn is in the ratio of $1:\sqrt{2}$ to the floor to ceiling height of the Sahn (12.25m.), the second is that the width of the Sahn has a 1:1 ratio with the height from the iwan floor levels to the apexes of the Great Arches.

The External Course Heights and Proportions.

The Recessed External Windows. (Drawing 28)

Attending to the design of the external recessed windows should be relatively easy as they follow directly the designs of the internal architectural elements, and there are, of course, the two existing window bays in the Madrasa's West Wall on which to build the reconstruction, they provide the complete sub-elements 'A', 'B', 'C' and part of 'D' table 1 on p.102.

Once more the number of stone courses combining to form the Cairo models seem to be appropriate, and by trying them both out on the drawings I concluded that the recessed windows of the Mosque and Mausoleum could most successfully be adopted for al-Ashrafiyya.

Remembering that it was the Triple Window Recess that gave the first clue to the extent and detail of the geometric proportional system and that the circle with a radius of one fifth of the GU underscored the geometry, I anticipated that it could also be extended to the reconstructed upper areas of the recessed windows if their designs were valid. Tangential to the circle W_1 a second circle can be added, its centre lies on the top line of the joggled ablaq relieving arch's upper compartmentation and one of the sides of its inscribed hexagon coincides with the sill of the arched clerestory. If this hexagon's side is used as the base line of an inscribed double hexagon the springing line for the three fifth radii is found, and if certain of its sides are produced they intersect at the silent links. A fourth circle tangential to the last one is centred on the upper edge of the compartmentation below the rectangular mugarnas and the zenith point of the circumference is tangential to the cornice line at the base of the fleury cresting.

A Summary

Through/

Through continual reference to the Design Precedents especially those of the Mosque and Mausoleum of Qāyṭbāy and his Mosque at Qal^c et al-Kabsh it is possible to reproduce the skeletal elevational elements on which the final appearance of al-Ashrafiyya depends. This procedure of referring back to past solutions, modifying them either to suit al-Ashrafiyya's specific problems or to improve them, is common to all architectural periods and movements. It was only through his intimate knowledge and understanding of what had gone before that the Christian architect was able to design al-Ashrafiyya; if I may be allowed to be immodest, I hope that it is with some of this same understanding, that has enabled me to go this far with a reconstruction, there being outstanding the design of the Loggia.

An abstract of the design decisions can now be prepared in tabular form for comparison with the tables 1 to 4 (pp. 102-14); the reconstructed course heights appearing between brackets. The conclusions to be drawn are obvious, al-Ashrafiyya was a building peculiar to its own time.

	Recessed External Windows	Sehn Great Arch	Sehn Side Arch	Sehn Side Wall
	(1)	(2)	(3)	(4)
A	1	$(8\frac{1}{2})$	(8)	(8)
B	8	2	2	5
C	5	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$
D	(4)	2	(8)	(4)
E	(6)	$(16\frac{1}{2})$	$(11\frac{1}{2})$	(1)
F	$(4\frac{1}{2})$	$(1\frac{1}{2})$	$(1\frac{1}{2})$	$(6\frac{1}{2})$
G	(2)	(1)	(1)	(0)
H	(4)			$(4\frac{1}{2})$
J	(1)			$(1\frac{1}{2})$
K	(1)			(1)
<hr/>				
Total No. of Stone Courses				
	$35\frac{1}{2}$	$33\frac{1}{2}$	$33\frac{1}{2}$	34
<hr/>				

For guidance on the appearance of the East liwan of the Madrasa once again I have to turn to van Berchem.

Quant au liwan latéral est LE, il offrait une disposition très originale, peut-être unique, dont le chroniqueur arabe et le pèlerin d'Ulm ont été vivement frappés. D'après le premier, ce liwan formait une tārīma, c'est-à-dire un pavillon, un belvédère ou une loggia, qui s'ouvrait sur le Haram par trois arcades retombant sur deux colonnes de marbre. Ce dispositif ressemblait donc à celui de ces salles égyptiennes qui s'ouvrent sur la rue ou sur une cour intérieure par deux ou trois arches brisées retombant sur une ou deux colonnes. Il n'est guère employé dans les monuments religieux, sauf à Jérusalem, au bord au Haram, où plusieurs loggias de ce type s'ouvrent encore sur un des plus beaux panoramas de l'Orient; l'architecte égyptien de l'Ashrafiyya s'est donc inspiré ici d'une tradition locale.⁸

The Loggia's essentials are therefore the three arches and the two marble columns, but we have the option of placing them in the Jerusalem or Egyptian design tradition. For an example in the Jerusalem tradition I need only turn to the Madrasa ^Uthmāniyya and inspect its two arched windows between three columns (these are seen behind the Sabīl of Qāyṭbāy in Plate XXI); to attempt to translate this design, belonging the Jerusalem tradition, into terms acceptable to al-Ashrafiyya, a building which I believe falls wholly within the Cairo tradition, is in my opinion hazardous. One fact is all that is required to establish this incongruity, they are too short even with the addition of the large loop like oeil-de-boeuf windows and a third arch (Drawing 29). However, I am not denying the possibility that it was the Jerusalem tradition which inspired the Cairo architect, what I am saying is that al-Ashrafiyya's Loggia is not simply transposition of an often repeated element or device from along the west and north walls of al-Haram.

It is stated by van Berchem that in religious buildings outside Jerusalem such a combination of arch and column is not much used other than in the sabīl-kuttābs placed at the external corners of many Cairo monuments.⁹

His dissertation continues on to include [49] the Mosque of Abū Bakr Muzhir, 884/1479-80, where two columns support a triple arcade placed across/

across the Qibla Iwān's eighteen metre width and an identical arcade is placed in front of the opposing Iwān. A decade before this same system (Pls. XXII and XXIII) was used in [82] the Mosque of Sīdī Madyan, c.871/1466 and even earlier in [204] the Mosque of al-Qādī Yahyā 856/1452. Referring to table 7 on page 113 it seems that van Berchem was correct in citing the Muzhiriyya, it has a total of thirty two stone courses just one to two courses below al-Ashrafiyya's reconstructed internal heights given on page 127 above. The fact is that this numerical proximity of the stone courses underlines why the tables can only be used as a 'rule of thumb': in no manner is al-Muzhiriyya's system compatible with the requirements of al-Ashrafiyya, it is too wide for the available space in al-Ashrafiyya and if it is scaled down to fit the width of approximately nine meters the arches become too short and resemble those of the Jerusalem tradition.

To clarify these problems a design essay was attempted (see Drawing 29), the intention was to remodel the Jerusalem and Cairo traditions in such a way that they might be attractively installed within al-Ashrafiyya's dimensions and basing them on the four column system preferred by van Berchem¹⁰ and Tamari¹¹. I gave a considerable amount of attention to the possible decorative qualities such a system might offer. The results were aesthetically execrable, highlighting such design puzzles as the discontinuity between the external and internal ablaq coursing, where one is white, the other is red.

Any external study must incorporate the pair of red stones, two courses high, on which the external columns presumably sat; structurally they are the most unsatisfactory aspect of the system, they restrict the diameter of the columns and because of the ablaq discontinuity there is small likelihood that the internal pair of columns sat on squat red padstones. In addition the external red stones make it difficult to centre/

centre the columns on the intrados of the external arcade.

In the search for a favourable solution I found inspiration in the secular complex, [228] the House of Qāytbāy, 890/1485, which has along one side of the central courtyard 'deux ou trois arches brisees retombant sur une ou deux colonnes',¹² (Pl. XXV). But, I am still confronted by the two red stones on which the columns must have been centred; the clue to the resolution of this is provided by [239] the Mosque of Sulṭān Shāh, before 901/1496, which although slightly later has triple arcades resting on octagonal piers (see Pl. XXVI). Drawing 30 takes full advantage of this discovery to solve all the outstanding design problems. The pair of external red stones set above the joggled ablaq string course are placed approximately equidistant from each other and from the opening jambs. These I have already suggested make it impossible to centre the columns under the intrados if they are square in plan; if instead they were rectangular then the columns could be centred correctly but their diameters would still be restricted by the rectangles' shorter side, but if I presume that the one visible facet does not form a square or rectangle and instead is part of an octagon then al-Ashrafiyya's solution was to have two octagonal ablaq piers, predating those of Sulṭān Shāh.¹³ Such a design solution overcomes any problems caused by the ablaq discontinuity through the natural contrast of pillar to column, it enables me to propose a design based on two internal columns and conforming to the contemporary descriptions and the impression given by Bernhard of Breydenbach's view (Pl. I). It would also have expressed the structural aesthetic of strength and confidence implicit in the gigantic members of the House of Qāytbāy. It allowed the three arches to rise to the same height as the Sahn's Great Arches. The solution also provides surfaces which may be divided naturally into decorative compartments, the spandrels might have exhibited vegetal forms and above the large framed areas might have been prepared/

prepared to take enormous inscriptions, almost certainly they would have been sheltered from the elements by an extensive cantilevered timber roof characteristic of the Cairo tradition.

4.05

The Loggia's Internal Design Solution introduced into the Sahn (Drawing 31)

There are a number of points which have already been fixed:

- i) The Loggia's maximum width equals the north-south dimension of the Sahn.
- ii) The Loggia's opening width to the Sahn is equal to the distance across the jambs of the north and south door openings in the Sahn's west wall.
- iii) The axes of the external red stones.
- iv) The differences in the floor levels of the Sahn and its iwans.
- v) The height of the Sahn's kufesque inscription.

Although the arcades across the sahns of the Cairo mosques do not necessarily feature arches of equal spans such is the relationship of the opening width of al-Ashrafiyya's Loggia to the axes of the red stones that the spans of the three arches can equal each other through the addition of mugarnas imposts. Is it coincidental that the distance separating the axes of the red stones, and therefore the columns, equals $1/5$ GU? The height and format of the imposts follow closely the form of the West īwān's mugarnas imposts, and as in the Cairo arcades their height has a direct bearing on the overall height of the intermediate columns.

The width of the coursed masonry above the columns equals the depth of the arcade's intrados which was calculated to be equal to the depth of the West īwān's intrados. The height of the arcading is controlled by the/

the heights of the Sahn's Great Arches and its side arch to the West Iwān. It will be remembered that one of the design items of the Great Arches was that their arcs did not coincide with the produced lines of the abutments since their radii were controlled by the nosings above the imposts, but as this does not hold for the triple arcade of [228] the House of Qāyṭbāy where the arcs do coincide with the produced lines of the abutments I am confronted by a choice. If the second choice is applied to the Loggia's internal arcade coupled with radii equal to $1/5$ GU the form of the three arches can be arrived at, included are nosings comparable with those exhibited by the House of Qāyṭbāy and which are level with the springing of the West Iwān's arch.

4.06 The Loggia's External Design Solution introduced into the East Elevation (Drawing 32)

The external design solution cannot be an exact replica of the internal solution because it has to be incorporated within a moulded frame along with the other known elements, the ablaq joggled string course and the ablaq jambs. Earlier I described why intermediate piers have an advantage over columns although in theory, whichever structural system is chosen the span and profile of the central arch will equal that of the internal arch. The external side arches while retaining the $1/5$ GU radii do, however, differ from the internal ones on account of there being no aesthetically acceptable method of accommodating muqarnas imposts without a total disruption of the Loggia's ablaq jambs; a disruption which might have forced itself onto the ablaq intermediate pillars.

4.07 Summarising the Restored East Elevation's Relationships.

I think the completed elevation emphasises the separateness of al-Ashrafiyya's three parts; the demure but strong majma^c, the inviting Portal full of light and colour, and the Madrasa built upon the platform which extended the riwāq's original roof terrace. Notwithstanding this separateness/

separateness there are minor interrelationships; the northern line of the North īwān's window recess coincides with the northern edge of the majma^c's window's moulded frame, the northern edge of the Loggia's moulded frame coincides with the edge of the moulded frame surrounding the majma^c's door, and finally, the central line of the Qibla īwān's recessed windows nearly coincides with the central line of the Portal's eastern arch.

The general conclusion must therefore be that no one proportional network could be discovered to suit all the vagaries of the elevation unlike that of the Kilāniyya (Appendix B). What can be seen is an expression of the Madrasa's plan form in terms of elevational elements generated by the same geometric constructions.

5.01 The Engaged Column at the Porch. (Drawing 43)

This engaged column articulates the south east corner of al-Ashrafiyya, and as Plate VI demonstrates it is now extremely weathered, so much so, that in a few years its decoration will be beyond recall. There are four parts to the column, a conventional bulbous base belted at its middle, a decorated shaft, an inscription acting as a collar below the curvilinear mugarnas capital.

5.01.1 The Decorated Shaft.

Superimposed on the drawn elevation is an inscribed hexagon centred on C_1 approximating the dotted $1/5$ GU radius circle. From this drawing it can be gathered that the width of the pier has a relationship with the height of the decorated shaft which can then be divided up into smaller hexagonal units, as is shown by the inscribed hexagons on the vertical C_1 axis. The placing of these inscribed hexagons repeats the positions of the assembled repeat units up the shaft. Turning to the detailed drawing of the shaft's decoration it is obvious that the repeat unit is based on a double hexagon¹ and from the 'Preferred Lines' it is established that the width of the repeat unit equals the width of the shaft's decorated area.

If reference is now made to the 'Geometric Plan of the Shaft' notice that the 45° axes pass through the centre of a circle (it is convenient to consider this as a theoretically complete column), and that the chamfered sides are at 60° to the two wall planes not as might have been supposed at 45° . The explanation is this, the width of the decorated area equals half of the theoretical circumference and the 15° differences on either side form the plain margins.

Thus a series of related geometric proportions can be eventually traced between/

between the width of the pier and the radius of the engaged column's shaft.

Surrounding the centres of the repeat units are hexagonal interstices decorated with vegetal elements flowing naturally out of the hexagonal borders to fill the space. This is one of the delights of the stone carver's art during the reign of Qāyrbāy, there is always a feeling of 'fitness for purpose' along with a remarkable clarity. Scrutinising the interstitial elements brings an awareness of the tenuous distinctions separating the simple trefoil from the palmette as there are included in the interstitial elements a trefoil with bracts. If the bracts are removed a simple trefoil is the outcome, if they are increased in volume the result is a palmette. The only other vegetal element used is the sculpted cinquefoil filling out the hexagonal interstices.

Observe that those interstices without vegetal elements are not void of decorative features, they all have shadow lines within them. These act to relieve any possibility of monotony, or it is more likely that they are added to accentuate the geometric shapes which are, in this instance, constructed by solid interlaced geometric lines which therefore cannot fully enclose the figures? Also observe that the non-vegetal interstices are essential to the understanding of the total pattern. Just imagine the confusion that would be caused if all of the interstices had vegetal decoration.

This variation in the weighting given to specific interstices must be considered as one of the decorative canons of the Qāyrbāy Period, and it is often the distinguishing mark between what is of the Period and what comes after it. There is an indefinable ration between the solid and the void, if there happens to be an imbalance it is immediately apparent.²

Two factors have to be borne in mind when inspecting the stone decoration of/

of the late Mamlūk Period. Are the elements fitted to their purpose? Is there an equilibrium between the solid and the void which contributes to an area's visual clarity?³

5.01.2 The Collar and the Capital.

The collar is inscribed with a one line inscription giving the name of Qāyṭbāy:

al-malik al-ashraf abu-n-naṣr Qāyṭbāy.

Around the base of the capital is an area decorated by a ribbon development which acts as an overlay through which the arabesque forms are seen, the essence of the design being the manner in which the two systems compliment each other. A contrast is provided by the purely arabesque decoration at the heads of the chamfered sides. A number of the curvilinear mugarnas' cells have internal modelling, and the topmost cell on the corner is filled by a vegetal element.

5.02 The Vaulting to the Porch (Drawings 44-46)

The earliest Cairo example of this type of 'fan' vault with a cruciform centre pointed at its extremities and joined to lozenges occurs in 131 the Mosque of Ylgai al-Yūsufī, 774/1373.⁴ Included in the same design scheme was a recessed portal with a plan form similar to al-Ashrafiyya's and whose origins were Syrian.⁵ From the point of view of al-Ashrafiyya this last fact has little significance since the plan form of the portal had by now been standardised in Cairo, the home-base of the Christian architect and his colleagues. Actually the pointed cruciform centre with decorated lozenges set into an ablaq vault was not new, it had recently been tried successfully in 99 the Mosque and Mausoleum of Qāyṭbāy.⁶ (See Pl. XXX).

The pointed cruciform centre has a rich chinoiserie floral border; I have not discovered why it is that its width varies to the extent it does, the only suggestion is that for some reason or another it was cut in situ otherwise/

otherwise surely the variations would have complicated the erection and
implacement of the central slabs. The significant images are, of course,
the solid interlaced geometric lines with a pleasing solid to void ratio.
This controlled exuberance of the centre's decorative elements is offset by
the slightly relieved or flat-carved arabesque and cusped ribbon develop-
ment of the lozenges.

The geometric construction of the centre illustrates how it is possible
(and aesthetically profitable) for a double hexagon to interact with a
square. In this instance it has resulted in the cruciform's points being
at 120° so suggesting a spirit of expansion; had they been at 90° each
point would have lined up with its neighbour thereby creating a feeling of
enclosure. Drawing 46 provides a logical method of constructing each of
the centre's five repeat units based on the double hexagon.⁷

5.03 The Window Wall. (Drawings 47-51)

5.03.1 The Joggled Relieving Lintel (Drawing 48).

Over the grilled window and its monolithic lintel lies the joggled ablaq
relieving lintel whose white voussoirs originally possessed vegetal
decoration. On two of these voussoirs the decoration has been totally
eroded, while on a third about half remains leaving only one voussoir's
decoration intact. From the available evidence I conclude that the
outer white voussoirs each contained one half of a double growth arabesque
system, and that the inner pair had an interlaced and self-contained
arabesque system, as had the decorated tympanum.

I think it safe to assume that the joggled voussoirs were cut to interlock
with each other on the ground before being hoisted into position; it is
likely that at this stage the white voussoirs were in an undecorated state.
Assuming this was the case I would have anticipated that the radiating
sides of the voussoirs and the arcs joining up the joggling's points of
departure/

departure from these sides might have had the same centre, but (at a drawn scale of 1:5) this is not so, instead my measurements indicate three separate centres. The first is 1.15m below the base line and from it are drawn the keystone's sides. The second is 1.22m below the base line and from it radiate the lines defining the outer lines of the pair of voussoirs on either side of the keystone. The third and furthest centre is 1.32m below. This was the major centre because, in addition to the lines controlling the inner sides of the pair of outer voussoirs, arcs can be drawn to join the joggling's departure points except where the extrados deviates slightly from its arc. This and other 'deviations' centred on the first and the second centres were, I think, intentionally made to exaggerate the visual expression of the structural strength of the joggled relieving lintel, e.g. if the keystone had been struck from the third centre its sides would have been that much nearer the vertical which would be sufficient to weaken the composition.

If I check these results against my 'Geometry Underlying the Window Wall and Vestibule' (Drawing 23) I find that at the smaller scale of 1:20 my constructions suggested the centre of the relieving lintel to be at the mid-point of the line 1-4, which is approximately 0.97m below the base line. Such a difference is far from being a tragic error since at the smaller scale the thickness of the inked arc covers a relatively greater area, and in Drawing 23 I was attempting to provide a logical proportional system which fitted naturally the majority of the Window Wall's features.

5.03.2 The Oeil-de-Boeuf Window and its Geometric Side Panels. (Drawing 49)

Set around this circular window are ablaq voussoirs, only the white stones are decorated and they all have the same shape, although handed left and right about the window's vertical and horizontal axes. The carver has introduced into an ostensibly conventional vegetal design a spiral at the lower/

lower 'inner' corners of each voussoir: in adopting a spiral he avoided the awkwardness arising from the split stalks being unable to complete their convolutions gracefully due to the confines of the corner. This is made possible by the fact that the internal width of the split stalks equals the distance between each rotation, and if this is added to a change in the normal linking function of a knotted scroll, then the eye perceives a symmetry which is illusionary, it is most obvious in the 'Vegetal Forms in Outline' (Drawing 49) that a malformation exists.

In the 'Geometry Underlying the Window Wall and Vestibule' (Drawing 23) the centre of the oeil-de-boeuf was found by W_2 at the centre of a smaller but similarly orientated square to the square 11-12-15-14, this smaller square defined the area of the window, its voussoirs and their surrounding compartmentation. Observation suggested and measurements confirmed that there is a generally accepted width for the red stone compartmental bands in Jerusalem and Cairo during the period of Qāytbāy. Thus this dimension can be subtracted from the square figure to leave the square central area of voussoirs and window.

In the 'Geometry of the Oeil-de-Boeuf' (Drawing 29) a circle is first described within the square, followed by an inscribed double square or octagonal star, when lines are drawn from the centre at $11 \frac{1}{4}^\circ$, $33 \frac{3}{4}^\circ$, $66 \frac{1}{4}^\circ$, and $88 \frac{3}{4}^\circ$ the splayed sides of the voussoirs are defined and where they intersect with the sides of the double square the intersections provide the circumference of the oeil-de-boeuf.

The geometry of the side panels is irregular since it does not follow the normal ruling that when a surface is to be decorated one of its sides is divided equally into a number of parts corresponding to the number (and size) of the repeat units required.⁸ Along the overall vertical height of the panel four $60^\circ/30^\circ$ rectangles were constructed, such that, the smaller sides/

sides equalled the overall width: thus a direct relationship exists between the overall height and width. This may appear to be a simple and easily arrived at fact, but it has other ramifications forged by the 'Underlying Geometry of the Window Wall and Vestibule': it must equal the height of the oeil-de-boeuf and its associated voussoirs; its width multiplied twice, plus twice the width of the vertical compartmental bands, plus the width (= height) of oeil-de-boeuf and its voussoirs equals the width of the relieving arch below; if two more vertical compartmental bands are added (having the same widths as the previous ones) the overall width of the window recess is equalled, it in turn approximates the side of the square inscribed by the $1/5$ GU radius circle. Of course interrelationships of this intricacy, if they are to have any aesthetic qualities, require to be conceived through graphical means to be followed at a later stage by their translation into measured units. Returning to the question of the actual panels' construction; once the overall dimensions have been arrived at the horizontal central axis can be found and the widths of the two side margins measured off, the same measurement is used to position the top and bottom margins. With the completion of the margins the panel now has two rectangles above and below the central axis which are confined by the margins, the horizontal axes of the two rectangles can now be found and drawn to produce a total of four rectangles in which the diagonals can be drawn and tangential circles described which will become the circles of the irregular geometries repeat units. The irregularities are seen if the sizes and shapes of the petals surrounding the nuclei are compared, and also its irregularities would be more pronounced and would certainly be more difficult to resolve or disguise if each of the assembled repeat units were to be complete throughout 360° .

5.03.3 The Rectilinear Muqarnas (Drawing 50)

Crowning the window recess the rectilinear muqarnas act as the element of transition between the planes of the recess and the general wall surface, and I would contend that the visual device whereby the compartmentation around/

around the mugarnas overlaps the general wall plane enforces this transition.

Three Dimensional Groups: Plate XXXI shows mugarnas from Cairo which are similar to those of al-Ashrafiyya, their prominent feature is the rectilinear quality of the cells highlighted by the strong shadow effects cast by the three dimensional forms. This three-dimensionality automatically organises itself into groups focussed on specific cells, in al-Ashrafiyya the focal cells are W1 and W3 (Fig. 15), but their areas of influence are not static, because they react to the changing light conditions which can expand or contract the groupings: an extreme case would be where the light source was directly in front of the mugarnas which would not produce any shadows and therefore must kill any sense of depth leaving the impression of a two-dimensional languid composition. An account must also be taken of the effectiveness and inquisitiveness of the human perceptual senses which should endeavour to create new combinations and relationships while trying to assess the physical form and realities of the mugarnas; such a perceptual conflict is the essence of the success and popularity of mugarnas generally in Islamic architecture.

Cell W1: This, the central cell in the lowest register, is larger than any of the others. It is two courses high and approximately one third of the width of the mugarnas. The decoration takes the form of a double growth arabesque system. One element is interlaced and self-contained with no specific point of generation and the other is semi-contained as it issues out of the cell's bottom frame.

Cell W2: An interlaced and self-contained arabesque system decorates this cell. It includes half-overlaps in addition to the full interlacings.

Cell W3: Unlike the two previous cells the form is not directly defined by the angled planes of the surrounding cells, rather W3 gives support to and/

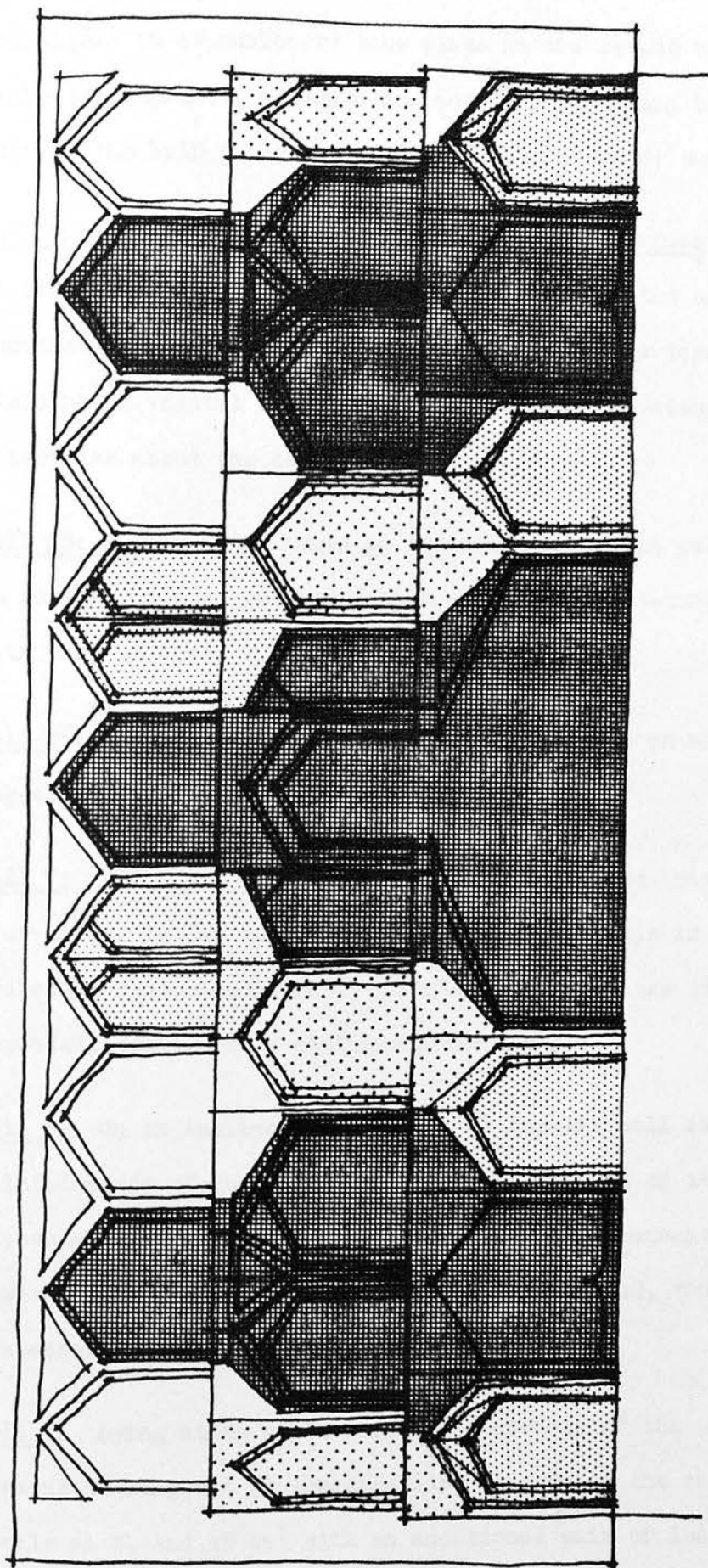


Fig. 2. Cross-section of a column of a columnar structure.

and allows an expansion to take place in the second register. The arabesque elements, although not actually repeating themselves do suggest through the half palmettes at the sides a chain or continuous development.

Cell W4: Repeated twice in each half of the mugarnas this cell is placed at the extreme end of the first register before the corner and also immediately after it on the reveal or ingo of the recess. The pointed field has a vegetal form arising from two points along the base line to intertwine about the central spine.

Cell W5: Lying at an angle to the wall plane this cell's vegetal element in outline is identical to that of W4 and its intercarving compares closely with that of W4.

Cell W6: Concave in plan this is decorated with an arabesque system suggestive of a chain development.

Cell 7: Set at an angle to the wall plane this concave cell is repeated four times, in two sets of pairs. Basically this is a self-contained arabesque system modified by 'half-bindings' at the sides which, if repeated, could form a continuous development.

Cell 8: On an inclined soffit this triangular cell is wedged between the pointed heads of the paired W7 cells. The form of its decoration is determined by its position and function; they concentrate and direct downwards the load of the top register's cell W12, thus the semi-contained arabesque system descends from the top frame.

Cell 9: Lying at an angle across the corners of the recess the vegetal element issuing out of the base line belongs to the same decorative family as W4 and W5 but with an additional pair of leaves.

Cell 10: Painted a yellow colour this is an umbrella semi-dome at the centre of the top register.

Cell/

Cell 11: Paired with another of the same this cell lies at an angle to the wall plane. It belongs to the same decorative family as W4, W5 and W9, and although it is narrower than W9 their outlines of the vegetal elements approximate each other in all respects as does the inter-carving.

Cell 12: Unlike the other cells which are to be found in both halves of the mugarnas this cell differs in each half: cell W12 (Left) is decorated by an arabesque system suggestive of a chain development similar to cell W6; cell W12 (Right) is a self-contained system.

Cell W13: Although belonging to the same decorative family as cells W4, W5, W9 and W11 all of whom issue out of the bottom frames, here the intertwining about the central spine is suggested, but not fulfilled, as one half of the element flows over the other.

Cell W14: The self-contained arabesque system decorating this convex cell is nearly identical to cell W7. It is interesting to note that the outlines of the vegetal forms are modified slightly in both of the examples of W14: they occur within the triangular heads, in the left half of the mugarnas there is a pointed terminal like that of cell W12 (Left), and in the right half there is instead, a heart-shaped palmette top bud with simple side buds like those of cell W12 (Right) making the main characteristics of W14 (Right) and W12 (Right) almost identical.

Cell 15: Functioning as a double spandrel and repeated eight times across the mugarnas, this triangular cell is decorated with a semi-contained arabesque system issuing from the side borders to grow upwards.

Cell W16: Being the terminal spandrel it has exactly one half of the decoration appearing in the double spandrel W15.

The vegetal forms decorating the cells of the mugarnas are not unique to al-Ashrafiyya, they belong to a well developed and established vocabulary, e.g./

e.g., the rectilinear mugarnas of [114] the Mosque of Qaḡmās al-Ishāqī 885-86/1480-81 (an exact contemporary of al-Ashrafiyya) display similar if not the same vegetal elements. (P. XXXI).

Subject Groups: On the completion of the identification of the individual cells they can be mentally reassembled to create groupings of like kind and so heighten and extend the observers understanding and appreciation. Two reassemblies which compliment each other are given in Figures 16 and 17, the first is an abstraction of the inner tensions and directions of the decorative elements which I feel were given a great deal of thought before their final positions were fixed, the second figure tries to interpret the necessary eye movements to complete the comparisons.

5.03.4 The Window Wall's Side Panels and the Shields of Qāyṭbāy. (Drawing 51)

Earlier in the 'Description of Today's al-Ashrafiyya' the existence of red bole was noted along with minute specks of gold leaf. They indicated that the total surface area of the circular shields were covered in gold leaf. If, as I presume, the vegetally decorated areas were in blue and white the visual effect might have been stunning.

The texts of the two shields differ very slightly from each other in the positioning and, or physical form of the diacritical marks.

- a) abu-n-naṣr Qāyṭbāy
- b) ^ciss li-maulānā as-sulṭān al-malik al-ashraf
- c) ^cazza nasruhu

(b) Glory to our Lord, the Sultan al-Malik (a) al-Ashraf Abu l-naṣr Qāyṭbāy (c) may his victory be glorious.⁹

The vegetally decorated corner pieces below the shield both have double growth arabesque systems composed of one self-contained and one semi-contained element. The small upper corner piece has a semi-contained arabesque element not dissimilar to the decoration of cells W15 and W16.

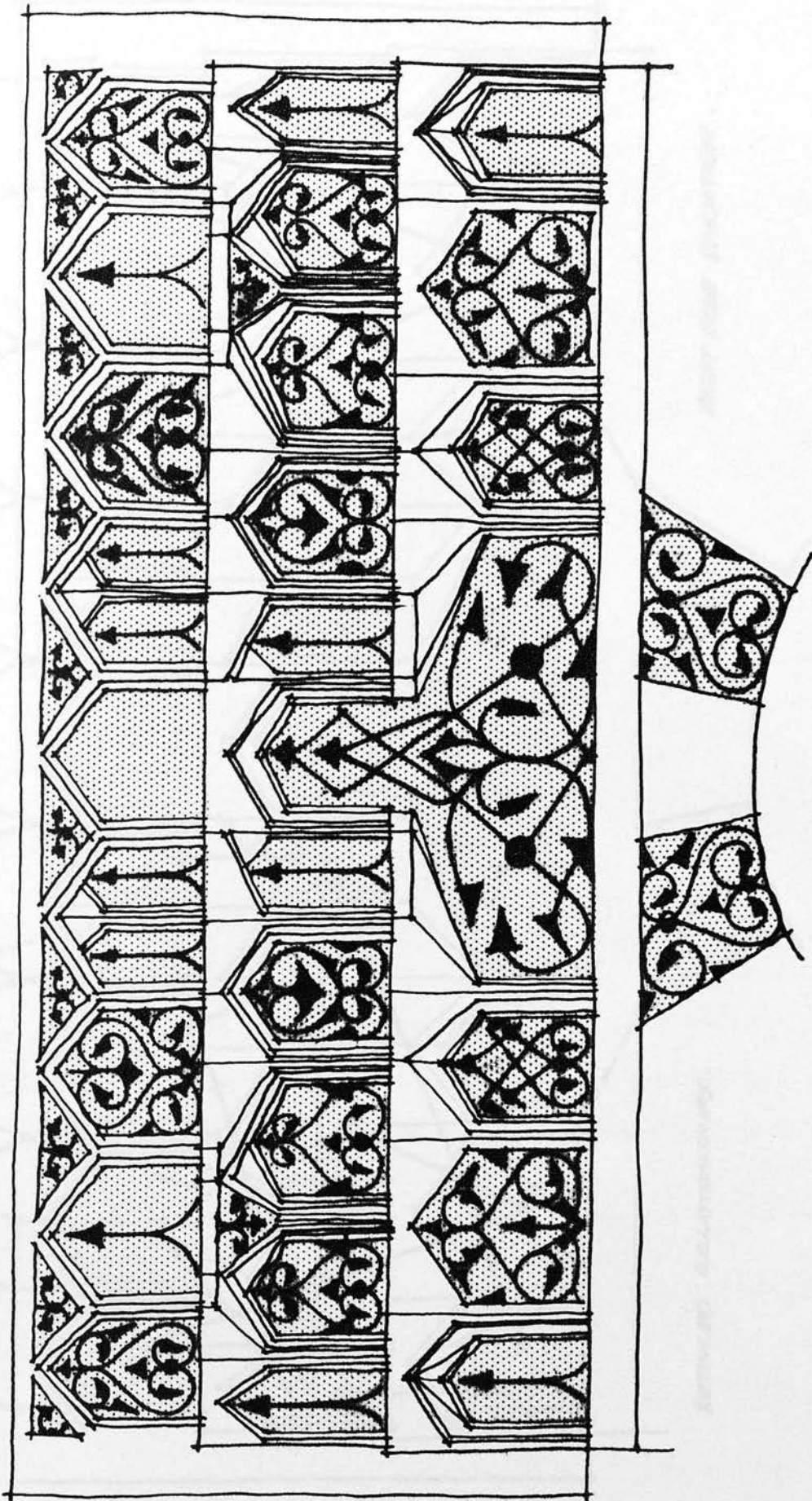


Fig. 24. Naqarnas: in the Window wall: Subject Groups.

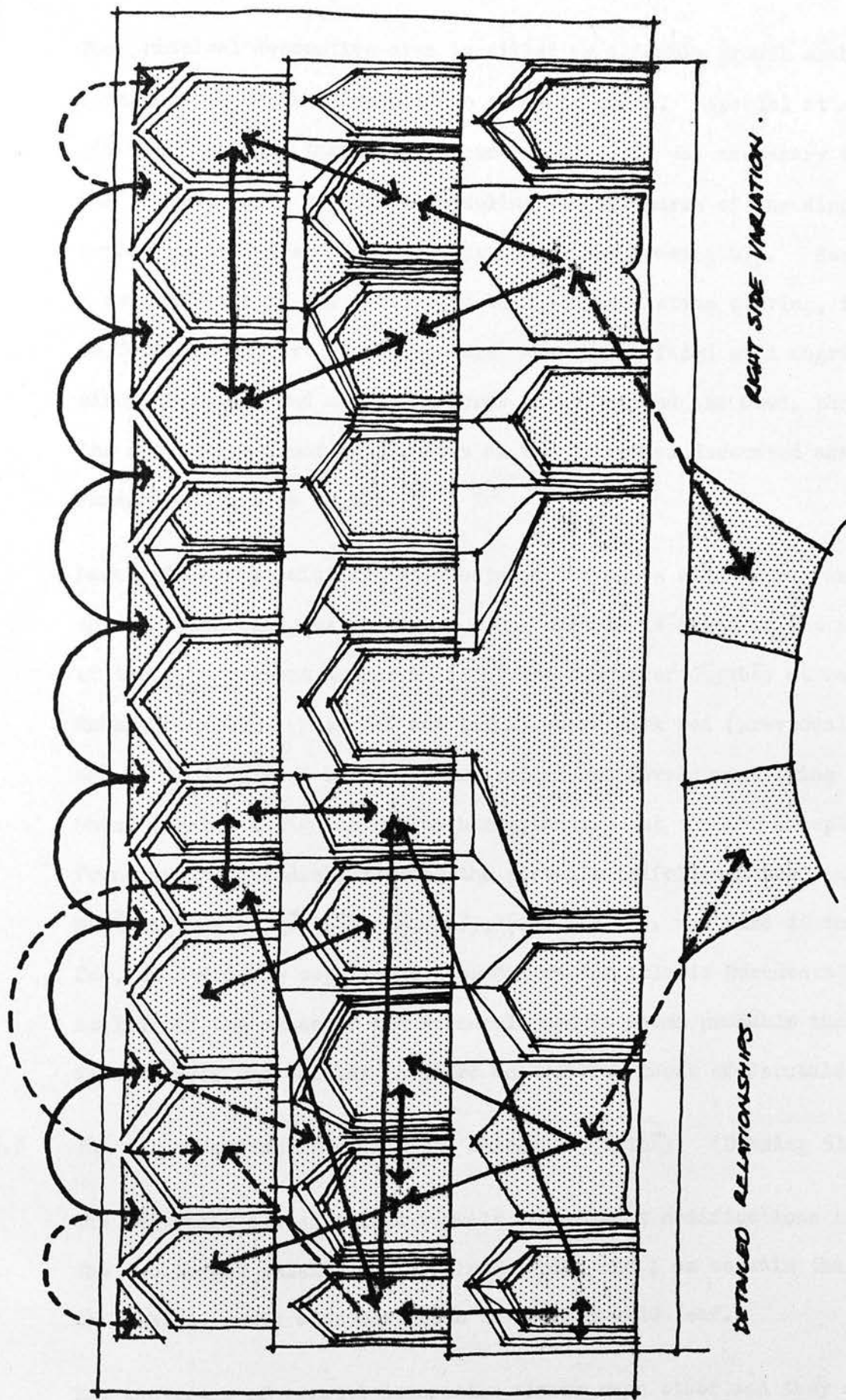


Fig.17. Muqarnas in the Window Wall: Subject Groups - Relationships.

The principal decorative area is filled by a double growth arabesque system, both of the elements are self-contained. Special attention was given to the line taken by the central axis, it was necessary to construct the correct curve so that it complimented the curve of the Window Wall's arched shape rather than matching it. (See Drawing 47). Such curving of a central axis is not restricted to the art of stone carving, it can also be found in the art of the armourer when he is faced with engraving a circular shield and arabesque forms onto a curved axe head, the shape of the decorative areas is the same as the principal decorated area of the Window Wall's side panels.¹⁰

Parallels can be distinguished between the above side panels and their shields with examples in Cairo. One example is found in the spandrels of the sahn's great arches in [223] the Mosque of Qāyṭbāy at Qal^c et al-Kabsh, 880/1475, (Pls. XVI and XXXII) where dark red (previously gold?) shield is displayed beside a dark red ribbon development lying above a white vegetal design on a blue background. Yet another example is to be found in the spandrels forming the portal's trifoliated head in [324] the Sabīl-Kuttāb of Qāyṭbāy, 884/1479, (Pl. XXXIII). I find it interesting, for, on a drawing supplied by the Centre for Islamic Documentation I scaled-off the sizes of the spandrels and it seems probable that the diameters of the shields in Cairo accord with those of Jerusalem.

5.03.5 The tympanum inscribed with the shield of Qāyṭbāy. (Drawing 51)

The centrally placed shield repeats with slight modifications the text on the two larger shields in the Window Wall, and I am certain that like them this shield would also have been covered in gold leaf.

The two areas of vegetal decoration mirror each other and they may be considered as one double growth arabesque system prised apart by the central shield. The convoluted stalks of the two elements in the system extend/

extend outwards the cycloidal nature of the shield.

Observe that in the right hand half of the tympanum the design is interrupted by a gap, 0.03m wide, caused by the 1545 Earthquake. This can be traced down the entire Window Wall but elsewhere it is less apparent since the displacement is spread over a greater number of stones the lower down the wall it goes.

5.04 The Portal Wall (Drawings 52-61)

5.04.1 The Mastabas or Bench Seats. (Drawing 53)

The General Divisions of the Mastaba: The 'Geometry Underlying the Portal Wall' provided a base line which coincides with the base of the joggled ablag decoration of the mastaba, so it is logical that this line should be used in the more detailed design of this architectural element. It is also known, or at least it may be assumed, what the width is of the linked and moulded frame surrounding the composition. (Drawing 24).

From the base line three squares are constructed between the centre line AB of the frame's vertical moulding and DE, the line across the faces of the horizontal mouldings where they turn inwards towards the door opening, points 1-8. Above and below the three squares the widths of the horizontal mouldings can be added so that their central axes, CD and EF, intersect at O_1 and O_2 on AB. From those two points lines at 45° can be constructed to intersect at point 9 on GH, the horizontal axis of the joggled area. At O_3 , the intersection of AB and GH the square 10-13 can be constructed within the width of the moulding, and its diagonals can then be produced to points 15 and 14 along 1-4 and 5-8 respectively, draw line 14-15. From 14 construct a line at 45° to intersect with line 13-12 produced at point 16, similarly from point 15 draw a 45° line to intersect line 10-11 produced to 17. On lines 14-16 and 15-17 construct squares 14-16-18-12 and 15-17-19-11. Points 16, 17, 18 and 19 become the centres/

centres for the arcs of equal radii which define the trifoliated terminal of the joggled area.

Point O_3 is the centre of one of the links of the moulded frame, to find the positions of the remaining links along CD and EF the following procedure was adopted by me. Divide the width of the mouldings into three. Produce line 16-17 in both directions to cut the two horizontal mouldings and construct in each of their middle thirds squares with centres O_4 and O_5 , these become the centres of two out of four links which had to be found. By producing diagonals 2-6 and 7-3 to cut CD and EF respectively the centres O_6 and O_7 belonging to the two final links are discovered.

The corner of the joggled area which lies at the rear of the moulding is defined by the lines drawn from O_6 and O_7 at 45° to intersect at point 20; this automatically provides the depth or height of the moulding's projection which remains constant throughout the portal's composition.

The Geometry Underlying the Joggled Area: Given the height and length of the joggled area including the trifoliated terminal and the links' centre the geometry can be established. By producing the line O_2-9 to cut the top side of the area point 21 is found. Point 22 occurs at the point of intersection of O_6-O_7 and the top side. From points 21 and 22 lines at 45° are constructed to coincide with GH at point 23, through 23 a vertical line 24-25 can be constructed as the central axis of the central joggled stone. About this axis the square 26-27-28-29 can be drawn in the lower half of the joggled area, at the centre of the square is O_8 . At point 24 and with a radius equal to O_8-27 cut the top side at points 30 and 31 and then join them to point 25, also join 24 to points 26 and 29. These last constructions provide the lower and upper cut sides of the central joggled stone.

From the points 30 and 31 with a radius equal to 26-27 cut the top line at

32 and 33 respectively. From point 34 (at the bottom left hand corner of the overall area enclosed by the vertical and lower horizontal linked mouldings) with a radius equal to 27-29 cut the base line at 35. Join 35 to 31 so that the line cuts GH and point 36, by joining 36 to 33 the lower and upper cut sides of the joggled stone left of centre are found. From point 26 with a radius equal to 29-35 cut the base line at 38, join this last point to 22 and where it intersects with GH join the point of intersection to 32 to provide the lower and upper cut sides of the joggled stone to the right of centre.

The white stone at the centre of the trifoliated terminal is also related to the above geometric constructions, it is based on the line joining the 'lower' centres of the trifoliations.

Figure 18 shows the basic proportions of $1/2$, 1 , $\sqrt{2}$ which occur if one unit equals half of the joggled areas height.

Construction Text Within the Portal's Recess (Drawing 54)

This inscription is given by van Berchem as No. 106¹¹, and with its attractive thuluth characters and the double fleury corner pieces it is totally within the calligraphic fashion current in Cairo at the time, as is the exuberant joggled ablaq fleury terminals at the beginning and at the end of the inscription.

5.04.2 Miscellaneous Details of the Portal. (Drawing 55)

A rectilinear muqarnas bracket is tucked under the monolithic lintel at the top of the door opening's jambs. This is very much a common element in the design of rectangular door openings, often they incorporate vegetal decoration, e.g., in the door opening to [324] the Sabīl-Kuttāb of Qāyrbāy 884/1479. (Pl. XXXIII). Curving into the top part of the profile of the muqarnas is the monolithic lintel's quarter round concave moulding terminating/

terminating in a half-palmette. This same moulding is taken around the pair of panels flanking the lintel, the panels are extremely detailed so much so that there is not sufficient background to support and define the positive and negative balance required by the arabesque systems; my opinion is that these are the only decorative items belonging to al-Ashrafiyya that fall below the quality standards I expect of Qāyṭbāy's craftsmen, even the drawing, 'Vegetal forms in outline' is difficult to follow and appreciate.

Flanking the joggled relieving lintel are a pair of geometrically decorated panels. There are two repeat units combining to form this design, both involve circles of identical radii but repeat unit A describes its circle with an external hexagon. At the nucleus of repeat unit B is a vegetal element whose logic is difficult to decipher, although as it is so very small its purpose must have been to identify the nucleus of B in contrast to that of A. In 'the Description of Today's al-Ashrafiyya' I wrote that this panel was painted black and I also mentioned that in some of the interstices were raised circular areas, these areas I always considered to be aberrations on the part of the carver and not until I had found a similar detail in the portal of 324 the Sabīl-Kuttāb of Qāyṭbāy did I revise my thinking and accept the raised areas as part of the original idea. (Plate XXXV). The panel in the Sabīl-Kuttāb is additionally interesting since it incorporates two repeat units and one of them is repeat unit B, reorientated so that the spear head centred on the vertical axis is transferred from the bottom in al-Ashrafiyya's case to the top in the Sabīl-Kuttāb, the similarity is taken further by the introduction of additional elements in the nucleus.

5.04.3 The Joggled Relieving Lintel.

The intricacy and beauty offered to the viewer by this ablaq architectural element is a delight, it is a masterpiece in the art of juggling and why black/

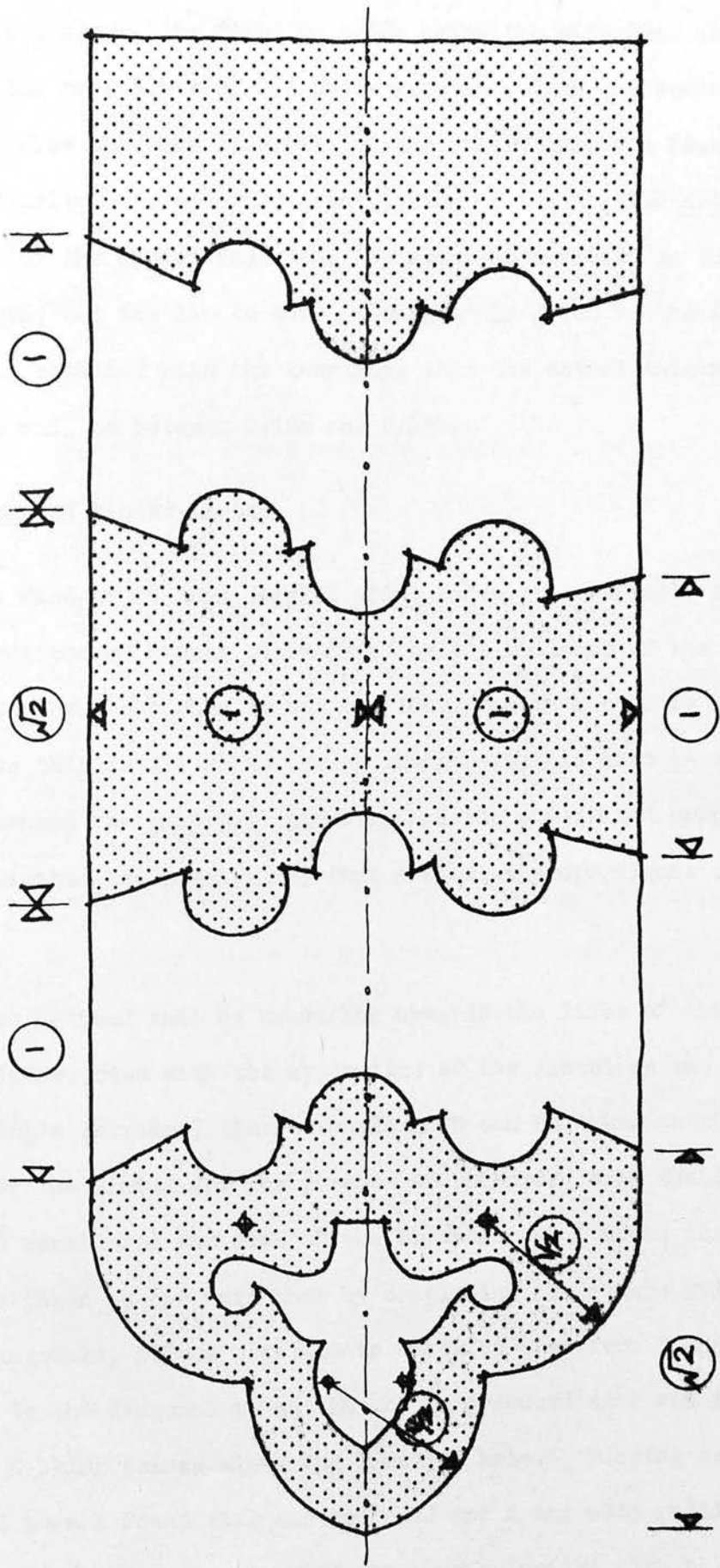


Fig. 18. The Basic Proportions of the Mastabas' Joggling.

black paint was ever required I cannot imagine. The underlying geometry has two centres, the first is 0.58m below the base line and from it are drawn the main lines of the white keystone, from the second centre, at 1.62m below the base line, all of the other lines are found. There is a similarity here with the construction of the joggled ablaq relieving lintel of the Window Wall, the key stone is narrowed to convey extra strength, but the lie to this 'strength' is given by the intricacy of the cutting combined with the knowledge that the actual thickness of the stones will be between 0.10m and 0.15m.

5.04.4 The Joggled Window Lintel.

On the face of it this joggled ablaq lintel is extremely simple consisting of three carved stones overwhelmed by the opulence of the surrounding architecture, but this is not so, there was as much care and attention paid to this detail as to any of the others; in fact it was having experienced the mastabas' geometry and the associated proportions that I investigated the possibility that a similar proportional content existed here.

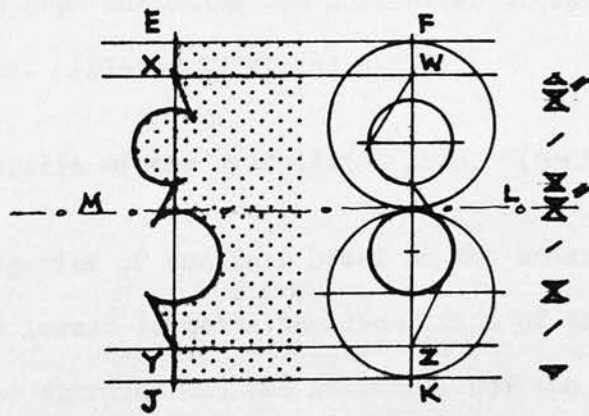
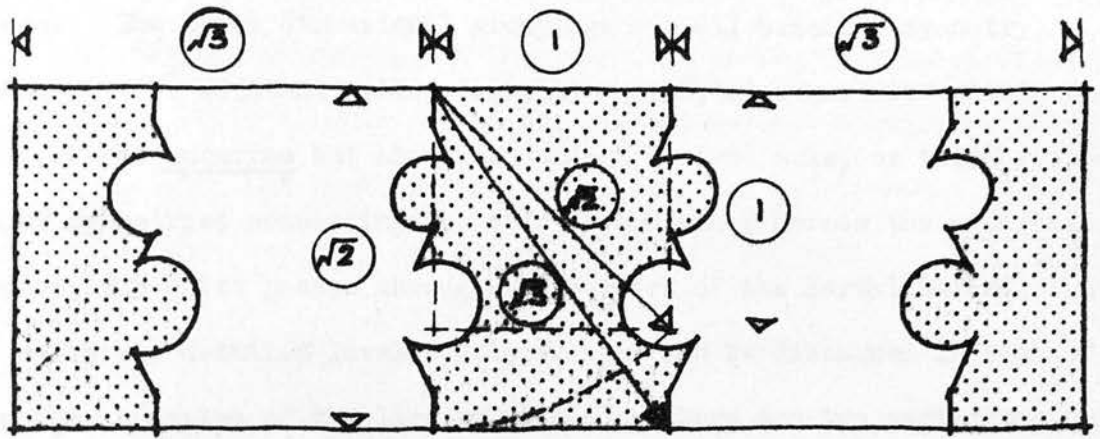
I first noticed that by producing upwards the lines of the window jambs they intersected with the upper line of the lintel on the line of the fan vaulting's intrados, the rectangle ABCD can be taken as the theoretical area of the lintel for the purpose of reconstructing the design procedures. I then considered the size of the keystone and I found that if its width EF was taken as one unit then by completing the square EFGH and drawing the diagonals, it was possible to describe arcs from E and F with radii equal to the diagonal to cut EH and FG produced at J and K respectively, J and K being points along the lintel's base. Playing around with my pencil bows I found that centred on J and K and with radii equal to the diagonal of the rectangle EFKJ the arcs coincided with points D and C, repeating/

repeating the operations centred on E and F the intersections of the four arcs were found at L and M, which are obviously on the lintel's horizontal axis. From E and J lines drawn and produced through M intersected with the bottom and top lines of the lintel at N and P. Similarly from F and K through L points Q and R were found. This completes the basic rectangles forming the keystone and the flanking white stones, the proportions which are inherent in these constructions are given in Figure 19A.

The points along the stones' sides where the joggled deviations happen can be found by first finding the points of intersection between the four arcs and lines P-N and Q-R, these are S, T, U, and V and then joining them thus, S to V and T to U. Before proceeding further I had to realise that the joggling in the upper and lower halves of the lintel differed as shown in Figure 19B, but there was one common denominator, the size of the circular joggling, and by studying the lower half it was obvious that their diameters equalled one quarter of the overall height of the lintel. Using this information the joggling of the lower half consists of a circle of the given radius tangential to LM and centred on the line EJ or FK, the joggling is completed by a line tangential to the circle drawn from Y or Z. In the upper half the given circle is centred on EJ or FZ half way between LM and WX, the joggling is completed by a line from X or W tangential to the circle, and a second line drawn from the lowest point on the circle's circumference at a tangent to the circle in the lintel's lower half.

5.04.5 The Rectilinear Muqarnas. (Drawing 57)

Decorated with conventional vegetal elements the rectilinear muqarnas within the Portal Recess exhibit more complicated three dimensional groupings than did the muqarnas in the Window Wall, in the Window Wall the depth of the muqarnas is minimal compared to those of the Portal, which being/



Voussoir 1: This geometrically decorated voussoir is generated by an inscribed double hexagon repeat unit described by a square whose sides equal the diagonal of the voussoir's decorated area on the extrados, i.e., situated at two of the voussoir's opposing corners are the nuclei of the repeat units. This solution combined with the aesthetic requirements for the fake line of a fan vault requires the design in the intrados to extend beyond the vertical axis of the nucleus of its repeat unit.

Voussoir 2: An interlaced and self-contained arabesque system decorates this voussoir, it begins on the intrados and grows outward on to the extrados.

Voussoir 3: At first glance this geometric design has few, if any, regular features which might indicate its basis. However, a clue is given by the decorated first voussoir of the sahn's side arches in [223] the Mosque at Qal^c et al-Kabsh, 880/1475. There the overall shape of the voussoir on the extrados is square (Plate XXXIX) and at its centre is an octagonal interstice with a flower of eight petals. This design generated by an inscribed double square described by a square can be used as the model for voussoir 3.

This does not provide all of the voussoir's features, especially the nucleus at the upper corner of the intrados, for those the intrados of the Cairo voussoir is helpful, (Plate XL) even though for Drawing 58 it was easier and initially more informative to use the extrados as the model. I am inclined to the idea that it was actually half of the intrados at Qal^c et al-Kabsh that inspired the total design of voussoir 3 not the extrados. The confusion arises mainly because I have taken a design consisting of a geometric network, which was obviously worked out in situ, and removed it from its three dimensional context flattening it out into a two dimensional one, in the process the disarrangement of axes/

axes along the arris is exaggerated. To a lesser extent there do exist certain confusions produced by the craftsmen twisting his model to position the nucleus at the upper corner of the intrados.

Vousoir 4: Decorated with a double growth arabesque system which is restricted to the extrados.

Vousoir 5: Composed of a ribbon overlying an arabesque system, both of the elements in this design suggest a chain or continuing development beyond the confines of the vousoir's extrados.

There are in Cairo examples of decorated vousoirs to the trifoliated arches over recessed portals, two such examples are: [75] the Wakāla of Qāyṭbāy where the vousoirs continue into the semi-dome as part of its ablaq decoration¹² (Plate XXXVI); and [225] the Mosque at Qal'at al-Kabsh in the secondary portal in the north east corner (Plate XII) where the decorated vousoirs occur only in the lower segments and they, unlike those of al-Ashrafiyya, do not continue into the intrados.

5.04.7 The Joggled and Ablaq Semi-Dome of the Trifoliated Arch. (Drawing 59)

Below the semi-dome undecorated red stone lozenges, nestling between the fan vaults, join the zeniths of the rectangular muqarnas to its curved base course, in which are curvilinear muqarnas cells placed in threes and incorporating a shell decoration. In the main design of the semi-dome white and red are the predominant colours; the white stones display carved vegetal elements inlaid with black glass paste contrasting with the unrelieved red surfaces, except at certain focal points which are picked out in an aquamarine coloured glass paste.

Once more parallels can be drawn between al-Ashrafiyya's decoration and contemporary Cairo, there are, in fact, two identical examples of this joggled ablaq semi-dome; [324] the Sabīl-Kuttāb of Qāyṭbāy, 884/1479, (Plate/

(Plate XXXIII) and 49 the Mosque of Abū Bakr Muzhir, 884/1479-80, (Plate XLII). Note that the base courses in each case differ but that each one incorporates muqarnas cells.

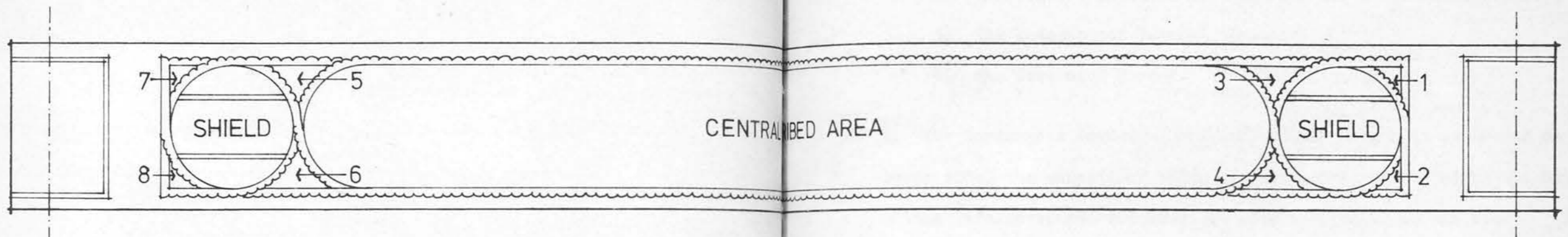
5.04.7 The Brass Revetments from the Timber Doors (Drawings 60 and 61 and Figure 19)

A pair of brass revetments¹³ were deposited c.1920 in the Islamic Museum in al-Haram. They can be assigned to al-Ashrafiyya on three accounts. First, their texts include the name and titles of Qāyṭbāy; secondly, van Berchem states that there were revetments in this door inscribed with a text from the Qur'an, Q.9/18,¹⁴ and the third reason is that they fit the door opening's width.

Each half is approximately 1.25m long by 0.16m-0.17m high, their combined decorated areas are 1.86m long. The central inscribed area has the name and titles of Qāyṭbāy in thuluth script interlaced with Q.9/18 in Kufī, the purpose of this combination is that while magnifying the earthly Lord it is set against the background of this specific text.¹⁵ At either end are shields repeating the name and titles of Qāyṭbāy, and they are joined to the central area by an interlaced and cusped border. Outside of these inscribed areas and separated by blank spaces are rectangular panels inscribed with vegetal elements.

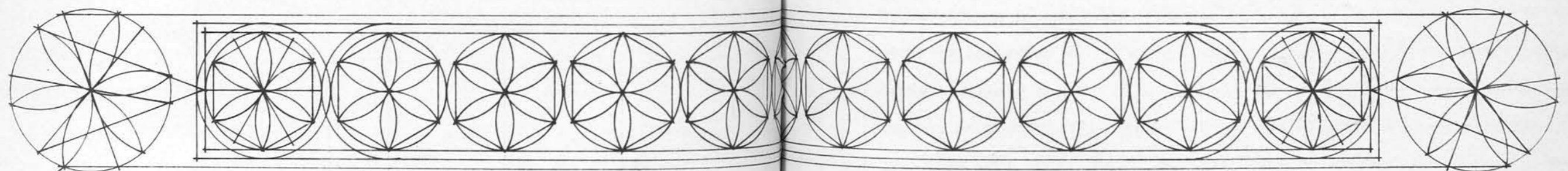
Rather than trying to isolate precisely the order and extent of the revetment's Appreciation Levels which would require possibly a detailed analysis to be continually moving from one area of interest to another and back again, I will consider the various design fields, overlaid one on another, in the following order: the Central Inscribed Area; the Shields, the Spandrels; the Decorated Rectangles. Finally the Geometry underlying the revetments will be discussed.

The Central Inscribed Area: There are six separate design fields which are brought together to form this the main feature, and their order shall follow/

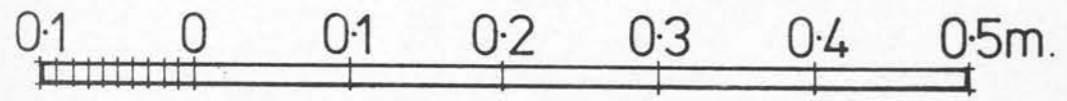


DECORATED AREAS

CENTRAL BED AREA



BASIC GEOMETRY



MADRASA OF THE MALIK ASHRAF QĀYTBĀY, JERUSALEM
BRASS REVETMENTS FROM THE TIMBER DOORS.

Fig.19.

follow what I see to be the ordered procedures adopted by the craftsman.

1. The Continuous Border.
2. The Names and Titles of the Sultan.
3. The Text from the Qur'an.
4. The Vegetal Elements issuing from the Diacritical marks.
5. The Independant Vegetal Elements.
6. The Decorated Ground.

1. The Continuous Border. For most of its length it is cusped on its outer side, the exceptions being an unfinished section along the bottom of the left revetment and where it runs vertically at the sides. The interlacing sequence follows the generally accepted rule of, over, under, over, etc.

2. The Names and Titles of the Sultan. This inscription takes the form of an arcade linked along the top by a geometric repeat unit which is repeated nine times in each half: the composition in the right revetment begins and ends with half of the repeat unit, while the left one has nine complete units. Thus the continuity of the repeat units' pattern is broken at the junction of the two revetments.

Where adjacent repeat units meet the interstice is filled by knots formed by extentions of the repeat units.¹⁶ At the extreme right hand side and over the beginning of the inscription is the first of these interstices, it is too small to support a full knot due to the curve of the continuous border, so a simple loop is employed. In the next interstice to be decorated by a knot, there is a bifurcating loose knot with a twist; this I assume was, on completion, found to be unsatisfactory in the eyes of the craftsman, because he does not repeat it but replaces it with heart-shaped loose knots with a twist. The reason it was unsatisfactory was that it either filled-in too much of the interstice so reducing the critical balance/

balance of positive to negative space necessary to the design's clarity, or, that it was considered that a bifurcating knot was over elaborate for the purpose. The latter explanation is weakened by the consistent use elsewhere on the revetments of bifurcating lines. I do, however, conclude that the suitable knot type was found by trial and error on the revetments not on a preliminary drawing to full size.

A total of thirty-six arcades form the letters of the name and titles. Each of the vertical members is composed of two lines emanating from two repeat units separated by a third. In the first arcade the right hand vertical member has only one line, not two, and it bifurcates to terminate in a pair of half-palmettes, thus the inscription properly begins with the arcades second vertical member. The thirty-sixth arcade ends abruptly against the last letter of the kūfī inscription.

3. The Text from the Qur'an. The kūfī script is centred on the horizontal axis of the revetments and it is interlaced with the arcaded thuluth, but not in the strictest sense are they interlaced as some of the letters cross a pair of arcaded letters instead of crossing in front of one and disappearing behind the other. There is in both of the inscriptions ample evidence to support that they were drawn out completely before being cut.

4. The Vegetal Elements issuing from the Diacritical marks. All of the vegetal elements in this category tend towards an arabesque outline, I think their function was to bring the design into balance by increasing the ratio of positive to negative space.

5. The Independant Vegetal Elements. The design function seems to have been the same as the vegetal elements issuing from the diacritical marks, but the independant elements float freely in the composition and relating to the spatial rhythms of the arcades. Examples are the droplets centred/

centred in the trifoliated interstices at the arcading's apexes, and in the adjacent interstices the 'fish tails' which occasionally orientate themselves towards the repeat units' centres and on other occasions, especially in the left revetment, point in the opposite direction.

6. The Decorated Ground. The ground is composed of hundreds of foliated vegetal elements formed by simply making small incisions in the metal's surface, the positive surfaces that remain are the vegetal elements.

The Shields: Within the shields there are five design fields.

1. The Continuous Border.
2. The Names and Titles of the Sultan.
3. The Vegetal Elements issuing from the spandrels.
4. The Independant Vegetal Elements.
5. The Decorated Ground.

1. The Continuous Border. This is the cusped border which is also common to the central Inscribed area.¹⁹

2. The Names and Titles of the Sultan. Qāytbāy's names and titles given in the shields are the same as those in the three shields of the Window Wall, and they appear in the same order. Also included at this level in the design hierarchy are the two horizontal lines dividing the shield into three.

3. The Vegetal Elements issuing from the Spandrels. These are the equivalent of the vegetal forms issuing from the diacritical marks of the central inscribed area if it is accepted that their common feature is that they have definite origins. There are no diacritical marks producing vegetal elements inside the shields, but the arabesque systems in the spandrels 3, 4, 5 and 6, with special reference to the last two, pass behind/

behind the continuous border into the upper and lower sections of the two shields.

4. The Independant Vegetal Elements. Independant vegetal forms are to be found dispersed across the shields, they could be mistaken for, or be combined with the elements issuing from the spandrels.

5. The Decorated Ground. The decorated ground is exactly like that of the central inscribed area.

The Spandrels: In the spandrels 1, 2, 7 and 8 the major element is the same, a self-contained arabesque system composed of a central palmette and bifurcating leaves. In the double spandrels 3, 4, 5, and 6 reside the vegetal elements which cross over into the shield's upper and lower sections, they are interlaced and self-contained arabesque systems with central collars and stalks which suggest a bifurcating loose knot without the twist. The ground decoration of the spandrels copies the other areas.

The Decorated Rectangles: There is a feeling that the two rectangular panels at the extremities of the revetments are based on a strongly defined geometry, and as such they contrast with the non-geometrically orientated vegetal elements found elsewhere. At first I thought that there were two superimposed arabesque systems but by tracing the elaborate paths of the stalks it is found that it is an interlaced and self-contained arabesque system.

The Underlying Geometry: Drawing 61 details conclusively how the calligraphic compositions are controlled by a simple but forceful geometry. The basic or generating unit must have been the inscribed hexagon of the shields, especially if I am correct in matching it with the shields on Qāyṭbāy's candlesticks made in the same year and presented to Medina.
This/

This same hexagon was then repeated nine times to create the central field and its necessary arcading centred on the junction of the revetments. How the width of the continuous border was arrived at I do not know, but it also features on the shields of the candlesticks. Nor, do I know how the height of the revetments was determined, was it the circumference of the repeat units which is tangential to chords in the inscribed hexagon and the revetment's top edge? Or, was the height determined by the rectangular side panels' geometry, generated by two inscribed hexagons juxtaposed in such a manner that the angles subtended by their axes are $20^{\circ}/40^{\circ}$ not the $30^{\circ}/30^{\circ}$ of the conventional double hexagon. The construction of the latter's internal geometry is related to the vegetal elements decorating the panels, and by projection it can be connected to the original inscribed hexagon of the shield to fix the width of the blank areas.

05 The Decorated Centre of the Vault in the Vestibule. (Drawing 62)

The beauties of this octagonal vault centre and its associated flat-carved lozenges have laid hidden under burnt black layers deposited by smoke from oil lamps suspended from the central point of the octagon. The vault centre's decoration is composed of a ribbon development, seemingly, superimposed on the vegetal elements. These two elements, the ribbon and the vegetal, I think, can best be appreciated if the octagon's close geometric relationship to a double square is remembered since the main axes of the two superimposed elements follow the main axes of superimposed or double square. The vegetal elements continue the principles of the double square to the fullest extent; if a series of self-generating double squares are drawn within the decorated octagon the intersections and angles of the geometry coincide with the salient points of the vegetal elements. In this specific instance the reliance on the double square is visually expressed by there being four, and only four, of each of the major/

major arabesque elements.

An explanation is required for the above qualification of superimposition by 'seemingly'. If reference is made to the central area of the drawing 'Vegetal forms in outline' it is seen that the arabesque's stalks end abruptly, these terminations are points of murgence with, or if preferred, points of absorption by the ribbon development. So the design offers a choice, either the ribbons and vegetal elements are separated from one another or they are linked together, with the ribbon development being 'complete' in its own right, it contributes more to the 'marriage' than the vegetal, by providing the linkages and the clear framework through which the arabesques can be admired.

At about the same time in Cairo, [129] the Mosque of Gānem al-Bahlawān, 883-916/1478-1510, was under construction and it included in its vestibule an ablaq vault with a decorated octagonal vault centre, but without associated lozenges. (Plate XLV). The size of the octagon approximates al-Ashrafiyya's, and it also provides an interplay between ribbon developments and vegetal elements, but the roles in this case are reversed. First, all of the arabesques point inwards, and some having grown out of the angles of the octagon, secondly, the most effective reversal occurs in the ribbon development where it subdivides into four independent trilobate units which rely on the vegetal elements to link them to each other. The ribbon development in al-Ashrafiyya's vault centre could be made to resemble the trilobate units if its inner points were pinched together.²⁰

In the rear wall of the Mosque of Gānem al-Bahlawān's recessed portal exists another ribbon development superimposed on vegetal elements, (Plate XLVII) and although there are major differences between it and al-Ashrafiyya's vault centre such as its square shape, there is considerable common ground if it is sought. What is immediately noticeable is that
the/

the square panel's decoration is composed and directed by a double square or a series of double squares and also the direction of emphasis is outwards. An earlier example in the same decorative vein is sited above the side door of [75] the Wekālat of Qāyrbāy, 882/1477, (Plates XLVII and LIV and Drawing 114²¹) here the composition based on an inscribed double square is more easily realised. Observe that below this panel and to the left of the door opening's lintel is a decorative area which includes a trilobate ribbon unit.

5.06 The Decorated Centre of the Vaults over Landings 0 and 4. (Drawing 63)

Generally one of the relationships provided by a newel wall stair is that 'Landing 0' is directly below Landing 4, however this cannot be the case in al-Ashrafiyya as its planning arrangements make it impossible. But, I was intrigued to discover that far from dismissing this preconceived relationship as a misconception, the decoration in the vault centres actually encourages the deception by sharing identical geometry.

When I first attempted to reconstruct the geometry I was only concerned with what lay within the decorated octagonal area as I was expecting it to produce the complete repeat unit. Any 'solution' on this basis was a failure, because, in order that I could match all of the actual geometric lines to my geometrical constructions any logical sequence had at some point to be broken to allow for some new and alien implant.

A final solution satisfying the logic of the actual geometry was only found after I had extended the Generating Unit of the Madrasa down to the Ground Floor's entrance areas, and to the plan size of the Grand Staircase's landings. I had long ago realised that the octagonal centre was smaller than the octagon formed by joining the square's corners to the mid-points of the opposite sides, but looking again at the question with a more experienced eye it seemed probable that the larger octagonal figure/

figure might provide the vault centre's repeat unit. Working on this assumption I experimented again with different geometric constructions until eventually one construction satisfied all of the requirements of a repeat unit, the most important requirement being that it should be easily reproducible. In addition, my constructions once they had reached the 'Preferred Line' stage suggested that by inscribing the octagon with a circle the difference between the circumference and the mid-points of the octagon's sides approximated the width of the actual geometric lines,²² and that the overall dimensions of the vault centre could also be found.

On two occasions in Cairo I saw this same geometry decorating the octagonal vault centres of vestibules, first in [75] the *Wekālat* of *Qāyṭbāy*, 882/1477, (Plate XLVIII), and then in [64] the *Wekālat* of *al-Ghūrī*, 909-10/1504-05 which is close by the first. Both examples are considerably larger than *al-Ashrafiyya*'s, but here was an indisputable resemblance in decorative forms common to Cairo and Jerusalem, but where due to their physical sizes any notion of the same template being used could be disregarded. In the *Wekālat* of *Qāyṭbāy* the resemblance extended to the sculpted cingfoils, which in the vault centre above Landing 4 they are seen alternating with solid cingfoils.

This great difference in the physical sizes of the vault centres, plus the fact that the impressions they give are in each case of similar 'weight', it is as though the farther away from eye level the larger they became. This led me to ponder on further relationships, relationships which I cannot yet establish as I have neither squeezed the Cairo vault centres, nor have I their plan and floor to ceiling dimensions. To obtain the last dimension for the *Wekālat* would entail digging through the compacted debris forming the present floor level. Notwithstanding this inability to prove certain relationships I feel they should at least be outlined.

The proportions controlling the plan and section of 'Landing 0' are given in Figure 20, they indicate a proportional ratio of 4:11. By measurement I established that the width of the solid geometric lines was 0.014m wide and that as the landing's width was about 1.45m there was a 1:100 ratio joining these dimensions. This in turn can provide a ratio between the line width and the height from floor level of 1:275. With this information and recognising that the exceptional calibre of the architects was firmly rooted in well tried proportions, can I postulate that the width of the geometric line (and by extension the size of any other elements), which is the essence of a decorative area's effectiveness, was controlled by an accepted formula? If there was such a formula, or rule of thumb, I consider it must be looked for, and will hopefully be discovered in the enclosed spaces within architecture, spaces where the distances between the observer and the observed are engineered by a designer. It might be that the average Mamlūk's eye height was taken as the base line for such calculations in preference to the floor level. This topic must now wait, not only for the measurements of the foregoing vaults, but on the identification of other instances where decoration is repeated in different types of enclosed space.

5.07

Decorated Centres of the Vaults over Landings 2 and 6. (Drawing 64)

Landing 2 is directly below Landing 6 and the decoration of their vault centres differ considerably, both factors which appear to be at odds with the undisguised attempts to bind together the vault centres of Landings 0 and 4.

Over Landing 2 the decorated octagonal has an interlaced ribbon development composed of eight trilobate ribbon units pointing inwards superimposed on a fringe of arabesques, also inward pointing: a total reversal of the orientation of the Vestibule's vault centre.

The/

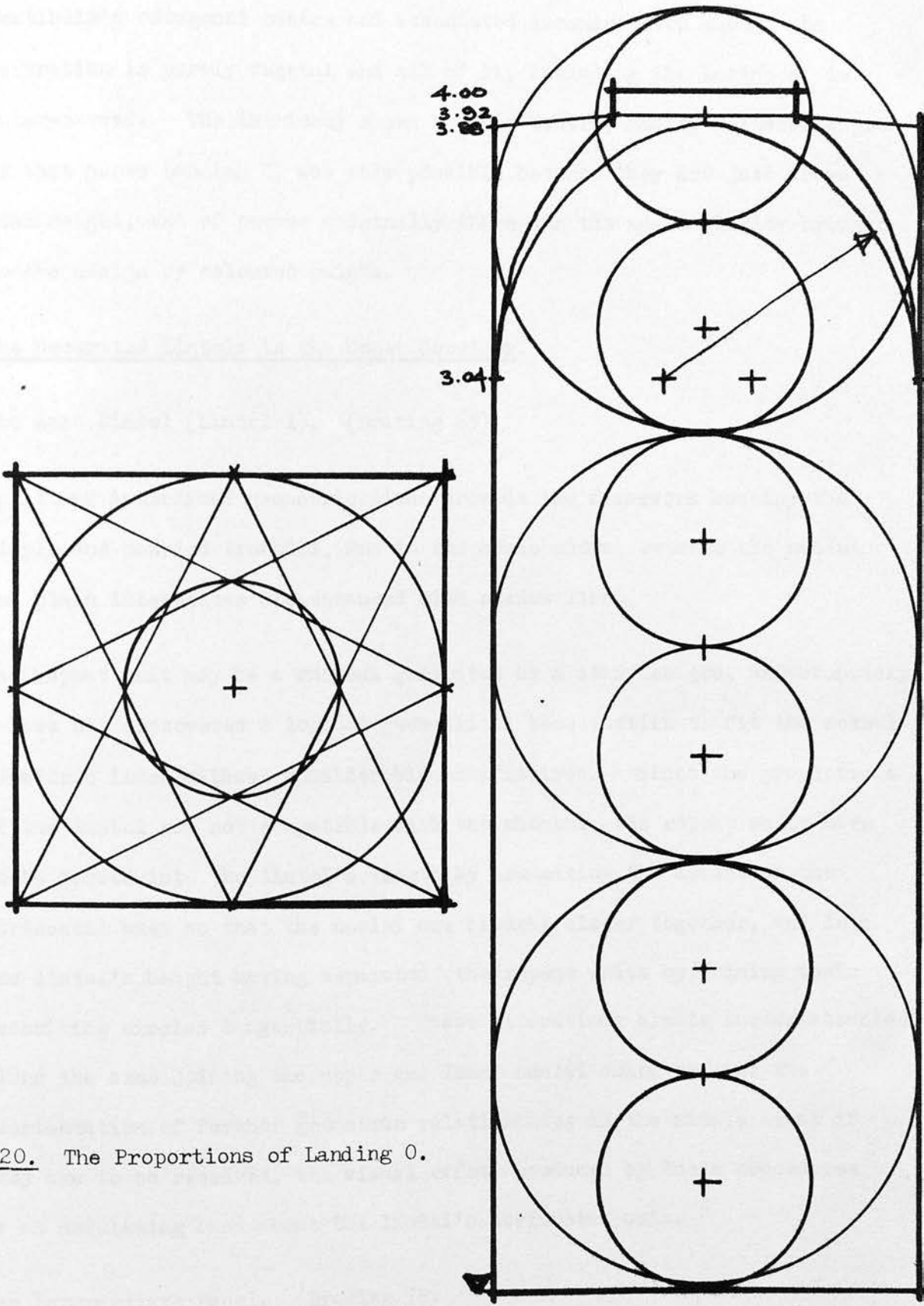


Fig.20. The Proportions of Landing 0.

The plan of the vaulting above Landing 6 is a scaled down version of the Vestibule's octagonal centre and associated lozenges even though the decoration is purely vegetal and all of it, including the lozenges, is inter-carved. The intricacy shown by this centre, and to a lesser degree by that above Landing 2, was only possible because they are just above head height, and of course originally there was the added clarity brought to the design by coloured paints.

5.08 The Decorated Lintels in the Upper Corridor.

5.08.1 The East Lintel (Lintel 1). (Drawing 65)

Split and interlaced geometric lines provide the framework housing the simple and coupled trefoils, and in the areas midway between the nuclei the plain interstices are enhanced with shadow lines.

The repeat unit may be a rhombus generated by a star decagon, unfortunately I have not discovered a logical geometrical construction to fit the actual geometric lines without considerable modification. Since the proportions of the lintel are not compatible with the rhombus, the repeat units have to be forced into the lintel's length by truncating the apexes on the horizontal axes so that the nuclei are brought closer together, and into the lintel's height having separated the repeat units by joining their describing circles tangentially. These alterations create inconsistencies along the axes joining the upper and lower nuclei which require the reorientation of further geometric relationships in the middle areas if they are to be resolved, the visual effect produced by these procedures is an undulating band about the lintel's horizontal axis.

5.08.2 The Intermediate Panel. (Drawing 72)

A pair of trilobate ribbon units, placed one upon the other, form the frame supporting a self-contained, but not interlaced, arabesque system that/

that lies behind the ribbons except where it passes the upper triblobate with a half-overlap.

5.08.3 The West Lintel (Lintel 2). (Drawing 66)

This composite lintel is decorated by split and interlaced geometric lines forming the interstices enclosing simple and coupled trefoils, sculpted six petalled flowers and in the remaining interstices shadow lines. The repeat unit is generated by a double hexagon.

5.09 The Doors in the Courtyard. (Drawing 67)

Any elaboration of the designs of the door openings in the Courtyard's southern areas has been kept to a minimum. The arched door in the west wall, paired with another in the east wall, has an unadorned looped archivolt enclosing simply joggled ablaq voussoirs. The arched east and west doors in the south wall have no decoration, unless it is considered that the emphasis given to the tall keystone is decorative. The central door's decoration is nearly as restrained as the decoration of the previous doors, a moulded frame beginning and ending as brackets within the opening's jambs, surrounds a monolithic lintel and a flattened joggled relieving arch.

5.10 The Triple Window Recess. (Drawing 67)

The elevation as it appears in the drawing has been restored up to the existing wallhead height following the evidence contained in Creswell's photographs, (Plates VII and VIII). Before embarking on the major decorative elements I must not bypass the uncomplicated joggled cill course, because the logic which I see in the design is developed further in Cairo to the extent that it can show that the 15th century designer recognised differences in the types of vegetal elements available to him.

5.10.1/

5.10.1 The Joggled Ablaq Cill Course.

I propose that, contrary to any assumption that this is an insignificant detail, the designer has brought to it the skill and understanding he had applied to the more ornate decorative items in al-Ashrafiyya. There is to my mind a pattern to be seen in the direction of the joggled nosings in the Triple and Single Window Recesses, a pattern hidden by the varying dimensions of the cill's stones and their positions relative to the window openings. It can be demonstrated if the letters N and S are used to indicate the directions of the nosings and zero to indicate the reveals of the Recesses, in doing so the following emerges:

The Single Window Recess

The Triple Window Recess

(0-N-N-N-S-S-S-0)

(0-N-N-N-S-S-S-N-S-N-N-N-S-S-S-N-S-N-N-N-S-S-S-0)

It could be thought that, either the above patterns have no logic to them, or that they were based on the widths of the recesses divided by the number of stones the designer had a liking to use. Neither possibility is correct. If the second had been the case the stones would all have been equally long; in fact the shortest is 0.25m and the longest is 0.40m with the majority being either 0.30m or 0.32m long. I interpret this as a conscious piece of 'arithmetic' detailing done to satisfy a design requirement. Consider first the Single Window Recess. Its sequence is $(3N+3S)$. This becomes the key to the pattern and logic of the Triple Window Recess because by applying it the sequence $(3N+3S)-N-S-(3N+3S)-N-S-(3N+3S)$ is found, with $(N-S)$ equated to the intermediate wall sections.

In Cairo the cill courses are generally taller, and in those which are ablaq there is a consequent increase in the joggling's complexities, but of greater visual interest are the joggled non-ablaq cill courses, where the individuality of the stones is expressed through recognisable patterns or groupings constructed from different types of decoration. Two prominent examples belong to 324 the Sabīl-Kuttāb of Qāyṭbāy, 884/1479, and/

and [114] the Mosque of Qaḡmās al-Ishāqī, 885-86/1480-81. (Plate XLIX).

The interest is not that the designer should choose to decorate the cill course, it is that in doing so he juxtaposed vegetal elements which he must have considered to have been as different from each other in their own way, as the more obvious contrasts dividing the red and white stones in ablaq courses. If he did not recognise them as being fundamentally different, then the kind of tension inherent in the design of ablaq courses would have been removed to the detriment of the visual images presented by the non-ablaq multi-decorated coursing. I accept that the idea of tension is very much a matter of personal interpretation, but in the architecture of the time elements with differing characteristics are continually being placed in some kind of relationship to each other. Therefore, I am convinced that the vegetal forms flanking the geometrically decorated stone were seen as being as different from the more realistic or natural vegetal forms as they were from the geometry. Sometimes it can be difficult to positively identify a design's content as belonging to one or the other vegetal form, especially when it is seen in isolation, but in spite of this I generally regard the more abstract forms as arabesques and the naturalistic as chinoiserie.

A similar juxtaposition is to be seen in the decorated crestings along the wallhead of [129] the Mosque of Gānem al-Bahlawān, 883-916/1478-1510. (Plate L). Here the geometric decoration of the last example is exchanged for a ribbon development's overlying arabesque systems, and the chinoiserie is interlaced with a subordinate arabesque systems. So far in my experience chinoiserie compositions never appear alongside a ribbon development, this I assume to have been a rule accepted by the designers, although I do not know the explanation, but I doubt whether it resulted from problems of visual clarity, as similar problems could easily have arisen in combined ribbon and arabesque systems. I can only wonder whether/

whether the reason can be traced to differences in the historical development of the two vegetal forms, and at the same time hope that further analysis of works of art in Islamic Egypt may lead to a deeper understanding of the elements with regard to this question.

5.10.2 The South Lintel (Lintel 3). (Drawing 68)

The solid and interlaced geometry of this lintel defines the interstices which are filled by simple and coupled trefoils, cinquefoils and shadow lines in some of the interstices of the middle areas.

Reluctantly I have to admit to having failed to unravel the geometric decoration's repeat unit, even though over the last few years I have returned to the problem again, and again, each time with a fresh eye which unhappily tires after four or five days of drawing-up possible solutions, only to discover new errors in the orientation or lengths of the lines when compared to the actual lines of the lintel. The part solution given in Drawing 68 is based on an inscribed double hexagon related to the height and length of the lintel, this is then described by a larger double hexagon. The solution falls short because it cannot integrate the nonagon stars at the minor nodes into the overall repeat unit.

5.10.3 The Centre Lintel (Lintel 4). (Drawing 69)

Presumably the 1927 earthquake destroyed this lintel as it appears in the photographs of Creswell taken a few years earlier. It is fortunate that the photographs were taken as otherwise there would be no means of completing this series of lintels. On a detailed photograph²³ of the lintel I was able to calculate the size and the types of ornament necessary to make a reconstruction drawing of the lintel which would be comparable to the other drawings.

The geometry, generated by a double hexagon repeat unit, was provided by

a/

a solid and interlaced line enclosing cinquefoils, palmettes and shadow lines. Lintel 3 showed that a repeat unit based on a double hexagon is compatible with the overall proportions of the lintel, thus it is surprising to see that here the repeat unit was restricted to a central field enclosed by a vegetally decorated border of varying width.

Although I may not fully understand the designers thinking I believe that a simple answer can be traced back to the decorated shaft of the Engaged Column at the Porch. (Drawing 43). The two geometries are identical, and any variations are confined to the interstitial elements; the partial interstices along the lintel's sides are left undecorated other than shadow lines, and only palmettes are used not simple trefoils. The similarities were so obvious I first thought the same template might have been used, which would have explained the restricted central field and its border. It also lead me to consider the template's material seeing that it had to be used on the curve and the flat. I concluded that a metal template would not have been satisfactory, while leather seemed to be a suitable material since it was pliable, easily stored and transportable from one job to the next. Unfortunately my calculations do not support this idea of the same template, they suggest that the height of the lintel's central field was 0.45m compared to 0.42m for the column. If this calculation is accurate, which I believe it is, then there existed a formidable discrepancy between the actual geometries which no template could bridge.

Thus I must accept that different templates bearing identical geometries were used, and I suggest that in the mind of the designer their sizes and decorative elements were such that a visual cross referencing was intended even though one was curved.

5.10.4 The North Lintel (Lintel 5). (Drawing 70)

A/

A split and interlaced geometric line creates the interstices in which lie cingfoils, palmettes and shadow lines; the only unadorned interstices surround the nuclei. The repeat unit is a double pentagon, equivalent to the star decagon which in Lintel 1 was found to be at odds with the overall proportions, but unlike Lintel 1 here the repeat unit has not been modified to comply with the lintel's area instead the central field was designed to accommodate the pentagonal repeat units, and the resultant side panels were decorated with chinoiserie elements.

5.10.5 The Intermediate Panels. (Drawing 72)

Creswell's pre-1927 photographs (Plates VII and VIII) show four complete intermediate panels between the lintels and relieving arches of the three windows; today they are reduced to one and a half panels.

The pair between Lintels 4 and 5 were able to be studied in an enlargement of Plate VII. It established that the lower panel, of which one half still exists, was probably a combination of a double hexagon repeat unit centred at the bottom left hand corner and a double square repeat unit centred at the top right corner. (In the drawing the missing geometry has been sketched in). The upper panel may also have been the result of different repeat units combined together, with a double square at the top left and bottom right corners, and in the two remaining corners pentagonal repeat units.

The one remaining complete panel lies between, and is level with Lintels 3 and 4, and although its geometry is not regular I consider it to have been generated by a double square before it was distorted to fit the panel's rectangular proportions.

5.11 The Lintel in the Single Window Recess (Lintel 6). (Drawing 71)

Solid and interlaced geometric lines contain the complicated palmettes and other luxuriant vegetal elements, they are contracted with the shadow lines/

lines which, through their simplicity highlight the quadrilateral separators surrounding the nuclei, the wedges and the intersections of the rays, and the apexes of the rays. The repeat unit is generated by a double hexagon.

5.12

The Upper Recessed Entrance.

It is ironic that the left half of the Recess' inscription had disappeared when van Berchem visited al-Ashrafiyya in 1914 and that since then the right half has disappeared while the left has been rediscovered.²⁴

(Drawing 73). The text is a repetition of Q 9/18 which was used earlier for the kufi inscription along the central axis of the brass door revetments.²⁵

The contribution by the inscribed stones to the reconstruction of this part of al-Ashrafiyya is considerable, for from them, the size of the demolished Recess can be gauged, and by extension the vestibule and corridor joining it to the Madrasa can all be guessed at with confidence.

The combined lengths of two of the rediscovered stones establish the depth of the Recess at 0.69m, and if 0.03m are added for the projection of the external moulded frame the total depth of 0.72m is calculated, and this equals 1/10 GU. The thickness of these same stones provides the distance from the stone inscribed with bismillah at the beginning of the inscription, which is the only one still in situ, and the corner of the Recess, a distance of 0.12m. If this is added to the length of the in situ stone the total distance between the external frame and the corner is calculated to have been 0.48m, and if this is placed in the context of the survey measurements the width of the vanished Recess is reckoned to have been 2.86m. (Drawing 3)

Considering this dimension of 2.86m, and being aware of the generally accepted convention current at the time, whereby a door opening equalled half/

half of the width of the Recess it may be assumed that the door opening was 1.43m. This is only one centimetre away from being exactly 1/5 GU.

These constructions and their successors can be referred to in the 'First Floor Plan (Restored) Showing Detailed Geometry' (Drawing 19).

Before leaving the Upper Recessed Entrance I wish to remark on a detail habitually used by the architects of the time. The detail forms part of the external moulded frame and always occurs in the horizontal mouldings at the top of the mastabas. It appears as vertical cuts interrupting the continuity of the mouldings lines, just as though there was a T-junction from which a vertical moulding might rise up the outer face of the corner. At first I termed them 'redundant verticals', later revising it to 'vestigial terminal' on discovering that the detail's presence could be traced back to earlier moulded frames which, having defined the planes of the mastaba, ended in line with the corner of the recess rather than continue on to rejoin the frame's vertical moulding. As an example see those in [149] the Khānaqāh of Farag b. Barqūq, 803-13/1400-11. (Plates LI and LII).

5.13 The Madrasa

5.13.1 The Lintel over the Sahn's North West Door. (Drawing 74)

It is saddening to observe the rapid deterioration of this composite lintel's decoration under the onslaught of wind and rain. The speed of the erosion can easily be judged from Creswell's pre-1927 photograph (Plate IX); in it the lintel is viewed from a distance, and in spite of this the darts created by its geometry are clearly visible, a photograph taken from the same spot nowadays would definitely not show any detail, even close-up photographs taken under various lights cannot match the clarity of Creswell's images. It is in these circumstances that paper squeezes/

squeezes prove their worth, as from them a true record can be made, perhaps the water and the stippling action of the brushes will, like the rain, help to disfigure the decoration, but this is a small price to pay compared to the total obliteration of the design without any record of it.

Generated by a double hexagon the repeat unit's character is expressed mainly by the darts and the darts with bars, all of them enclosing shadow lines. The nodes or the centres of the repeat units are identified by the hexagonal interstices which incorporate simple trefoils.

My opinion is that the side and top borders were decorated with vegetal elements. This may be supported by Plate IX. Unfortunately the weathering has erased any indications of specific patterns which could have helped in the borders' reconstruction. I am also inclined to the idea that the lintel's soffit was decorated, because the appearance of the erosion has a uniformity reminiscent of the erosion in the borders, rather than tallying with the form of erosion that might be expected had the soffit been plain. Assuming the soffit was decorated then it was a unique feature that was not repeated in any of the Cairo structures.

5.13.2 The Curvilinear Muqarnas Brackets to the Sahn's West Arch. (Drawing 75)

The cellular construction and many of their associated decorative elements are common to both the north and south muqarnas. The decorative exceptions all belong to the lowest courses: cells N1 and S1 have dissimilar double growth arabesque systems; cell N2 has a semi-contained arabesque system competing with the chinoiserie elements of cell S2; and cell N3 has one half of a double growth arabesque system contrasting with the chinoiserie characteristics exhibited by cell S3.

The side panels to the brackets, which are in the west wall of the Sahn, also show individuality in their designs. In the northern panel a trilobate ribbon emerges from the arabesque system backing it by way of

a half-overlap; this category or type of decoration where a ribbon development is dependant on an arabesque system is not uncommon in Cairo monuments, (see Plate LIV). A self-contained and interlaced arabesque system covers the southern side panel.

5.13.3 The Lintel over the Sahn's South West Door. (Drawing 76)

Like its northern counterpart this lintel has suffered greatly from erosion, but paper squeezes were able to capture its superb decoration. Straight geometric lines are exchanged for intricate palmettes and half palmettes so skilfully and delicately carved that they were like fine lace, at the nodal points the 'threads' are drawn together to form curvilinear hexagonal stars. These stars provide the hint necessary to uncover the conventional hexagonal repeat unit underlying the exuberant ornament.

Compared with the other elaborately decorated areas of al-Ashrafiyya, this lintel has an immediate visual appeal due partly to the lace-like qualities, and partly to the surprise and relief of curvilinear geometry at the end of an abundance of straight line figures. It punctuates the line separating the Qibla Iwān from the Sahn and all of the other spaces that preceded it. I think that it was chosen because there is an exclusiveness surrounding designs based on curvilinear geometry. I can think only of three equivalent designs in stone, they occur in [49] the Mosque of Abū Bakr Muzhir, 884/1479-80, (Plate LV) and in [114] the Mosque of Qagmās al-Ishāqī, 885-86, (Plates LVI and LVII).²⁶

Setting the photographs of the two lintels side by side the first reaction is the realisation that their overall proportions differ, Muzhiriyya's being approximately 1:4 and al-Ishāqiyya's approximately 1:3, this is especially unexpected if they are first seen separately in their Cairo contexts where this distinction is less evident. Closer inspection reveals that in Muzhiriyya's example the repeat unit is generated by a double/

double hexagon (or at least there is a two-fold increase in the number of rays surrounding the nuclei if compared to al-Ashrafiyya's design), in contrast to the double pentagonal repeat unit of al-Ishāqiyya's lintel. In addition, I feel that the effectiveness of the positive and negative equilibrium in al-Ishāqiyya's lintel has been reduced by the insertion of vegetal elements in some of the middle ground's interstices.

The third design is to be seen in the side walls of the īwān opposing al-Ishāqiyya's qibla īwān, initially it looks exactly like al-Ashrafiyya's design until scrutinising it carefully, it is discovered to be generated by a double square repeat unit. This confusion is caused by two related design factors that camouflage the differences even in the face of direct comparisons. The first is that in the wall panel semi-repeat units are given without reference to a complete one, if this had been altered then the double square repeat unit could have been directly appreciated, rather than through the indirect method of recognising the panel is square, that it is compatible with the geometry, and that there is one ray and two half rays in opposite corners, observations which can be followed by the conclusion that there are eight rays to each nucleus and therefore a square is involved. The second design factor concerns the scale and the shape of the interstices controlled by the angles of the lines joining the nodes. In al-Ashrafiyya's design the lines are at 30° and are relatively near to the 45° of al-Ishāqiyya's lintel, in that, in each quadrant of the former's repeat unit there is one and one half ray compared to the one and two half rays of the latter. Introducing the two lintels from Cairo into this comparability exercise an arithmetic sequence is discernible which suggests the reasons whereby a design could be mistaken for the designs next to it in the sequence:

total/

	Total rays	rays/quadrant	angles
al-Ashrafiyya lintel	6	$1\frac{1}{2}$	30°
al-Ishāqiyya wall panel	8	$1\frac{1}{2}+\frac{1}{2}$	45°
al-Ishāqiyya lintel	10	$2+\frac{1}{2}$	$18^\circ, 64^\circ$
Muzhiriyya lintel	12	3	$15^\circ, 45^\circ, 75^\circ$

It will be seen that a design is separated from the ones next to it by either plus or minus a half ray per quadrant, this difference is masked by the complexity of the curvilinear geometry and the palmettes until sufficient time has elapsed for the mind's comparative processes to be completed. One of the hurdles the eye has to overcome is the increasing number of angles as the designs become more complicated, often when a strongly structured design is considered the eye, out of habit, reads the design along its vertical, horizontal and 45° axes, and when it follows a ray not aligned on the 45° axis this information may not be consciously processed, instead the eye balances a perceived 45° line with a complimentary ray. This at least is the way my eye traces out the designs, each time I look at them even though I know the lines are not always at 45° : as a test refer as quickly as possible to the four designs and concentrate on the directions the eye takes and then decide whether the ray was at 45° or not. Although the designs appear in separate buildings, taken as a sample of curvilinear geometry each design is representative of one of the primary repeat units; the hexagon, the double square, the double pentangle, and the double hexagon.

5.13.4 The Decorated Spandrels. (Drawings 77-85)

At this stage in the description of al-Ashrafiyya's decoration I think there is no real need to analyse the decorated spandrels of the Qibla and North iwāns individually, one's eyes should be attuned to the games played by the decorators. The spandrels should be imagined in their two groupings, and the eye allowed to roam over the arabesque systems noting the/

the geometrically influenced curves, the symmetries or the occasional breakdowns, it can make comparisons between adjacent or distanced spandrels, as well as discovering new elements like the seed pods in spandrels B and C.

If the spandrels were designed to satisfy some all-encompassing scheme I have not unravelled it. But there is at least the possibility of such a scheme, otherwise why was spandrel G wrapped around the North īwān's north west corner to link the spandrels of the west and north walls? This is a unique detail in my experience, the practice in Cairo was to separate the corner spandrels from each other using vertical compartmentation. And as the decoration of the corner spandrels A, C and D are detailed in the same mode as G in that they extend to the corners, it intrigued me to notice that vertical compartmentation was utilised in the Sabīl of Qāyṭbāy built nearby; this disunity was resolved when I inspected the Sabīl's six spandrels and found that they had all been taken down, some of the stones reworked and then replaced with compartmental additions and new stones above the arches' apexes. (Plate LVIII). Another reason for suspecting a design scheme is the effort made to focus the North īwān's spandrels around its pseudo gateway at the centre of the north wall through the introduction of trilobate ribbons dependent on the arabesque systems of spandrels J and K.

In my opinion none of the decorated spandrels seen in Cairo have the maturity, the design flexibility, and interest, they are normally smaller and on an inclined axis not a vertical one. An appropriate comparison is at least with regard to size, the decorated spandrels in the qibla wall of [99] the Mosque and Mausoleum of Qāyṭbāy, 877-79/1472-74 shown in Plate XIII.

While in Jerusalem, and prior to my studies in Cairo, I had concluded that/

that the decorated spandrels were cut in situ due to certain areas where, in spite of the erratic stone coursing, the arabesques held their lines. Confirmation that this was the accepted technique came on a visit to 49 the Mosque of Abū Bakr Muzhir, there, preparatory cuts were visible in the spandrels above the sahn's keel arches.²⁷ (Plate LIX).

5.13.5 The Shields and Arabesques Interrupting the Grand Inscription.

Centred in the grand inscriptions above the Mihrāb and above the North īwān's pseudo gateway are identical shields bearing the names and titles of Qāyṭbāy carved out of red stone. The geometry controlling the design is based on a square with sides equal to the inscription's height. I am ignorant of any other instances where Qāyṭbāy's shield is arranged within a lobate octagonal field, nor am I cognisant of it ever appearing on a stone of this shape, far less a red one. In Cairo, Qāyṭbāy's shields follow the orthodox circular pattern, also displayed in al-Ashrafiyya's Window Wall; exceptions are found in the minor arts where his shields can be cusped or lobed, e.g., the shield at either end of the brass door revetments now in the Islamic Museum in al-Ḥaram.

At the centre of the Qibla īwān's west wall the lower half of another shield of Qāyṭbāy still exists, and like the previous one it is placed within a design unknown in Cairo, it is based on a square with sides equal to the inscription's height.

Two variants of the arabesque corner medallions are to be seen at the corners of the grand inscription bands. In Cairo they are universal, and are not confined to corners, for often they are placed at the centres of an inscription as a substitute for a heraldic device. During a cursory study of their numbers, I was surprised that there were only two or three basic designs in continual use throughout the period. It might be profitable to catalogue and compare the medallions in case they throw some/

some light on the organisation of the building trades, the ateliers and the craftsmen; of course similar cataloguing should be extended to the other recurring details.

5.14 Details that are not included in al-Ashrafiyya.

Notwithstanding its present physical state, al-Ashrafiyya is one of the best collections of stone carved architectural ornament, very few of the details successfully tested in the Cairo monuments were not selected by the Christian architect and his team. However, there are two details which do not seem to have been included although eminently worthy; the first concerns joggling, and the second stucco tympana.

Joggling must rank second to the innumerable examples of ablaq masonry in late Mamlūk architecture. Normally the existence of joggled elements is readily seen and appreciated, but there is a joggled detail that more often than not is disregarded and which should be recorded if only to compensate for its own obscurity. The joggled detail is repeated in alternate stone courses up the outer vertical edges of a moulded frame surrounding a portal or window recess, the joggled stone that is in contact with the moulding in the majority of cases is a red colour, which, when combined with the red courses above and below it creates a feathered or softened outline to what is fundamentally compartmentation. (Plates LXII and LXIII). I feel the reason the detail was not selected for al-Ashrafiyya may rest in the differing strengths dividing the external ablaq stone work of Cairo from that of Jerusalem, in Cairo the colour contrasts can be imperceptible while in Jerusalem they are always striking. Therefore, if this detail had been translated into the Palestinian mode and incorporated into al-Ashrafiyya it would have entailed considerable changes in the elevational treatment; possibly expanding the already extensive ablaq work to the detriment of the intelligibility of the elevational/

elevational rhythms, in addition to the creation of a harshness in the feathered profile which was alien to Cairo sensibilities.

The second detail concerns the tympana enclosed by the arches of the Madrasa's internal window recesses which now offer a view of the composite lintels' rear, a state of affairs that would not have been contemplated by al-Ashrafiyya's architect. I propose that the stucco tympana followed the flat carved vegetal tympana of [99] the Mosque and Mausoleum of Qāyṭbāy, 877-79/1472-77 (Plate LXIV)²⁸ or the tympana incorporating the shield of Qāyṭbāy,²⁹ and that they were possibly painted with the conventional blue and white colour schemes.

In [519] the Mosque of Qāyṭbāy on Rōḍa island the window recesses along the qibla wall display a variation of this theme of stucco tympana, firstly because they are larger descending below the springing lines of the arches, and secondly the design concept is changed. Each tympanum has an enclosing border decorated with rectilinear forms, some derived from kufesque or pseudo inscriptions, at the centre is a large ellipsoidal and lobed medallion with palmette terminals top and bottom and decorated with dart producing geometries with interstitial flowers, the medallion is placed on a field decorated with luxuriantly contrived flowers and pomegranates; neither the interstitial, nor the types of vegetal element in the field can be classed as chinoiserie ornament they are too naturalistic. (Plates LXV and LXVI). As a result of their size and shape these tympana could not have been selected for al-Ashrafiyya, but the need to place them on record is essential and if it is possible their unique characteristics require to be studied for out of the four tympana, one has lost half of its decoration, another about a quarter and the two others are not entirely unscathed.

5.15

The Mihrāb in the Majam^c (Drawing 87)

The/

The evidence suggested that this formed part of the 1st Phase al-Ashrafiyya, 885/1480; a parallel has been drawn between it and the mihrab in the Madrasa of Muhammad b. Muzhir 885/1480-81, (see p. 19 above). Up the left side the mihrab projects out from the general wall plane, obviously it was intended to be seen against a plastered background. It is probable that the rectangular area contained by straight joints above the mihrab was originally a window.

The niche is decorated with alternating red and grey facets, the red strips are 0.17m wide and the grey are 0.18m wide and recessed 0.005m. Above each of the grey facets are decorated terminals recessed into the red ablaq course with a vegetal positive-negative design inlaid in black glass paste. On the outside of the faceted area and at the rear of the vacant column recesses a yellow stone facing is applied. Notice the silent links in the pseudo keystone separating the undecorated spandrels.

5.16 Some Further Considerations.

5.16.1 Were Comparisons required?

Reflecting back to the richness and the high standards set and maintained throughout this decorative cornucopia, the most persistent need has been the continual reassessment and cross referencing of the details as I made my way through al-Ashrafiyya. From some designs an understanding could be got without reference beyond their physical limits; the muqarnas fall into this category, they can exercise the eye wonderfully in the search for all of the alternatives offered by the complicated internal relationships expressed in the Three Dimensional and Subject Groups. The door's brass revetments are another example of self sufficiency, amongst the superimposed design fields lurk many visual games awaiting discovery, but the raison d'etre is the background's statement 'God is all powerful' which is seen to be at the centre and to be modifying the clearly presented statement/

statement magnifying the earthly Lord.

Contrasted with these absorbing designs are the majority of decorative areas that are appreciated at a superficial level; by taking note of their surface textures and colours, their sizes and their shapes with occasional incursions into the identity levels composed of the small, but distinguishing details I have to restrain myself from expanding al-Ashrafiyya's superficial levels to embrace their counterparts in Cairo since I have the advantage of photographs enabling direct comparisons, a facility that was not available to the citizens of Jerusalem in the 15th century, therefore I cannot gauge to what extent such comparisons were necessary before fully appreciating al-Ashrafiyya. Certainly few of the local inhabitants would have been conversant with Cairo's architectural idiom, if they had travelled they were more likely to know the nearer Mamlūk monuments of Syria. Presumably many of the religious community could recall Cairo's architecture from their student days at al-Azhar Mosque and that they were well versed in contemporary architectural philosophy. Again I am aware that my circumstances and experiences are not at all similar to those of the Mamlūks, on this occasion it is to my disadvantage, since there is no reliable method of knowing precisely how a designer intended his designs to work effectively, or what he saw as their essential components, nor is it possible to accurately predict the impression gained by the cultured sections of the community.

On a general level it is safe to assume that the passing of the centuries has not radically altered the reasons for the success and public acclaim given the major architectural works of Qāyrbāy and his chief officers of state. These are traceable to the repetitious use of architectural elements chosen from a small and well tried vocabulary, to the high quality of their design and execution, and to the clarity with which they are presented. These are characteristics common to many periods of art and architecture/

architecture wherein there exists the successful communication of an artist's idea via an artifact to an audience, and where the audience relies on their own cognition of, and familiarity with a standardised corpus. Had the vocabulary of Qāyṭbāy's craftsmen been too small the resulting combinations might have been extremely dull, and had it been infinite both the cultured and the common folk might have felt threatened by the display of some self-satisfied designer's ultra-modern arsenal of materials, textures and shapes, of which he had only a rudimentary knowledge. Fortunately neither extreme is applicable to Qāyṭbāy's architecture for its standardised vocabulary paradoxically freed the designer by defining the parameters in which he could work, experiment and increase his own understanding of the divers ways the elements could be made to co-operate and co-exist.

5.16.2 Conditional Answers

Much of my thesis concerns the combinations of ideas and practices required before eventually producing an architectural gem like al-Ashrafiyya, all of them must be conditional, none can be substantiated by textural evidence from the pen of the Christian architect or his colleagues, although a few can be accepted on circumstantial evidence, e.g., the concept of a primary geometry linked to a particular mode of measurement controlling the buildings planning and elevational relationships. Therefore it is natural that questions concerning detailing procedures arise on completing my tour of al-Ashrafiyya's decoration.

5.16.3 Positive to Negative Equilibrium.

How essential are the spaces separating the geometric lines or vegetal elements to the effectiveness of the decorated area? The answer must be that they were essential because the visual success of a design depends on its clarity which is related to the ratio of negative to positive space:
as/

as an effective demonstration of this I need only cite the comparison of the decorative areas illustrated in Plates XXVIII and XXIX. I have also conjectured that clarity is a function of the distance between the observer and the object, and that in the case of enclosed environments, where there is the opportunity for greater control by the designer, rules might have existed to help effect a successful positive to negative equilibrium. Actually in the pair of geometrically decorated vault centres which initiated the idea of control, the ratio is different for each, in the first a bold geometric statement is made, in the second the statement is mollified by the vegetal elements; it could be that these changes were possible owing to the different floor to vault heights, which brought the second geometric vault centre nearer the observer with its additional elements so maintaining clarity.

Similarly in the ostensibly free flowing arabesque systems a reasonable equilibrium has to be sustained; although I have not found any concrete evidence my guess is that, first of all the general lines of the systems were sketched in according to a predetermined geometry, this was then followed by precise drawings to provide the appropriate positive content, e.g. the spandrels in the Madrasa.

The ability to assess the success or failure in the positive to negative ratios in al-Ashrafiyya's decoration is, of necessity, subjective in the absence of any evaluation control or standard, especially as I assume that all of the completed decorative areas were satisfactory in the expert eyes of the carvers, an assumption which denies the existence of failed designs in al-Ashrafiyya. In spite of this absence of a control the repetitious nature of geometrical decoration offers greater opportunities to consider the mechanics of positive to negative ratios than to the freeflowing vegetal decorative areas.

Certain/

Certain rules regulate the detailing of geometrical interstices wherever they happen to be seen. Interstices below a certain scale (where scale is related to the perceived size) were generally left undecorated, although on a few occasions they did receive the added emphasis brought by shadow lines which in at least one instance were not carved in relief but were incised. Shadow lines come into their own with the advent of medium scale interstices, and from observing their characteristics when they are coupled with solid line and interlaced geometries I have noted that there is a constant relationship governing the distance separating the shadow line from the geometric, this distance is always equal to the spaces separating the geometrical lines at their intersections which is often equal to the width of the geometric line. Of course, medium scale interstices can be embellished with different vegetal elements, an area in the design process where I might have anticipated a complete freedom on the part of the designer to choose a vegetal element so long as it was compatible with the interstice's shape, particularly when the options are increased by a number of established elements which had the ability to harmonise with the specific shape, e.g. three elements are recognised as having an affinity with pentagonal interstices, shadow lines, trefoils and cinquefoils. Further observation convinced me that this idea of total freedom was a misconception for in every case the position of a pentagon in the overall design influenced the choice of vegetal element. When pentagons are near the geometry's nodal points there is a greater likelihood that their shape is irregular and will be successfully filled with simple trefoils or one of the derivatives, only occasionally does this combination stray into the geometry's middle areas. In direct contrast, the cinquefoil-pentagon combination is without exception to be found in the geometry's middle and outer areas. With further increases in the scale of the interstices the vegetal elements become more elaborate eventually appearing as primitive arabesque systems.

POINT CENTRES.

ON LEVEL	SUPPLEMENTARY LEVELS					
RIBBON	NUCLEUS	COMPLICATED PALMETTE	SOLID FLOWER	SCULPTED FLOWER	CHINOISERIE	REPEAT UNIT

DESIGN ELEMENTS OF DECORATED VAULT

	1st APPRECIATION LEVEL			2nd APPRECIATION LEVEL	
	POINTED CRUCIFORM	OCTAGON	LOZENGE	SOLID LINE INTERLACED	VEGETAL
PORCH VAULT CENTRE					
VESTIBULE VAULT CENTRE					
LANDING 1					
LANDING 3					
LANDING 5					
LANDING 7					

If I have drawn the correct conclusions from my observations with regard to pentagonal interstices, and if similar rules were applied to the embellishment of the other shapes, then two design methods are indicated. One is that when the basic repeat units (squares, pentagons, hexagons and their doubles) generated pentagonal interstices the designer had two options, either he could emphasise them using shadow lines, or dependant upon their positions incorporate the appropriate vegetal element. The second is more complicated, but it surely was not beyond the capabilities of the designers to consciously decide on a geometric network with pentagons or other interstices in specific positions enabling the inclusion of certain predetermined vegetal elements.³⁰

Consequent on the above, ripples of fluctuating positive to negative densities contrast with the consistent and stabilised geometrical network. These fluctuations are essential to a lucid presentation of a decorative area's internal organisation, its stresses and tensions, for without them the decoration is liable to be bland and unexciting.

5.16.4 Paint

Applications of white or blue paints on stone decoration should not be ignored, their use naturally heightens the contrasts inherent in the positive and negative design elements, which are otherwise the same colour. Evidence supporting the use of colour exists in the Porch and the succeeding decorative areas up to the last vault centre in the Grand Staircase, after this point no further evidence was discovered. I am inclined to the idea that as a result of the indisputable connections that can be drawn between al-Ashrafiyya and 223 the Mosque of Qāytbāy at Qal^c et-Kabsh where little of the internal ornament carved in stone is not painted in blue and white, that this colour scheme was adopted in Jerusalem. Indeed it would be most surprising had any evidence been provided by the Madrasa's decorated areas in view of its ruinous condition and/

and paint's inability to resist the abrasive and eroding actions of the elements. However, a similar explanation cannot be found for the pairs of lintels in the vaulted Upper Corridor which are devoid of paint, and which give the impression that this has always been so. I think the reason may have been that had they been painted, then in the mind of an observer they would automatically be separated from the decorated external lintels in the Madrasa's West Wall, which, no doubt, were never considered for painting.

5.16.5 The craftsmen and design

It would be difficult enough to reconstruct in a meaningful way the cutting techniques of the carvers if the only available evidence lay in al-Ashrafiyya' decoration, and it would be even more difficult if the same evidence had to be relied on when deducing the lines of command from designer to the detailed drawing out on the stone surfaces. Fortunately the evidence of al-Ashrafiyya can be combined with Cairo's architectural evidence in an attempt to partly resolve and understand the general craft organisations of the period. There is little relevant textural evidence to elucidate this problem, if there was I.M. Lipidus would certainly have discussed it in detail under the heading of 'The Urban Society', instead he writes:

"Considered from the point of view of political organization, economic regulation, or even corporate fraternal life, there were no guilds in Muslim cities in this period (of the later Middle Ages) in any usual sense of the term. Still, workmen must have had a more highly organized social life than our sources reveal. Apprenticeship arrangements for the perpetuation of craft skills and long training under close personal supervision of master-workers must have been necessary. Nonetheless, there is no evidence that the terms of apprenticeship were organised on a craftwide basis. Informal traditions must have created uniform employment conditions."⁵¹

More recently an article was published on the tiled street fountains of Fez which relates how the craftsmen are still trained using traditional methods, methods which I feel could easily appertain to Mamlūk Cairo.

"The/

"The first step in ... composition is the first phase of apprenticeship, which boys undertake between the ages of 8 and 10 ... He draws about seven hours a day throughout the week for at least five years ... All training in the apprenticeship, at least through on site pattern construction - permitted when a boy has worked satisfactorily for about 12 or 13 years - is by example. The apprentice learns by observation and imitation, not by verbal instruction. In terms of composition there are two data which must be incorporated by rote: the asfat (cut shapes) forms and their combinations, the models which are transmitted by observation of the master's work and the work of others."³²

The textural sources state that a committee of highly trained craftsmen were sent from Cairo to construct al-Ashrafiyya. What I do not know is from whence they actually came, the order was issued in Cairo but were the craftsmen already away from Cairo working on Qāyṭbāy's projects in Mecca or somewhere else? My hunch is that they were permanently in the employ of the Royal Dīwāns (the sultan's household and other offices of state), that their apprenticeships were supervised by the master-craftsmen of the Dīwān, and that they were transported from one site or city to the next on the orders of the sultan.

In provincial Jerusalem the effects of this are not as marked as they are in Cairo, where it is noticeable that there are two distinct classes of monument, these classes do not distinguish one building's function from another, they are purely qualitative. The first were constructed for the ruling élite and are richly decorated and positioned at focal points in the urban setting³³ even now some five hundred years later they retain their influence over the immediate vicinity and are included on the itinerary of the well prepared traveller. The second class were constructed by the notables, who unable to lay their hands on fabulous sums of money had to be content with sparse and humdrum decoration devoid of excitement or experimentation: to me they are equivalent to our own drab speculative housing schemes, and I guess that almost the same procedures accompany their construction. The notable having acquired a site would negotiate/

negotiate with a local builder to construct and decorate his foundation within specified budgets, the experienced builder, knowing the budget, could then present alternative models at standardised prices to the client for his approval.

Although considerably more field work is necessary before incontestable architectural evidence can be found to support this idea of 'off the shelf' building, in the interim I offer one example of the standardised details that resulted from this trading method. The detail is a lintel decorated with positive and negative fleurons (Plates LXVII and LXVIII) which is found in this calibre of building from 823/1420 to c.900/1494-95, further research may extend its period of use.³⁴

Even though I have convinced myself on architectural grounds that the divisions did exist, it is still hard to explain why the more elaborate designs remained the prerogative or the reserve of the élite unless there were fundamental differences separating the personnel and organisational structures of the two levels. The flamboyant and intricate geometrical and vegetal patterns are unknown in the monuments of the notables, surely the explanation does not always have to be the want of money? Could it rather be that the apprentices were wholly trained in the Royal Diwān and that they received an extensive grounding in geometrical appreciation, eventually one or two might have been selected to specialise in geometrical designs and so gradually increase the corpus of geometric decoration.³⁵ Knowing the thousands of hours I have spent trying to unravel and 'return' geometric designs to logical repeat units I shudder at the thought of the many additional hours that would be required for an embryo idea to be developed to a successful completion, however if it is seen in the context of the years of apprenticeship that are still being served by the tile workers in Fez time is insignificant. The other decorative forms while requiring tremendous skills cannot provide the designer with enigmas comparable/

comparable to geometrical ones.

At either level, when a design is successfully concluded it must somehow or other be conveyed to the craftsman, if it is geometric then a repeat unit could be the vehicle for the transference of the geometry's structural concept and procedures and this would allow it to be reproduced at whatever the required size was, if the decoration was vegetal then the instructions would generally be less complicated but still be given in a reproducible form. Once again the problem of templates arises; did they or didn't they exist? I am convinced that they did: for instance, the geometrically decorated panels flanking the top windows in the sahn of [223] the Mosque of Qāyṭbāy at Qal'at al-Kabsh (Plate XVIII) are repeated eight times, and no craftsman worth his salt is going to make a completely new start on each panel, instead he will rationalise his working mode to overcome any avoidable repetitious, and therefore wasteful actions; I submit that exactly the same on-site procedures were carried out in al-Ashrafiyya's Sahn, possibly utilising the same template. I know of a third instance of this same geometrically decorated panel, it flanks two of the decorated lintels belonging to [75] the Wekalat Qāyṭbāy, opposite al-Azhar, here it is considerably reduced in size.³⁶ (Plate LXIX). Thus there is evidence of the same geometrical design being transmitted in such a manner as to allow it to be reproduced at about the same size in different cities, and at different sizes within the same city.³⁷

5.16.6 Decorative Grammars

Before embarking on the survey of al-Ashrafiyya I had already established to my own satisfaction the existence of Interrelated and Integrated decoration, (see Appendix C) and so it may have been this and the anticipation of discovering more that attracted me to al-Ashrafiyya, in addition to a concern for its structural future. I expect I was well aware of the pitfalls that could result from an over-zealous and enthusiastic/

enthusiastic commitment to the idea of the existence of a decorative syntax when in fact it was a pure figment of my imagination.

Gradually, however, while taking paper squeezes a realisation dawned that the decorated vault centres of the Porch, Vestibule and those of the Grand Staircase fell into a pattern indicative of some decorative syntax. I also realised that it ran parallel with my concept of Appreciation Levels through which I try to record in chronological order the mental images projected by an object. Thus a syntax, embracing a number of decorative areas, will rely on the summation of the arrangement of the appreciation levels occurring in each decorative area.

The general content attributable to the various appreciation levels remains constant for most objects. The first and most basic level is shape, this is often only subconsciously assimilated by the observer, and it may be mistakenly combined with feelings related to hugeness or smallness. At the second level a conscious recognition has to be made of the class, type or category of the object's visual characteristics, this can evolve subordinate levels concerned with the recognition of established variations produced by additional elements that cannot exist on their own, e.g. ribbon developments. Any subsequent levels supplement and qualify the preceding levels.

The Decorated Vault Centres: The six decorated vault centres have each been described verbally and graphically (pp.136,166-72 and Drawings 45, 46, and 62-64). During the verbal descriptions I deliberately remarked on the details which I consider to be relevant to the decorative grammar about to be disclosed, at that time I did not involve them with, or elucidate on their positions within the grammar for two reasons.

Firstly, by keeping to the physical sequence imposed on me by al-Ashrafiyya's plan I could not have referred to some future comparison with an unknown and future element. Secondly, I considered the most propitious time to contemplate/

contemplate the vault centres was at the end of al-Ashrafiyya's decorative description enabling them to be seen as part of a total decorative scheme. There are possibilities for a variety of detailed conclusions depending on the observer's previous experiences. My own impressions might differ from another's but this does not invalidate them for eventually they can be broken down into comprehensible quantities based mainly on visual attributes which are common to the majority of observers' experiences.

A tabular statement of the design elements found in all of the vault centres is given in Figure 21, for me this expresses the decorative syntax more effectively than any verbal description could ever do. The reason is that it is graphical like the objects and therefore it can use the same symbols or 'words' in an abstracted form bypassing the need for changing into another descriptive media.

The First Appreciation Level: This is provided by the overall shapes of the decorative areas which begin and end with lozenge combinations.

The Second Appreciation Level: Requiring a conscious recognition of the type of decoration, this forms the main theme of the vault centres, 'reciprocal' decoration. Consideration can be given to a subordinate level of established variations such as the incorporation of a ribbon development.

The Supplementary Appreciation Levels: All of the subsequent levels are composed of the vegetal elements that supplement and qualify the images of the first two levels.

The Decorated Lintels: Having deciphered the reciprocal decoration of the vault centres, I felt certain that al-Ashrafiyya's decorative grammars could not end there, the obvious candidates to continue it were the decorated lintels in the Upper Corridor and in the Courtyard along the Madrasa's West Wall. (Described in detail on p. 172-79 and Drawings

65, 66 and 68-71).

I have convinced myself that a grammar does operate amongst the lintels (Figure 22) although I am forced to admit it is less easy to demonstrate than the preceding Reciprocal decoration, I may even have fallen foul of the very pitfall mentioned earlier, an enthusiastic imagination.

The First Appreciation Level: Throughout the series the rectilinear shape remains constant, modifications appear in Lintels 4 and 5 where the size of the central fields are reduced.

The Second Appreciation Level: As predicted this level establishes the decorative type and theme. Once it is clear that all of the lintels have geometrical designs, it is perhaps overlooked that some have a solid line and that others have a split line. I interpret the six lintels as forming a Reciprocal syntax alternating thus, a:a:b:b:a:b: unlike the six vault centres which go, a:b:a:b:a:b.

The Supplementary Appreciation Levels: It will be to these levels that any criticism will be focussed, for I am the first to allow that much depends on the choice of elements that appear in the tabular description.

I view the mechanics which relate the supplementary elements of one lintel to the next in the following manner. The sequence starts with Lintel 1 and its split geometrical line which houses three supplementary elements; in Lintel 2, two of the elements are retained and one is exchanged; in Lintel 3, the decorative type changes so the supplementary elements are consolidated by keeping the three elements seen in the last lintel and reintroducing as a fourth element the one dropped between Lintels 1 and 2; in Lintel 4, the two elements which have consistently appeared are discarded and replaced by two new elements (one of them appearing not within the geometry but in the borders); Lintel 5 is another point of change for the decorative type while maintaining the elements present in Lintel/

DESIGN ELEMENTS OF DECORATIVE LINTELS.

	←1st A.L.→	←2nd A.L.→		←SUPPLEMENTARY LEVELS→						
	RECTANGLE	SPLIT LINE INTERLACED	SOLID LINE INTERLACED	NUCLEATED	SIMPLE TREFOIL	COUPLED TREFOIL	PALMETTE	SCULPTED FLOWER	CHINOISERIE	REPEAT UNIT
LINTEL 1										
LINTEL 2										
LINTEL 3										
LINTEL 4										
LINTEL 5										
LINTEL 6										

A.L. = APPRECIATION LEVEL

Lintel 4; Lintel 6 is again a point of change in the main theme of decorative types, it retains two of the preceding lintels' elements and adds a new one to the series, which being more complicated than its predecessors, is indicative of an increase in scale of the geometry and a need to reconsider the positive to negative balance.

The Two Series Combined (A Processional Way?): For a time I considered the possible purpose of this decoration, as I believe that there is nothing unplanned about al-Ashrafiyya otherwise continuity could not be traced from one design aspect to another, which signifies that everything had a predetermined position within the general architectural concept. Therefore, I feel that the simple and uncomplicated explanations for the magnificence of al-Ashrafiyya as a building and its decoration like 'it delights the eye...' or 'It was an expression of the high qualities of carving ...' do not do it justice.

Attempting to unearth any possibilities of grammar the two series were combined (Figure 23) and as a consequence the complicated palmettes were seen to occur in the first vault centre and the last lintel, which meant that their geometrical networks belonged to the upper scales, unlike the remainder which were all medium scaled. After discarding the different shapes further observation revealed that the solid geometrical line and the predominant supplementary elements were common to the first vault centre and the last lintel. With this information I referred to the complete designs (Drawings 45 and 71) with the intention of trying to recreate the essential mental image of one or other of the decorative areas as if it was my first contact with it, having stored one image I then confronted the other area and compared it with what I could recall of the first. My hope is that I have not deluded myself, especially as I have 'tested' successfully the reactions of companions on visits to al-Ashrafiyya by describing the decorative areas as we processed through the entrance/

entrance areas up to the Courtyard, eventually they were asked to remember Lintel 6, and on the way out they looked again at the Porch's Vault Centre and tried to recall the lintel. I do not offer this as a controlled experiment but rather as a group experience where, because the observers were completely under my guidance, they were for the first time they were 'seeing' decoration and using criteria which I had suggested was relevant: it is analogous to a visit to a one man art exhibition where people strive to link the theme expressed by the artist in the catalogue to his artistic works, some may see it, others will not.

Returning to my thoughts on the purposes of the series when combined I tried unsuccessfully to visualise a syntactical form which could be traced through the twelve decorative areas, and which would underline this unique architectural feature, the Processional Way produced by the Madrasa's elevation to the West Riwāq's roof level. I then considered what conclusions might be drawn from six vault centres equalling six lintels pivoted at the point where the first close encounter with the Madrasa is met, a further complication was the evidence of paint in the vault centres and none in the lintels which, as I have already suggested, would automatically have separated the two series.

Unfortunately I have not found a comprehensive solution, but I am sure the two Reciprocal decorative grammars do exist and that somehow they were an expression of a 'Processional Way', and of its uniqueness as an architectural planning device in Mamlūk architecture, just as the decorated areas themselves are rare, for there are no comparable decorative series in Cairo whether judged for their variety or for their number.

As a postscript, it appears that the repeat units generating the geometric networks do not play any significant part in the decorative grammars, a fact which is the reverse of the Interrelated decoration in the Turbat Turkān/

COMBINED DESIGN ELEMENTS OF DECORATED VAULTS AND LINTELS.

	1st APPRECIATION LEVEL			2nd APPRECIATION LEVEL			SUPPLEMENTARY LEVELS									
	POINTED CRUCIFORM	OCTAGON	LOZENGE	RECTANGLE	SPLIT LINE INTERLACED	SOLID LINE INTERLACED	VEGETAL	NUCLEUS	COMPLICATED PALMETTE	SIMPLE TREFOIL	COUPLED TREFOIL	PALMETTE	SOLID FLOWER	SCULPTED FLOWER	CHINOISERIE	REPEAT UNIT
PORCH VAULT CENTRE																
VESTIBULE VAULT CENTRE																
LANDING 1																
LANDING 3																
LANDING 5																
LANDING 7																
LINTEL 1																
LINTEL 2																
LINTEL 3																
LINTEL 4																
LINTEL 5																
LINTEL 6																

Turkân Khātūn. (see Appendix C). This may be interpreted as indicating that the geometry was solely a vehicle for the presentation of chosen interstitial elements.

The stone minbar constructed in Rabi^c II 888/May 1483¹ was presented by Sultan Qāytbāy to [149] the Khānaqāh of Farag b. Barqūq 803-13/1400-11: it is the most illustrated example of the many fine pieces of mosque furniture existing in Cairo.² My study of it was partly prompted by the frequency of the illustrations and the implicit interest therein, and by the practical consideration of the time available to me in Cairo. Unlike the large constructions of Qāytbāy the minbar could be squeezed and a complete set of full size drawings prepared in a matter of months. As the study progressed my own excitement increased with the uncovering of gold leaf and coloured paints lost long ago under encrustations of mud and dust, just as I had previously discovered gold leaf and coloured paints on al-Ashrafiyya's stone decoration. It is one of the advantages of taking paper squeezes, that they force a person to be meticulous and to pay close attention to detail, this generally introduces intriguing harmonies missed in more cursory inspections.

By classifying the minbar as solely a piece of furniture is to do it an injustice, it is greater, it is architecture on a small scale. Being constructed of stone it exhibits some of the types of decoration associated with the monuments of the period, rather than the deep carving and inlays commonly found on contemporary timber minbars. I feel that the likely explanation for this divergence from the norm can be traced to the personality of Qāytbāy, 'the Prince of Builders',³ he probably considered the purpose of the minbar in the same light as his numerous restorations and additions to other notable buildings which enhanced his reputation by associating his name with those of the revered founders and no doubt attested to his own piety. Thus my conclusion is that the purpose of the presentation was twofold, firstly it was an acceptable addition to the Khānaqāh, and secondly he added his own architectural contribution,

or/

or mark, to the first and most substantial edifice in the Northern Cemetery, a cemetery reserved exclusively to the royal Mamlūks.

Supposing this to be the correct conclusion, it may provide an explanation for the minbar's decorative syntax which I see as binding it into the Khānaqāh. Minbars are usually assumed to be symmetrical about the central axis so that the sides are constructed from similar components, naturally in this, the Khānaqāh of Farag b. Barqūq the most ostentatiously symmetrical of all Mamlūk structures which is easily identified from afar by its pair of identical minarets and its pair of identical domes, it could be expected that the minbar would express its own symmetry. But on a closer inspection it is found that the Khānaqāh is not symmetrical for as well as the paired minarets and domes there are two principal entrances and two sabīl-kuttābs which destroy any theories concerning symmetry (Figs. 24-25), similarly notions about the minbar being symmetrical have also to be jettisoned with increased familiarity.

Professor Scanlon of the AUC provided me with the keys to an understanding of the Khānaqāh's planning arrangements. The two entrances were placed at the terminal points of two roads or processional ways, and although the roads forced the entrances to be at right angles to each other their asymmetry is disguised so well that the Khānaqāh's square plan is minimally disturbed by the exterior square-planned projection along the south wall. Only by circumambulation can it be realised that in one case the principal door has the sabīl-kuttāb on its left side and projecting in front of it, while the other has its sabīl-kuttāb on its right side and in the same plane.

If the Khānaqāh's theme is remembered during the detailed analysis of the minbar, I intend to show how the minbar exhibits a complicated play within a general concept of symmetry which provides a connection between it and the Khānaqāh, or in other words, the design of the minbar was conceived through/

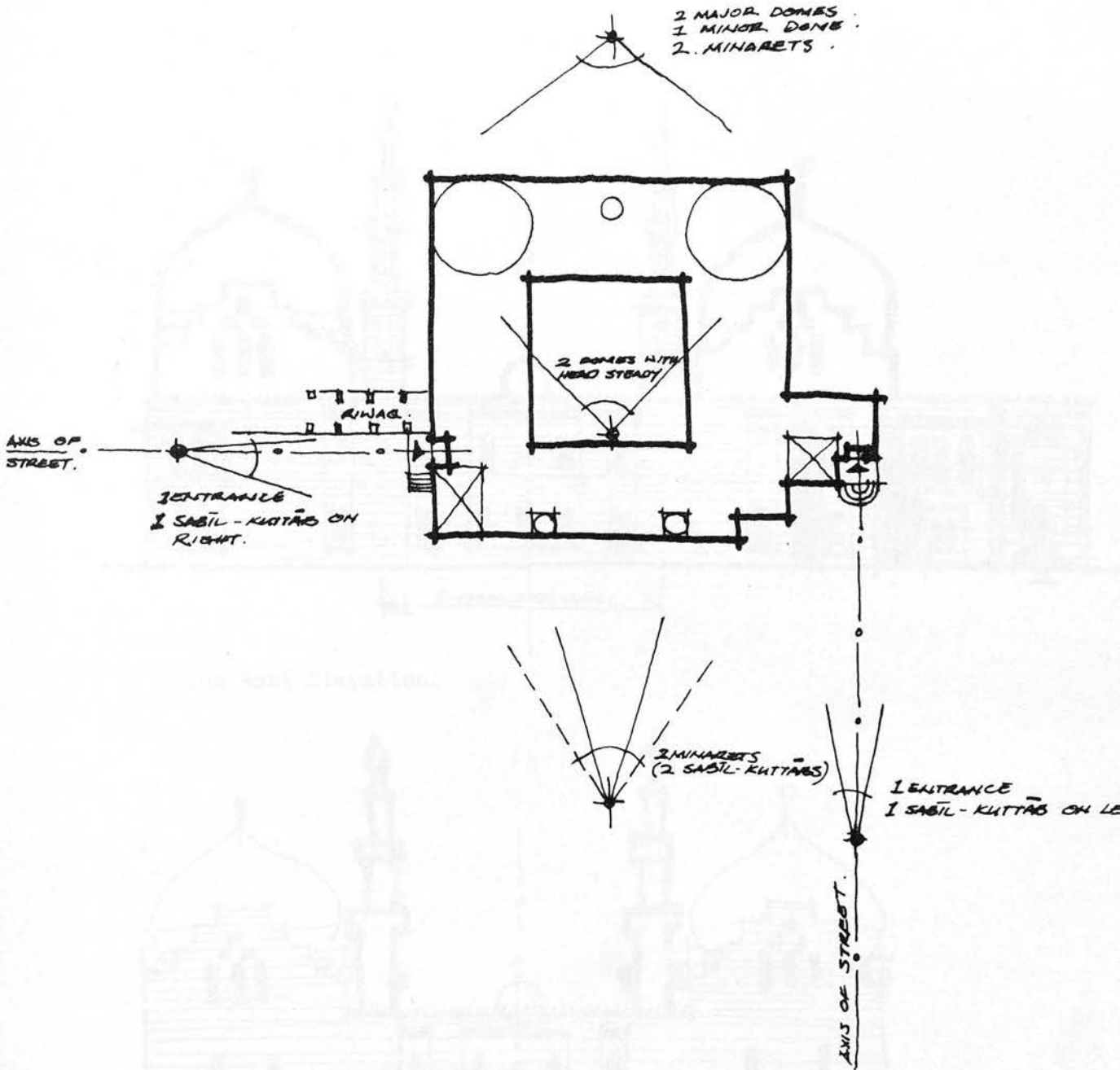
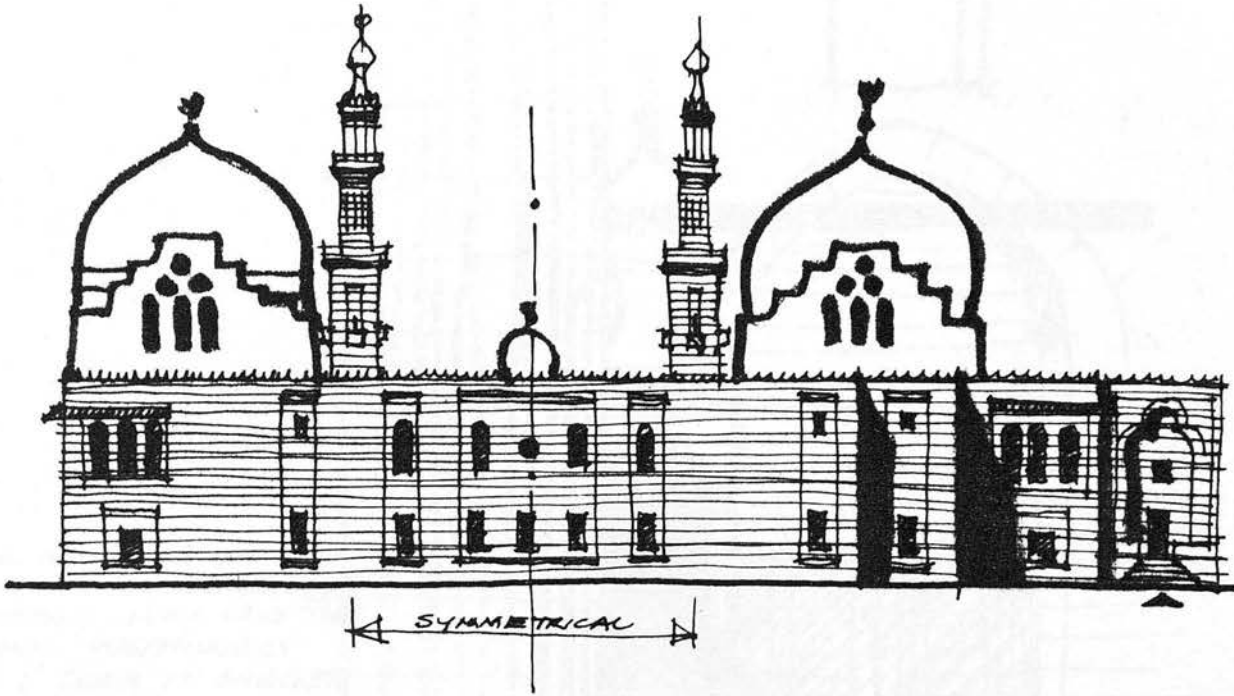
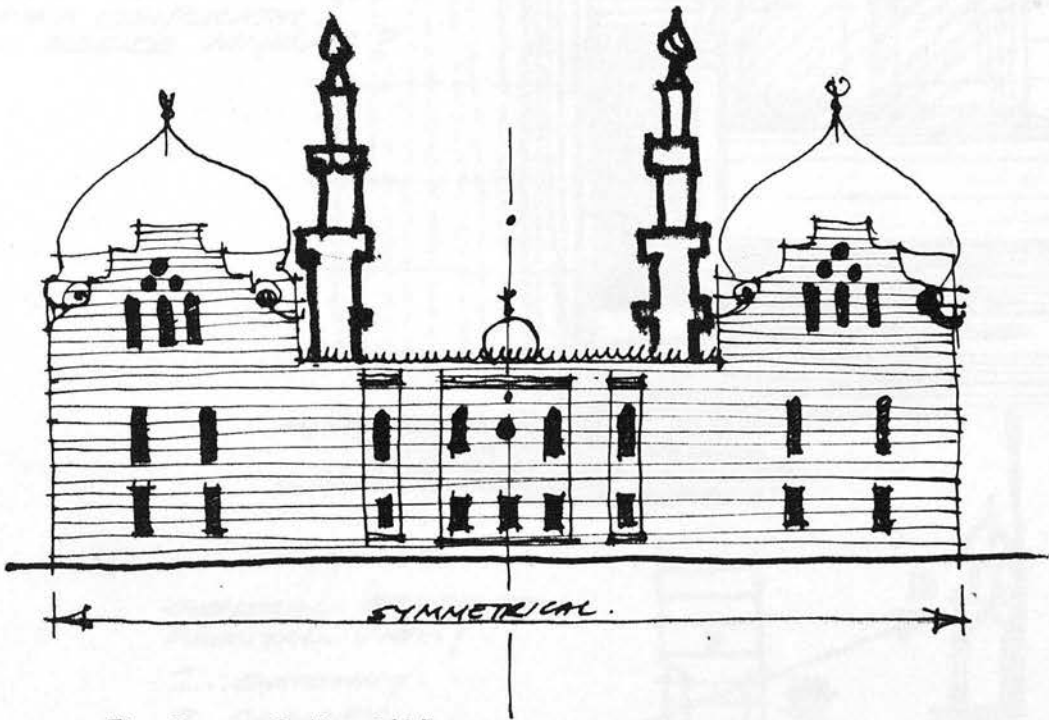


Fig.24. Khānaqāh of Farag b. Barqūq: The Planning Arrangements.



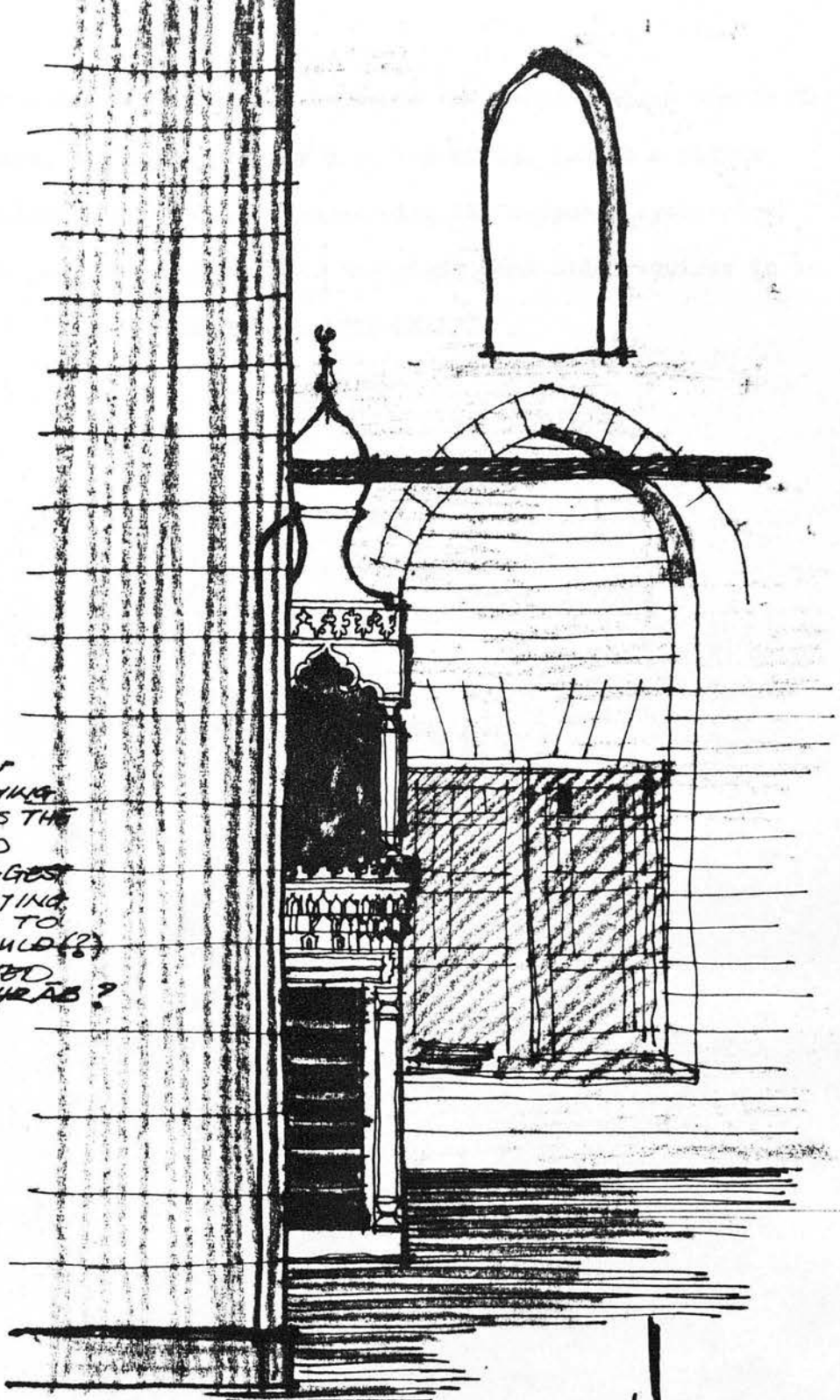
The West Elevation.



The Rear of the Qibla.

Fig.25. Khānaqāh of Farag b. Barqūq, The East and West Elevations.

PILLAR HIDES ONE HALF
 OF MINBAR SO DESTROYING
 SYMMETRY. WHY WAS THE
 MINBAR POSITIONED
 THUS? DOES IT SUGGEST
 RIGHT HALF IS STARTING
 POINT LEADING ON TO
 THE LEFT WHICH SHOULD(?)
 BE MORE COMPLICATED
 BEING BESIDE MIHRAB?



GENERAL ORDER OF
 FRONTAL VIEW?

1. GATEWAY
2. CANOPY

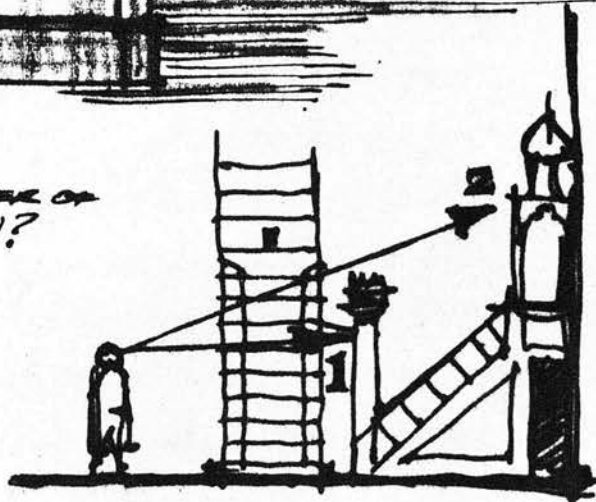


Fig.26. The Minbar's Setting.

through an appreciation of the design concepts that were used to create the Khānaqāh. In fact, the minbar's very position hidden behind a pillar should automatically raise questions concerning its supposed symmetrical nature; does its position suggest that the right hand side requires to be considered first? (Fig. 26 and Plates LXXI-LXXII).

In common with other minbars of the period the internal stair is concealed by a gateway traditionally composed of engaged columns at the outer corners, and inscribed lintel, and a crown of muqarnas and crestings; all of these stone elements can still be admired. One traditional feature that has perished or been removed is the timber doors, ample evidence that they did exist is provided by the anchorage holes for the timber door frame hidden behind the door opening's stone jambs.

Of the two inscriptions on the Gateway one can be seen from the sahn or central courtyard of the Khānaqāh, the other is on the internal face and would therefore only have been visible to someone standing on the stairs. The texts were identified by van Berchem as Q.33/56 and Q.16/92 respectively.¹ In the external inscription the colour of the letters is that of the natural stone set against a now only faint background of white paint.

With the loss of the timber doors which presumably were decorated in a way, and to a standard appropriate to the rank of Qāyrbāy, and which would, therefore, have been totally in keeping with the rest of the Minbar, it is the three courses of rectilinear muqarnas and their fleury crestings that attract greatest attention. (Plates LXXIII-LXXIV). Their attraction is due to their repetitive shapes, their varying planes, and their perceived cellular combinations which are aided by the contrasting highlights and shadows, later they are joined by the carved vegetal designs. Combine with this array the additional elements of gold leaf and coloured paints and the result must have been overwhelming when new. (To my twentieth century western eyes the result might be too garish, and I must admit to being initially seduced by the simplicity and directness of the uncoloured stone carving of the period, but presumably an abundance of certain colours was attractive to the Mamlūks.)

The/

The individual mugarnas are dominated by the overall geometric structure which controls their disposition, this structure was designed presumably within an established framework that laid down the precise rules governing all mugarnas designs, a point which is easily confirmed by comparing the mugarnas which appear on the buildings of the élite in Cairo. Thus it is likely that having successfully isolated the cells from the general mass they would then have been regrouped by the Mamlūks utilising their differing characteristics, if this was the case, then I suggest the first Appreciation Level concerned itself with the three dimensional groups and that the second was concerned with subject groupings.

7.01 Three Dimensional Groups (1st Appreciation Level).

One's first idea about Three Dimensional Groups could be that they are static and do not vary, this is totally wrong as it goes against one of the fundamental purposes of mugarnas design. Mugarnas will generally break up a solid architectural element, whether it be part of a wall or a ceiling does not matter, however in doing so it may disorientate the observer, or at least it forces him to redefine his relationship to the mugarnas. He can be faced with questions such as, 'How far are they from me?', 'What are their internal depths and the variations in their planes?', and at some stage he is going to try and order the mugarnas by regrouping them into what are recognizable systems for him at that precise moment. There are occasions where this is impossible due to the immense complexities accrued by an infinite number of variables; but this is not a problem presented by the mugarnas of the Gateway, there are only one or two permutations available, and they, as in any other mugarnas, are conditioned by lighting. In the case of the Minbar the lighting is ever changing as a result of the Earth's rotation around the Sun, on occasion the sunlight is non-directional and will not cast shadows and so at such times there may not be identifiable Three Dimensional Groups, compare Plates LXXIII and LXXIV.

Rhythms/

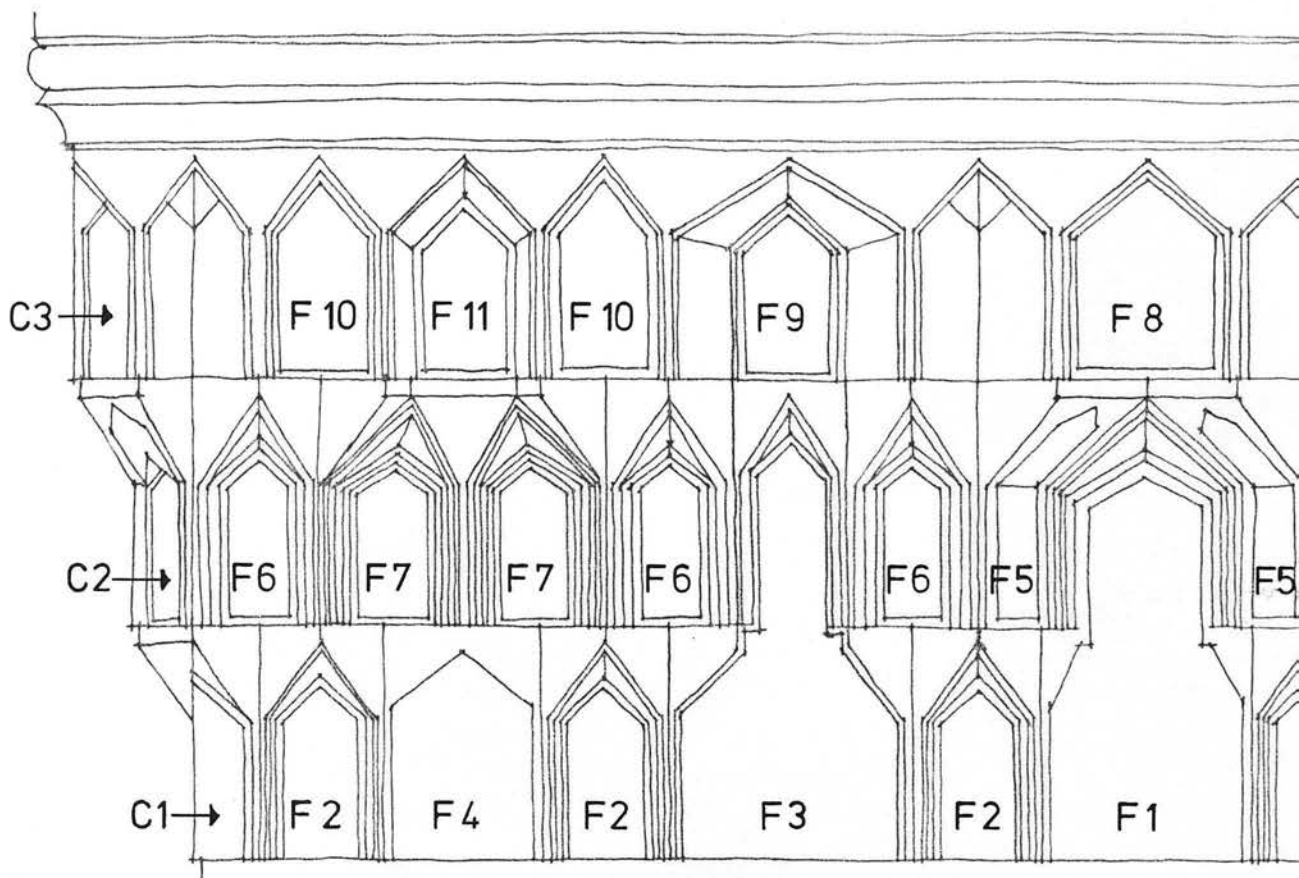
Rhythms of combined cells can be focussed on the following specific cells: F1, F3, F4 and S1, C1 may also be included. (See Fig. 27 and refer also to Fig. 26). The cells which naturally combine with F1 can be read in the following manner with the number of the stone course being given in brackets at the beginning of each sequence: (1st) F2, F1, F2/(2nd) F5, F1, F5/(3rd) F8. The combinations centred on the other cells are: on F3 --- (1st) F3/(2nd) F3/(3rd) F9; on cell F4 --- (1st) F2, F4, F2/(2nd) F7,/F7/(3rd) F11; on cell S1 --- (1st) S2, S1, S2/(2nd) S3, S3/(3rd) S5. Observe in the combination centred on F3 that it contracts at the second course and continues unchanged into the third, or there is an alternative, having contracted it expands to incorporate the splayed reveals of F9. Another alternative can be seen at S1 where the two S2 cells can be removed so that the combination becomes pinched at its base, fat at its centre and ends with a pointed head, this modification can also be applied to the F1 and F4 combinations with the consequence that they both become separated from F3.

I hesitated over the inclusion of the C1 combination in the preceding sequences, because it is nebulous, being contained on only one side by muqarnas and on the other by the depth and darkness of the qibla iwan, unless of course it is observed along an axis at 45° to the corner, but my misgivings were overcome when I saw that it was essential to the rhythms of the other Three Dimensional Groups.

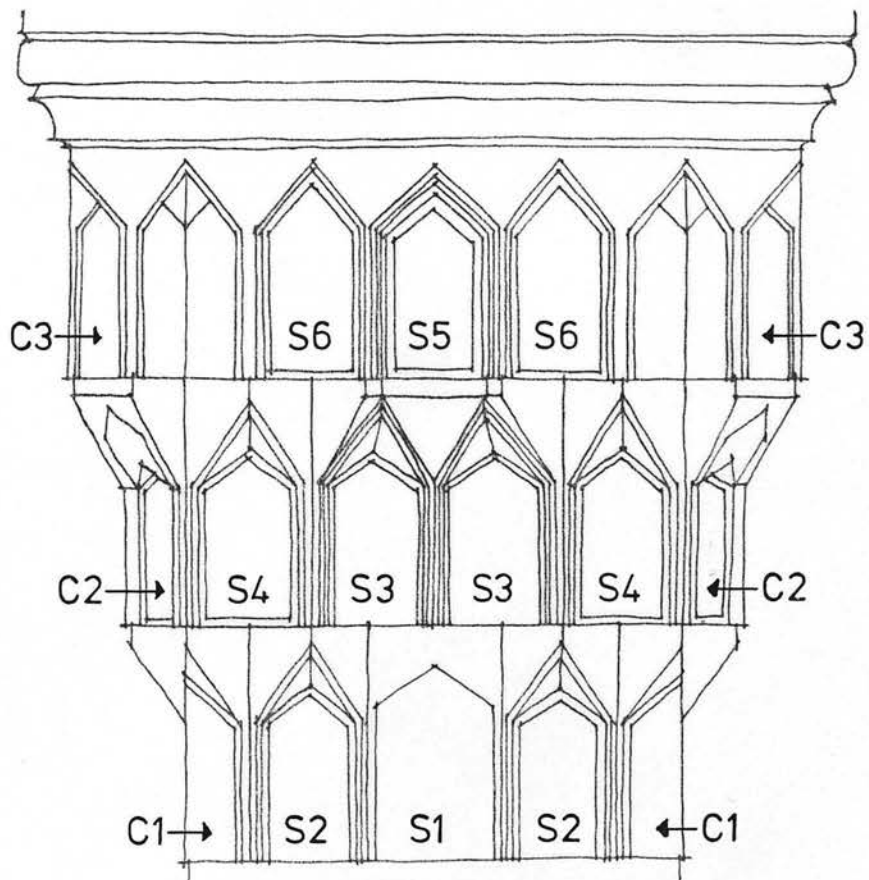
Subject Groups (2nd Appreciation Level).

Just as the cells can be grouped using Three Dimensional rhythms, more complicated or less obvious rhythms can be retrieved using the vegetal forms. I am bound to the idea that the distribution of the vegetal forms are not accidental but are the result of careful consideration.

In Figure 29 the vegetal forms shown in Drawings 89-90 are reduced to symbols/

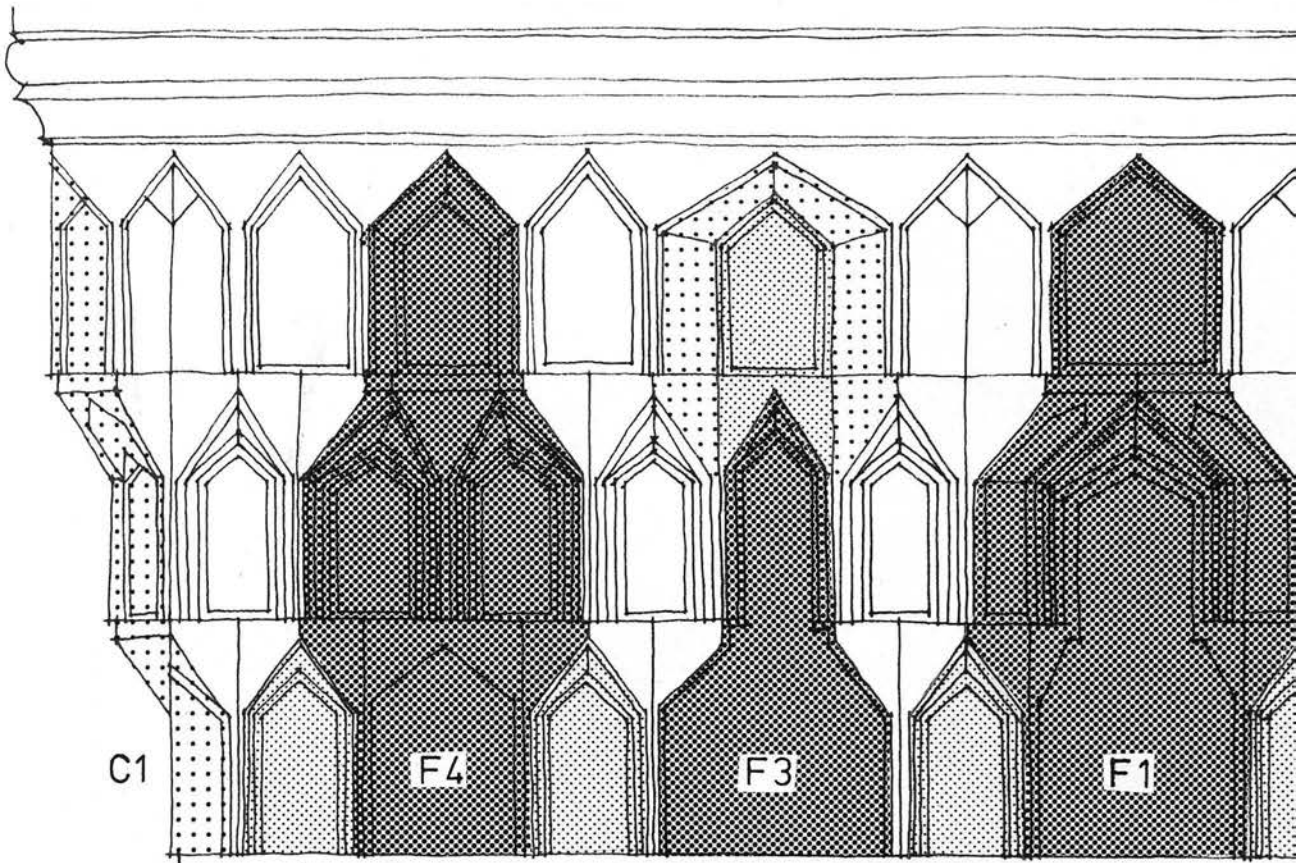


Left Half of Front Elevation.

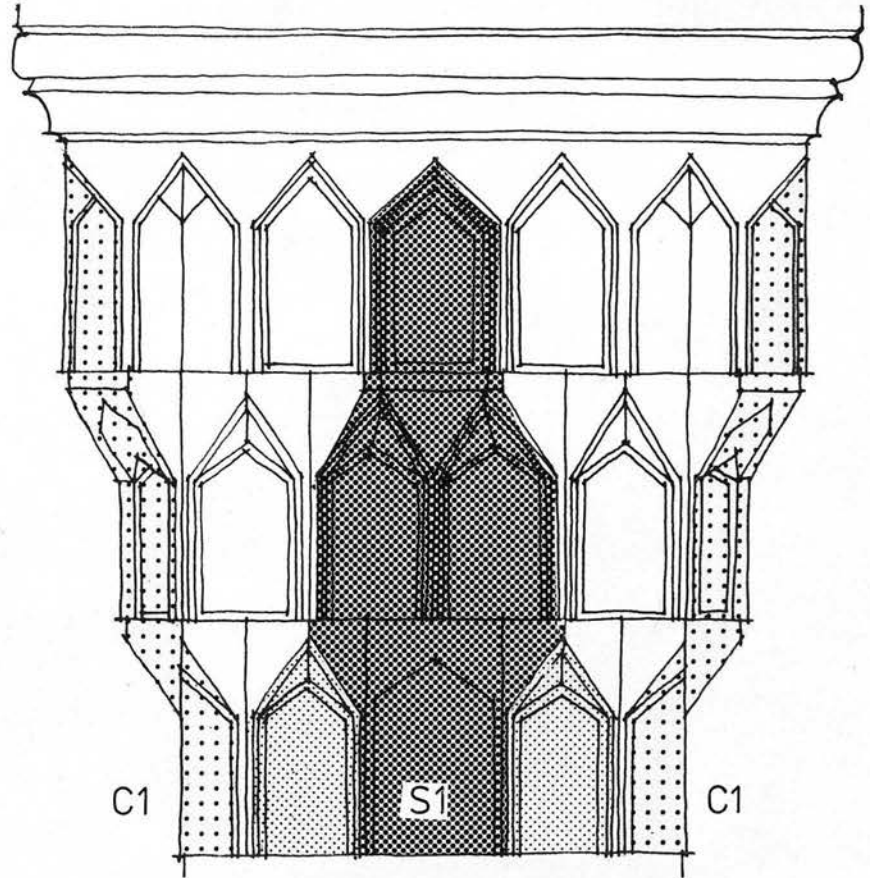


Side Elevation.

Fig.26. Muqarnas on Gateway: Reference Numbers.



Left Half of Front Elevation.



Side Elevation.

Fig.27. Muqarnas on Gateway:the Three Dimensional Groups.

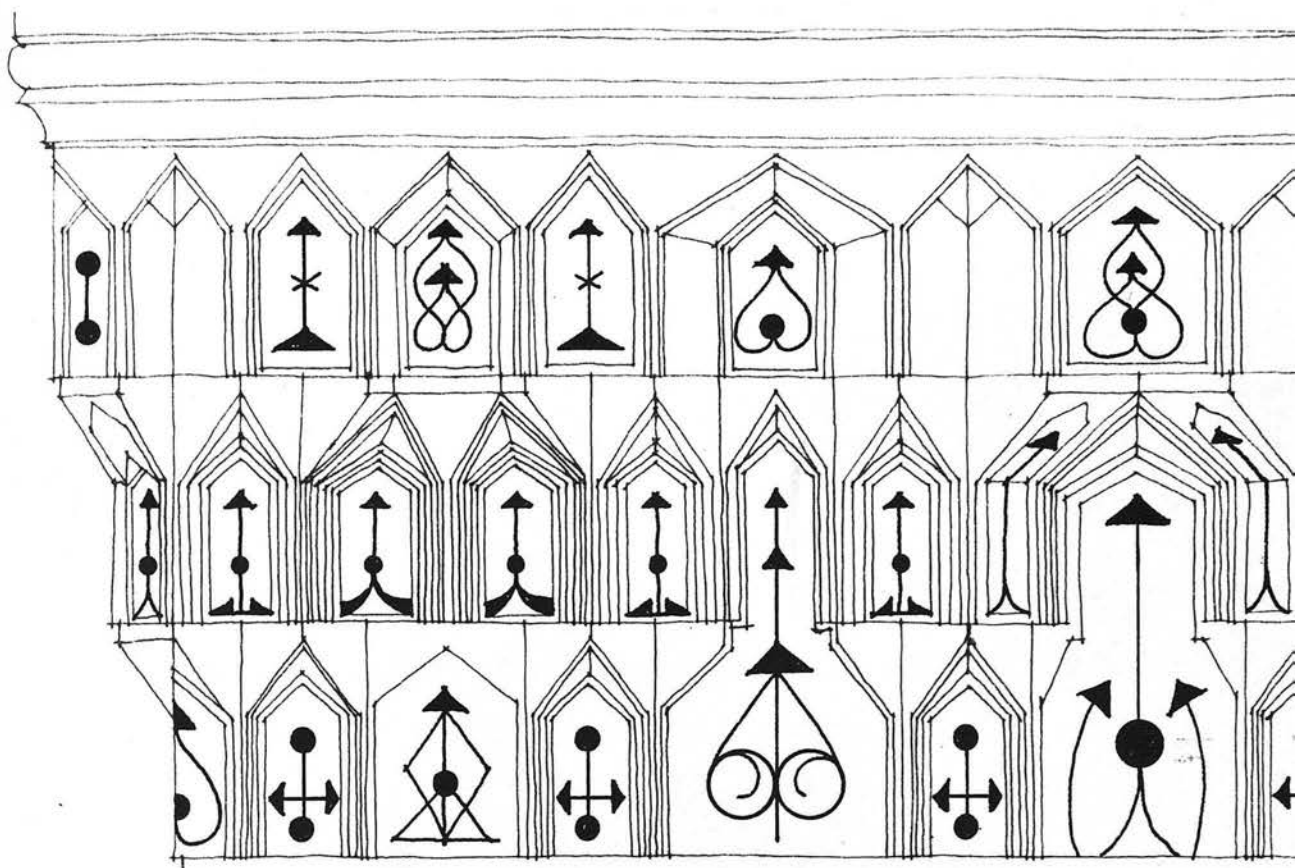
symbols conveying the basic movements using arrows and their points of concentration represented by circles. If we consider the subject groups in the same combinations as the Three Dimensional Groupings (Figs. 27-28) we find the following. In the F1 combination; the cell F1 provides a vertical emphasis gathering the stems to a major point of concentration and on up through a minor point towards the field's apex, the side sprays also have an upward movement and they emphasise and expand the influence of the major point of concentration. F5 helps the upward movement of F1 through the second course, while the entwined arabesque confines its point of concentration and also its upward movement. The two cells F2 suggest a horizontal motion cementing or linking together this combination with that of F3; F2 has two minor points of concentration above and below the line.

In the F3 combination; cell F3 has rotating concentration points on either side of its axis of upward movement, spinning out of those points are leaves which increase the upward momentum. F9 confines its point of concentration with lines indicating minimal upward movement.

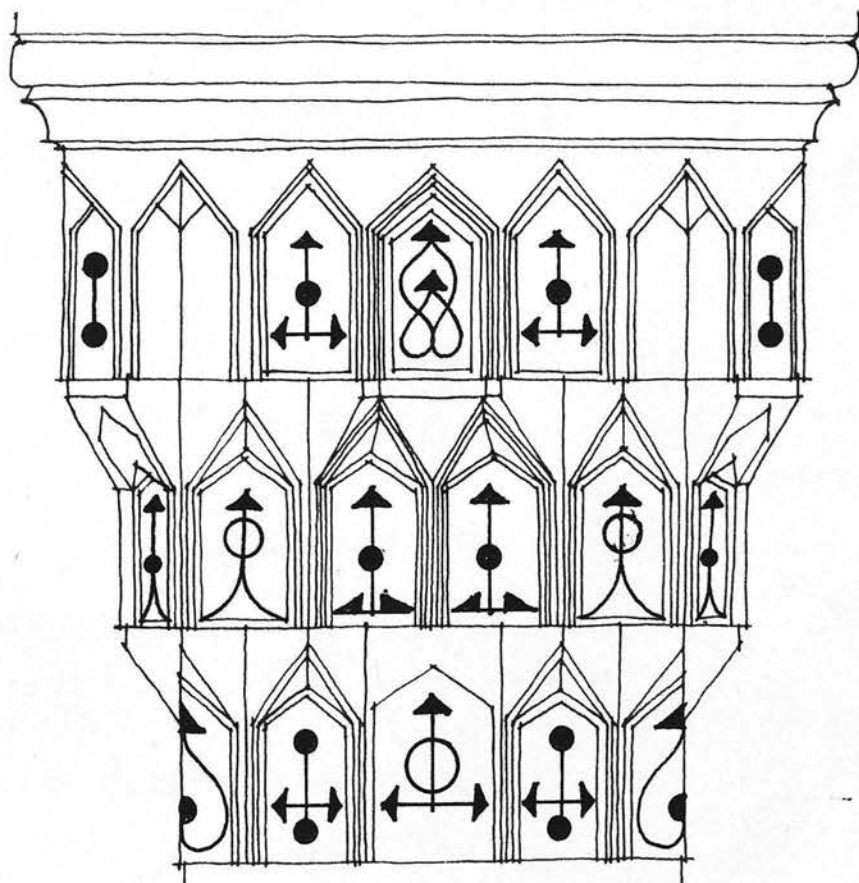
In the combination based on F4; the cell F4 gathers together its two arabesque systems and gives them an upward thrust. F7 can be given two alternative functions, the first is that it can act as a link like F2, the second alternative is that the bifurcated stems move up to the point of concentration and an upward explosion. F11 confines and concentrates its movements in the manner of F8. Returning to the first course F2 again acts as an expanding or linking device.

In the S1 combination; the content, movements and concentrations in the F4 combination are varied only slightly.

In the corner combination; the arabesque of C1 provides continuity around the base, it confines one point of concentration, it suggests a horizontal linking/



Left Half of Front Elevation.



Side Elevation.

Fig.28. Muqarnas on Gateway: Subject Groups.

linking movement through the small side knots, and it extends up to another concentration point. C2, like F7 can be assigned two interpretations. C3 with its abrupt start has two minor points of concentration on its axis of movement.

Excluded from the above Subject Groupings are the cells F6, F10 and S6. The vegetal forms of F6 and S6 are basically horizontally motivated linking the combinations together. F10 on the other hand has a broad base and vertical direction without any specific point of concentration.

Less obvious relationships can still be discovered if the visual characteristics (refer to Drawings 89-90) are used in the following way to provide 'Ethnic' Groupings: F1 - F10; the already discovered F6 - F7(S3) - S6 - C2 - S4 - S1 (?); F2 - C3; F8 - F9 - F11 (S5). By coincidence the only decorated cell not to have a close relative on the Gateway is F5, it does have five 'relatives' in the rectilinear mugarnas on the Window Wall of al-Ashrafiyya. (see Drawing 50). There is no clear boundary separating the identification of Ethnic Groups and the gathering of detailed descriptions of the individual cells, progress in one means progress in the other.

7.03 The Front Mugarnas (Drawing 89)

Cell F1: Two courses high this is the central and also the largest of the cells, its outlines are not followed by its central decorated field which encloses a large inter-carved semi-natural vegetal form between smaller curved semi-natural sprays. On the vegetal forms can be discovered minute traces of a light red paint.

Cell F2: Across the Gateway this unit is repeated six times, and on the sides four times (see Cell S2). Over the blue ground the white semi-vegetal form grows out of the side borders rather as if it was but one link in a chain.

Cell/

Cell F3: Like F1 this cell is two courses high, but it is narrower and has a bent apex. The comparative narrowness may be compensated for by the intricacy of the double-growth arabesque system picked out in gold leaf; this leaf may also have covered the background as well.

Cell F4: Unlike the other cells across the front this is not defined by the angled planes of the muqarnas along its upper surface, instead it gives those muqarnas above some support. Contrasting with the rectangular appearance of the cell is the point central field with its flat-carved double-arabesque system. The simpler system grows out of the side borders to form first an ogival arch before bifurcating to produce leaf systems; the more complicated system, lightened by slight quantities of inter-carving, is a self-contained system of bifurcating and overlapping leaves ending in a single bud. Pin-head sized particles of gold leaf were observed below a later coat of dark red paint.

Cell F5: Repeated twice along the front this splayed cell increases the prominence of F1, it also bends to run up the sides of the latter cell's apex, the result is a 'twisted rectangle'. The pointed field has a semi-vegetal form growing up from two points along its base.² The complete field seems to be painted white.

Cell F6: Repeated six times across the front, this cell is concave in plan producing a semi-conical head. Often in this type of cell the base of the semi-cone defines the upper limits of the vegetal form's curving leaves allowing only a bud or single leaf to intrude into the head. (In flatter concaved cells the heads can accept a number of leaves and buds.) The inter-carved semi-vegetal form issues from the centre of the base line, on it are traces of a light red bole below specks of gold leaf which have been submerged in a dark red paint at a later date.

Cell F7: Four times this is repeated on the front and twice on each of the/

the two sides (see S3). Like F6 it is concave but smaller overall. Displayed on a blue ground the white semi-vegetal form has a simple lower half emerging from the base's corners, its upper half resembles the upper half of F6.

Cell F8: This slightly concave cell ties together cells F1 and the paired F5's. It is decorated by a self-contained and interlaced arabesque system cloaked by a dark red paint. Contrasting with the semi-conical head in F6, the head of F8 is wider and shallower allowing room for a trifoliated bud and enclosing side leaves.

Cell 9: The visual influence of F9 over F3 and a pair of F6 cells is conveyed by its recessed and splayed sides. On those sides I found miniscule traces of gold leaf overpainted in dark red. The self-contained arabesque system is painted white on a blue background, its curving tendrils coincide with the sides of the decorative field.

Cell 10: Reproduced four times along the front this concave cell has a semi-vegetal motif covered in a bright red bole with traces of gold.

Cell 11: The splayed recess is similar to that of F9 including the gold leaf particles and the dark red paint. The self-contained and the interlaced arabesque are painted white on a blue ground. With minor colour modifications F11 is repeated as cell S5.

In the top muqarnas course along the front there are four unadorned cells and on each side two more; each of the cells encloses two "cell-shaped" planes which abut one another at the rear of the cell. There are indications that the complete cell was covered in gold leaf, but without the light red bole, thus when the gold deteriorated the natural stone colour showed through. At a more recent date a cream coloured paint was applied over the majority of these and the other muqarnas cells.

The Corner Muqarnas (Drawings 89-90)

Three cells stacked one upon another manipulate the corners of the Gateway's muqarnas; at three of the corners the cells are carved, those which have no carved decoration form the rear corner on the Minbar's left side.

Cell C1: This unit wraps itself around the 90° corner, the arris halves the flat-carved self-contained form.

Cell C2: This cell's outline and central field bend outwards outwards near their apexes in a fashion similar to F5, however unlike F5 the central field is divided into a plain chevron shaped area and below it a concave decorated field adorned with a combination of the semi-vegetal forms found in F6 and F7. (Actually S2 is a nearer relation than F7, see below.)

Cell C3: Of all the cells in the Gateway, this is the smallest, it is decorated with a simplified version of F2(S2) and shows no attempt to create a link or chain reaction, on the contrary, there is a feeling of complete isolation effected by the truncated stem.

The Side Muqarnas (Drawing 90)

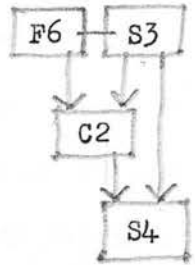
Cell S1: The central and major cell occurring on the sides belongs to the same level as F4 in the hierarchy of the significance and influence of cells, fulfilling the same supporting function with regard to the cells above it. The gold leaf semi-vegetal form curving out of the field's sides is accentuated by painted black or dark blue lines.

Cell S2: A repetition of F2 the vegetal form is painted white contrasting with a blue background.

Cell S3: A modified version of F7 with white and blue paint which if combined with F6 provides a closer ancestry for the corner cell C2.

Cell S4: In a curious way S4 combines the characteristics of
the/

the cells C2 and S3 which lie to either side of it. If we liken these relationships between the mugarnas cells to a family tree, S4 becomes the all-golden offspring of an incestuous relationship.



Cell S5: Identical to C11 except for the addition of a blue border separating the central field from the gold leafed walls of the recess.

Cell S6: An enlarged version of S3, it has the light red bole on which are traces of gold leaf, touches of blue paint appear in the channel of the inter-carved and swagged stalk.

Traces of painted white lines are found between the apexes of the top mugarnas course and the cornice. Similar traces are found on the sides separating the mugarnas and the geometric square.

7.06 The Rear Mugarnas.

Three courses of mugarnas crown the rear of the Gateway, and all of their cells are devoid of carved decoration. To my surprise and delight when they were soaked with water phantom arabesque forms appeared at the centres of some of the cells, they resembled the forms enclosed by the bases of the candlesticks in the 'Mihrab' panel. (See Drawing 91). There are two possible explanations, either the original scheme included gold leaf or painted arabesques and the smooth stone surfaces absorbed some of the red bole or a painted red base coat. My preference was for the painted arabesques because the absorbed colour is considerably darker than the bole found elsewhere, and because I supposed that gold leaf might not have been expended on arabesques in this concealed or at least restricted position. I am no longer sure of this or any other explanation for two reasons, first, the dark red paint of the front and sides of the Gateway must be later as it covers the specks of gold leaf and so how does one explain its use in the original colour scheme, the second reason is that although/

although the colour differs from the light red bole my supposition that the obscured position might have effected the economic use of materials is proved false by the obvious efforts made to beautify the hollowed out dome which can only be viewed by someone sitting on the top step with his head pushed well back and his eyes directed vertically. (see p. 241 below).

7.07 The Fleury Crestings (Drawings 89-90)

The positive and negative crestings carved like fleu-de-lis run the full circuit of the Gateway. There are now no particles of paint adhering to their surfaces, but when soaked with water dark red phantoms appeared at their centres with a margin of natural stone, this indicates either the existence in the original scheme of gold leaf or a red paint.

7.08 The Decorated Engaged Columns. (Drawing 90)

The transition from the Gateway's front to its sides is provided by a paired set of engaged columns. In each, the base and capital are identical belonging to a type commonly used in Mamlūk architecture. When wet both changed colour from their dry grey to one of a dark reddish hue, which is indicative of either gold leaf or red paint.

The geometric skeleton covering the shaft is based on a rhombic repeat unit, at its centre a decagonal star polygon is inscribed by a circle.³ I began to re-establish the repeat unit of the engaged column by first taking the length along the column's circumference, multiplied it by two to find the width of the rhombus thereafter working out the height of the figure. This was a profitable error on my part, it showed that the slightest inaccuracy made while measuring the width of the rhombus can produce a disproportionate error (plus or minus) in the height. It is simpler and more accurate to reverse the procedure, starting with the height of the rhombus equal to the height of the shaft's decorated area, this establishes the width of the rhombus, which is twice the length along/

along the circumference. I am positive that this was the order used by the craftsman and that he then created a suitable column using the now established length as half the circumference of a theoretically complete column which is reminiscent of the proposed procedures for al-Ashrafiyya's Engaged Column. (p. 134 above).

Using this rhombus he could begin the long process of working out the details of the rhombic repeat unit. In my own analysis I uncovered only one set of lines not found by point joining, these emanate from the first intersection outside the circle and along the central axis of the basic repeat unit. In the 'Point Joining' these lines are dotted and are drawn at 45° to the axis to complete the quadrilaterals placed on the axes joining the centres of the combined repeat units.

The craftsman, having adopted a successful geometric skeleton, outlined the majority of the interstices. Those he left out were avoided on purpose, either because they were too small or they clarified the star polygons at the repeat units' centres by isolating them from the other concentrations. He chose to decorate the outlined interstices with simple trefoils, double trefoils, half-palmettes and two varieties of cinque-foil: all of them well known elements in the stone carving of the period. I found no evidence of any kind on the shaft indicating the application of gold leaf or paint.

7.09 The Geometric Square. (Drawing 90)

At the same height as the inscription panels and below the muqarnas on the Gateway's left and right sides are identical geometric squares. Their design is based on the octagonal star (or the $\sqrt{2}$ system of proportioning).⁴

Again an error on my part was advantageous; in Figure 30 the completed repeat unit is reproduced with additional dotted lines. These lines I first considered to be correct as they joined obvious points, the apex of the/

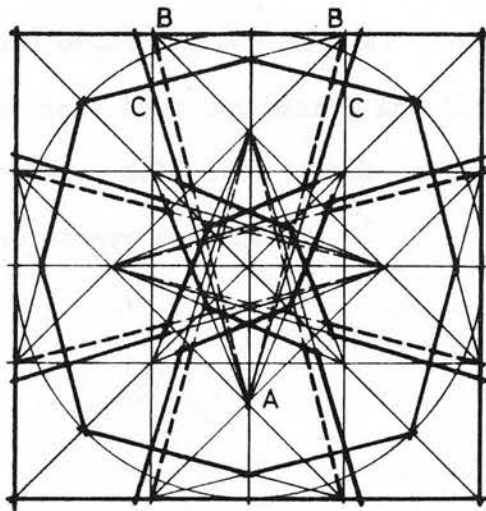


Fig.30. Geometric Square on Gateway: showing anticipated and actual points.

the inner octagonal star (A) and the intersections of the outer octagonal star (B). When compared to my squeezes this proved to be wrong, it narrowed the interstices housing the vegetal elements. The correct width of the interstices was attained by drawing the line from A through the intersection C, this line also improved the pointedness of the quarter stars.

Only the interlaced solid geometric line and the thin interstices along the square's sides were left to show the stone's natural colour. The eight petalled rosette at the centre of the design is in gold leaf over-drawn with blue lines outlining the petals. The arabesque interstices are covered all over in a dark red paint, and the "fan" shaped interstices between are lime green. Gold leaf traces occur in the inter-carved quarter stars at the square's corners.

THE 'MIHRĀB' PANEL ON THE REAR WALL (Drawing 91)

The subject of a mihṛāb portrayed on a panel on the rear wall is not unique to this specific Minbar,¹ but it is most often used as a decoration appropriate to prayer carpets.² Prof. Ettinghausen, in one of his articles when discussing the ancestry of the Kufesque motif and how it can be forgotten, wrote:

"There are others where the content of an incipient symbol became lost while the outer form remained either to become devoid of meaning or to be combined with other concepts of a different nature. The mosque lamps suspended in the mihṛāb-like arches of prayer carpets are the best-known examples. They originally reflected Verse 35 of Sūra XXIV which states;

Allāh is the light of heaven and the earth; a likeness of his light is as a niche in which there is a lamp, the lamp is in a glass and the glass is as it were a brightly shining star

Later on the light-carrying lamp became a flower vase and it was eventually placed on a saucer at the bottom of the arch"

The 'Mihṛāb' panel therefore combines the original concept with the later version of the theme using the background arabesques.

The General Divisions

Like a piece of string with end loops locked together, the panel's border has at its top centre an interlace locking its two end loops together. The lower lines issuing from the interlace create a horseshoe arch. Margins on the same plane as the rear wall's general surface define the border and separate it from the more deeply cut decorative areas. The margin surrounding the mihṛāb area is continued down from the arch's zenith into the lamp, it also extends into the paired candles and their candlesticks.

A number of people have suggested to me that the paired objects represent cyprus trees, a motif closely associated with prayer carpets and islamic tile work, but of course I had to disagree with them on four accounts.

Firstly/

Firstly, if they were representations of trees why do they grow out of tubs instead of a straight line symbolising an earthen surface? Secondly, Fehervari postulated that candlesticks with some exceptions 'rigidly adhere to a canon according to which the overall height is equal to the diameter of the base, and the side of the socket and the body is concave in profile', a description that fits perfectly the candlesticks of the 'Mihrab' panel.³ Thirdly, in a comparison between the bases depicted in the panel and the candlesticks presented by Qāyṭbāy to the Shrine of the Prophet at Medīna in 887/1482-83, which is the year preceding the construction date of the Minbar, the similarities are indisputable.⁴ My fourth reason concerns the significance of incorporating candlesticks inside a mihrab in addition to the lamp: candles are sometimes placed outside actual mihrābs to light them,⁵ just as lamps can be found hanging from the centre of a mihrab's arch; by placing them within the 'Mihrab' panel the intention may have been to strengthen the symbolism of 'a likeness of his light is as a niche'.

8.02

Vegetal Forms in Outline (Drawing 91)

If the arabesques are divorced from the lamp and the candlesticks and the inter-carving is dismissed from the border's arabesques their curvaceous tendrils and leaves are exposed. By reducing the arabesques to their outlines and so enabling their shapely forms to be considered alone, is not to diverge from the actual methods employed by the craftsman, as I will explain later. So, by separating the component parts of the panel we find that the seemingly wild and uninhibited curves closely relate to the general divisions of the mihrab area, that the nodal points are incorporated into the bodies of the lamp and the candlesticks, and that there are two independent arabesque systems in operation; the larger system covers those spaces above and between the candlesticks while the other, smaller system extends along the area's base and up into the bodies of the candlesticks.

In/

In the upper reaches of the larger system, although symmetry is maintained, there is a noticeable deterioration in the fluid character of the curving tendrils. As the arch narrows and the spaces between it and the lamp contract the curves are harsher and more abrupt creating an effect like a mass of spaghetti.

The symmetrical smaller arabesque system is actually composed of three separate systems. The most important of them consists of palmette heads surrounded by a "collar" which can be imagined as continuing down behind the candlestick's base-line to form swags. The two other systems are rather like the numeral 3 lying on its left side, or are like croquet hoops pushed into the top of the lower border, these two identical systems are combined with the former system to create an impression of symmetry below the base-line of the candlesticks, and also to retain the correct balance between the arabesque lines and their background spaces.

On the line of the mihṛāb area's sides are "locking" or "linking" devices, one pair is level with the candlesticks and the other pair is level with the springing of the horseshoe arch. One interpretation of their function is that they act as bonds between the mihṛāb's flat-carved arabesques and the inter-carved arabesques of the borders, but this interpretation cannot be easily upheld in view of the differences in the levels of the relief planes belonging to the two systems, and the visual differences produced by inter-carving and flat-carving which help to dispel the idea of bonding, instead they reinforce the effectiveness of the margin in its containment of the mihṛāb's flat-carved arabesques. (It will be demonstrated later that the original intention of the designer was to have had inter-carved arabesques instead of the existing, had this intention been completed then the foregoing interpretation would have had to be reversed to take account of the bonding notion.) The second interpretation I wish to consider concerns a greater honesty in the design. The "linking" devices/

devices were employed by the designer to overcome any awkwardness arising from the juxtaposition of the centrally orientated and curving tendrils and the straight sides of the panel. Therefore I interpret the devices as space fillers that were essential to design whether it was flat-carved or inter-carved as was originally planned.

Another 'linking' device is used as a collar enclosing the palmette head in the lamp's body, I feel that there was an intention on the part of the designer that this collar should rise upwards behind the outline of the lamp's body and into its neck to terminate in a fleury head. Had this intention been fulfilled the presently well defined outlines joining the neck to the body would have been deranged.

8.03 The Stone Carving Sequence.

The flat-carved arabesques provided me with an extremely crucial key to help me unlock and rediscover some of the ideas, reasoning and understanding of the craftsmen in the late Mamlūk period. Also, it provided me with indisputable evidence which can only strengthen my notion that there are no significant conceptual differences separating flat-carved forms from similar inter-carved forms. The discovery I made was the existence of dark blue or black painted construction lines to the flat-carved arabesques which appeared when the stone was damp. Utilising the construction lines one can now strive after an appreciation and understanding of the craftsman's aesthetic feel for his subject in addition to a reconstruction of the (logical) order of his tasks.

Imagine this medieval master confronted by a prepared but blank stone surface and in his hand some form of drawing or sketch illustrating sufficiently the proposed decoration. Surely his first step was to find the main axes of the stone, especially the vertical central axis on which he would hang his design and on it he would decide where the upper and lower/

lower lines of the panel would fall. After these decisions had been made the general divisions of the panel, the margins, the lamp and the candlesticks could be constructed and finalised before being marked out in painted lines of uniform width. This uniformity of line seems to have been of great importance, as in the later stages when the stone was cut back the areas of high relief were defined by the edges of these lines. At this point the mihṛāb area is cut back to a constant depth leaving the painted lines, the new surface is smoothed and dressed in preparation for the next marking out operation. Similarly the spandrels are cut back to approximately the same depth and their new surfaces prepared. The craftsman is now ready to embark on the drawing out of the outlines of all the arabesques, including those in the borders, and the chinoiserie flowers of the spandrels. Having completed this last task and satisfied himself that the balance of the design is correct, with especial reference to the positive to negative ratio of outlined forms to the spaces backing them, the uniform lines defining the inter-carving could then be drafted. With the exception of the areas so far cut back from the panel's general plane the craftsman has still the option of changing or modifying his design by simply bleaching away his painted lines thereafter drawing new ones in their stead. Like the earlier painted construction lines their width remains constant and the craftsman works up to them on both sides to give the completed relief lines the consistency required to make them legible.

8.04

The Composite Design.

With the conclusion of the above tasks we are given a rare glimpse of the aesthetic "feel" of a highly-skilled medieval craftsman. He actually completed drafting in the lines for the inter-carving of the mihṛāb area's arabesques; they appeared while I was peeling off the paper squeezes and the stone was still damp. I must therefore conclude that flat-carved arabesques/

arabesques were to be taken further and were to be inter-carved; I can also state that the arabesques were to be interlaced, at some overlap points the upper and lower tendrils can be identified, there is even an example of the "half-overlap" where the curled tip of a leaf is first taken under a tendril and then brought over it rather like threading the eye of a needle. I judge from this important piece of evidence that having completed the inter-carved border arabesques the craftsman realised that if he was also to inter-carve the mihṛāb area's arabesques the definition, simplicity, clarity and identity of the complete panel would be annihilated, thus his solution was that he should stop the work instead of continuing with the original proposals.

If I am right in my reasoning that the craftsman was able to change the original idea on aesthetic considerations this gives some indication of the regard and respect placed in his ability by some higher person or committee. I must rule out the probability of a shortage of money, or of time, effecting the final content of this principle decorative area in the Minbar.

8.05 An appraisal of an early illustration.

Prisse d'Avennes is the only scholar to have attempted to publish details of this mihṛāb panel and so, unlike others who have only included it in deep shadow in general photographs, his is the only illustration which can be criticised.⁶ (Plate LXXVII). My natural reaction is to congratulate him for making available to others the general contents of, and impressions given by the panel, although I do find fault with him not only in this panel but in some of the other decorative areas which will be described below.

In the mihṛāb panel the details which are inaccurate are as follows:-

1. Prisse d'Avennes suggests that the panel is raised above the general/

general surface of the Minbar's rear wall. This is not so.

2. The pointed arch is mistakenly drawn as a circular one and at its apex the direction of the loop is reversed.
3. The borders are decorated with chinoiserie flowers on an "open" background in place of the actual closely fitting arabesque forms.
4. In the drawing of the lamp a number of mistakes are incurred: the circular body is not separated from the neck or the base, nor is the flat-carved arabesque background brought into the body or the neck.
5. A thin border in relief is indicated around the candles which does not exist, also a circular knot has been introduced midway up the candles.
6. The arabesque decoration in the candlesticks is shown separated from the remaining background arabesques, this separation is reinforced by two features. The first is that there is no indication of the arabesques continuing down behind the base lines of the candlesticks to join the lower vegetal forms. The second feature could be the mistake of the engraver (but I doubt it as the same technique is used in the lamp); it is that the arabesques are placed on a light grey background matching the colour of the margins, lamp and candles, which is in contrast to the darker grounds used elsewhere. I am assuming that the gradation of grey indicates the differing depths of relief.
7. Unfortunately the largest error concerns the background flat-carving wrongly portrayed as curving tendrils with chinoiserie floral heads and leaves all of them inter-carved, instead of the/

the flat-carved and (interlacing) arabesques.

Although I cannot explain why Prisse d'Avennes included the above inaccuracies I find it interesting that he chose to decorate the borders and the mihrab area with chinoiserie flowers, since to my eyes they, of all the motifs incorporated into the panel, are the most difficult to see because they only appear in the small spandrels tucked into the upper corners well above eye height and in the depths of the Canopy's shadow where they surrender to the encircling and positively dominant arabesques of the borders.

One other observation deserves to be mentioned with the outside chance that it may explain the first inaccuracy listed above. Lying outside and parallel to the panel's left hand edge is a short length of painted construction line visible only when damp, if Prisse d'Avennes did notice this he may have mis-read his survey notes when making his final drawing. I have not ascertained the exact purpose of this line, it may have been an error in the original setting out, but whatever its purpose might have been it was ignored and made redundant by the craftsman.

9.00 THE CANOPY (Drawings 92-94)

9.01 The Columns

The Canopy is supported by four octagonal columns, the two along its front are full columns, the two at the rear are truncated as they abut the Khānaqāh's qibla wall giving the appearance of being engaged with it. The shafts are enlivened by rings of multi-relief chevrons having a cross section formed by two parallel V-shaped cuts. When the capitals and the shafts were wet traces of colour became visible; on the capitals a lime green paint was seen and on the shafts a red tinge. Regarding the latter the redness could have been affected by the heightening of the stone's natural colour, but I remain undecided on this point.

9.02 The Decorated Front Spandrels.

If we first consider the outlines of the arabesque decoration paying special attention to the tendrils it is immediately clear that the spandrel exhibits reversed symmetry, it also becomes clear that the "central" axes of each arabesque development coincides with the outer vertical sides of the spandrels. We find that when the development of the tendrils is traced in either direction from the half-palmettes on these axes it is found that the arabesque development has only one open ended system to each spandrel.⁷

The fleury profile given to the Canopy's intrados is like the outline of a giant palmette or one of the fleur-de-lis crestings from the Gateway. Similar profiles decorate windows and recessed alcoves in, for example, the Drinking Troughs of Qāyṭbāy beside al-Azhar, and in the Northern Cemetery near his Mosque and Mausoleum. (Plate LXXV).

9.03 The Blind Crenellations

The positive and negative shapes of the blind crenellations are not unusual/

unusual in Mamlūk architectural decorations as they are often seen in joggled lintels and relieving arches where their opposing forms are strengthened by the differences in the coloured stones used. But in the case of the Minbar's crenellations they have all been carved out of the same stone so the craftsman cut a thin margin around the positive crenellations to form a lower central field which was then covered in gold leaf on a red bole contrasting with the lime green paint of the negative crenellations.

The Decorated Side Spandrels

9.04 My first thoughts were that due to the placing of the "central" axes of the front spandrels at the corners of the Canopy the spandrels round those corners on the left and right sides could be continuations of the open ended arabesque systems divided only by the corner margins, but this is not the case, the decoration of the side spandrels does differ.

On neither side are the overall forms of the paired spandrels symmetrical although they are similar. The rear spandrels on each side is shorter because of the truncated rear columns abutting the qibla wall, plus the fact that wider margins separate the decorated areas from the wall.

On the left side of the canopy the rear spandrel is flat-carved unlike the others, when damp this spandrel showed the now anticipated painted constructional lines. I think that there had been the intention to inter-carve its arabesques, this is given support by the fact that a start had been made on the lowest leaf, what stopped the completion of this inter-carving remains a mystery, however we can be fairly sure that it was not due to a sudden shortage of money as Qāyṭbāy is known to have taken extreme action on other occasions to get monies for building.⁸ A plausible explanation might be that the craftsmen were ordered to another job and being forced to skimp they chose this spandrel in the hope it would never be noticed. It is sad that this masterpiece could be marred by/

by this imperfection after the craftsmen had expended so much energy and skill, it is a sadder thought to consider the damage to their pride and self-esteem that such skimping may have caused.

The arabesque developments decorating the left side's two spandrels are similar to each other, each is a single open ended system with a "collar" below the half palmette on the "central" axes.

In the right side's spandrels the collar, found on the left side, is substituted for a self-contained system consisting of a bud, bifurcating leaves and a palmette head, and is interlaced with the larger open ended system.

9.05 The Decorated Onion Dome (Drawing 94)

Onion-shaped domes normally cap the minbars of Cairo and occasionally, as in this case, they are decorated. Here the arabesque and ribbon combination covering the Dome's multi-curved surface is a translation of an often seen two-dimensional design that is evoked by the drawn elevations on the 0° and 90° axes. The 'flattened out' version is a true rendering of the actual decorative forms drawn from a paper squeeze, (Plate LXXVI), this explains the indented shape of the drawing caused by the build-up of layers of wet paper on the multi-curved and waisted Dome which when dry were impossible to remove without vertical cuts; the cuts were made as close as possible to the $22\frac{1}{2}^{\circ}$ and 45° axes to minimise any disturbance of the arabesque and ribbon design.

The flat-carved arabesque forms are organised by the trilobate ribbon developments along the 0° , 45° and 90° axes of the dome, a feature that is immediately apparent, but it was interesting to discover black painted lines coinciding with these axes, lines which were not visible from ground level. The lines are not like the precise lines noticed on the 'Mihrāb' panel, they are rougher and broader and so more appropriate to the less refined/

refined cutting of the Dome's decoration. From a close examination at the junctions of the decorated and undecorated areas it can be gathered that the decoration was cut in situ and that either the extension of the cut decorated surfaces was inhibited by the proximity of the qibla wall, or it was rightly considered that the absence of decoration in those areas of the Dome between the 135° axes would be overlooked.

Once again traces of paint appeared as a consequence of making paper squeezes, they provide evidence that the background surfaces were painted a lime green on an undercoat (?) of a darker green to contrast with the arabesques and ribbons which were either left unpainted to show the natural golden colour of the Dome's stone, or painted white as suggested by small quantities of that colour trapped by surface irregularities.

9.06 The Dome's Hollowed Out Hunderside.

As the view of the Dome's underside is restricted to the few privileged to stand at the top of the staircase and address the congregation it was with some surprise that I discovered a small concave dome resting on four shallow pendentives and a drum. Around the drum runs a painted golden yellow Kufesque inscription interrupted at regular intervals by floral motifs of the same colour. A chamfered neck reduces the diameter of the drum to that of the dome whose curved surfaces are painted black and orange to simulate the joggled vegetal forms found in certain domes (e.g., the semi-dome over al-Ashrafiyya's Portal), even though it is hollowed out of one stone block.

10.01 A General Description (Drawings 99 and 104)

My first consideration should be concerned with the effect the two Principal Side Panels might have on the uninitiated and initiated observer as they are the biggest decorative areas on the Minbar's sides and can offer the greatest number of decorative elements. In the mind of the uninitiated these factors could combine together to produce a grey blur, they are too complicated for him to even begin 'wasting' his time on coming to some form of understanding, and if he is asked for a reaction it can always be cloaked in a defensive veil of polite exclamations on 'its beauty and superb workmanship' before hurrying on to the next obfuscating artifact. An initiate, on the other hand, may prefer to react in silence, remaining mute until the eyes have had the satisfaction of perceiving and comprehending the visual intricacies and the significance of the decoration.

If the decorative stimuli are organised into their Appreciation Levels, then the first factors to emerge are that the panels are stone, that the carving ignores the stone courses, and had they been inspected in the late fifteenth century they would have exhibited red, black and blue paints with the possibility of more gold leaf.

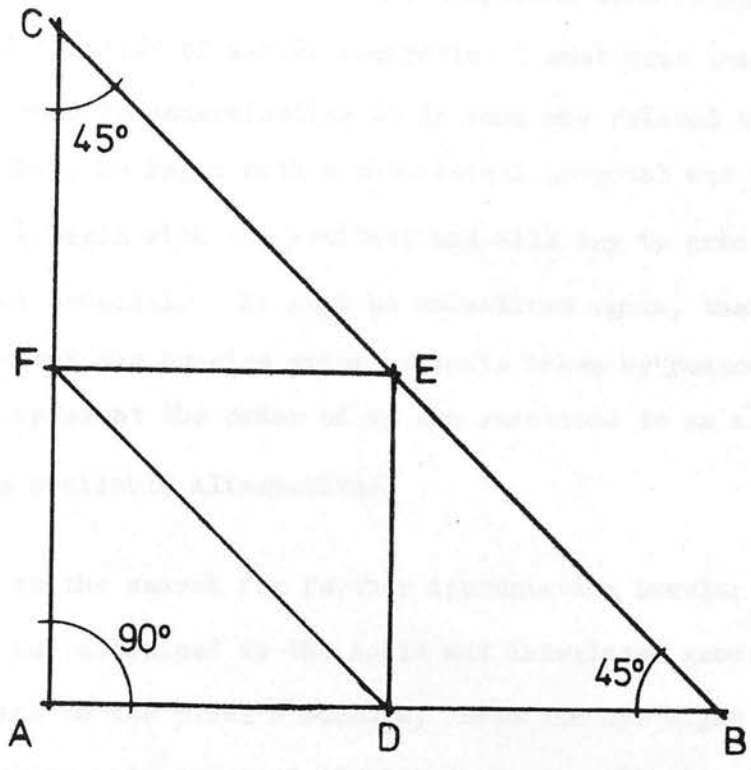
Once the size of the triangular panels is appreciated there must also be an awareness of their considerable scale in contrast to other decorative areas of the Qāyṭbāy period due to the ability of a person to inspect them at close range rather than being kept at a distance as was usual, and there is also the scale relationship to the total size of the Minbar. Following on from this the large linked moulding surrounding and containing the decorated areas might be recognised, along with an appreciation of the inherent properties of a 45° isosceles triangle, an appreciation that might be the result of observing the triangular sides of other Cairo minbars.

By concentrating on the geometric properties an increased understanding can be gained. Figure 31A shows an isosceles triangle ABC with two angles at 45° and one at 90° along with the mid-points of the sides D, E, and F; when point E is joined to both D and F square ADEF is formed along with two identical triangles D and FEC; and by drawing the diagonal DF in the square two further triangles are formed of identical size. These subdivisions may seem immensely simple especially as they are drawn in Figure 30A without any extraneous details camouflaging them, but it is as much due to this simplicity as to any other factor that enables them to be applied with success to the design of the Principal Side Panels. If these subdivisions are insufficient to delight the mathematically inclined there are many more features waiting to be uncovered which should intrigue him, but for the moment there need only be added the ratio's of the lengths of the lines as given in Figure 31B, including the irrational number of root two it being the ratio between a square's diagonal and its sides.

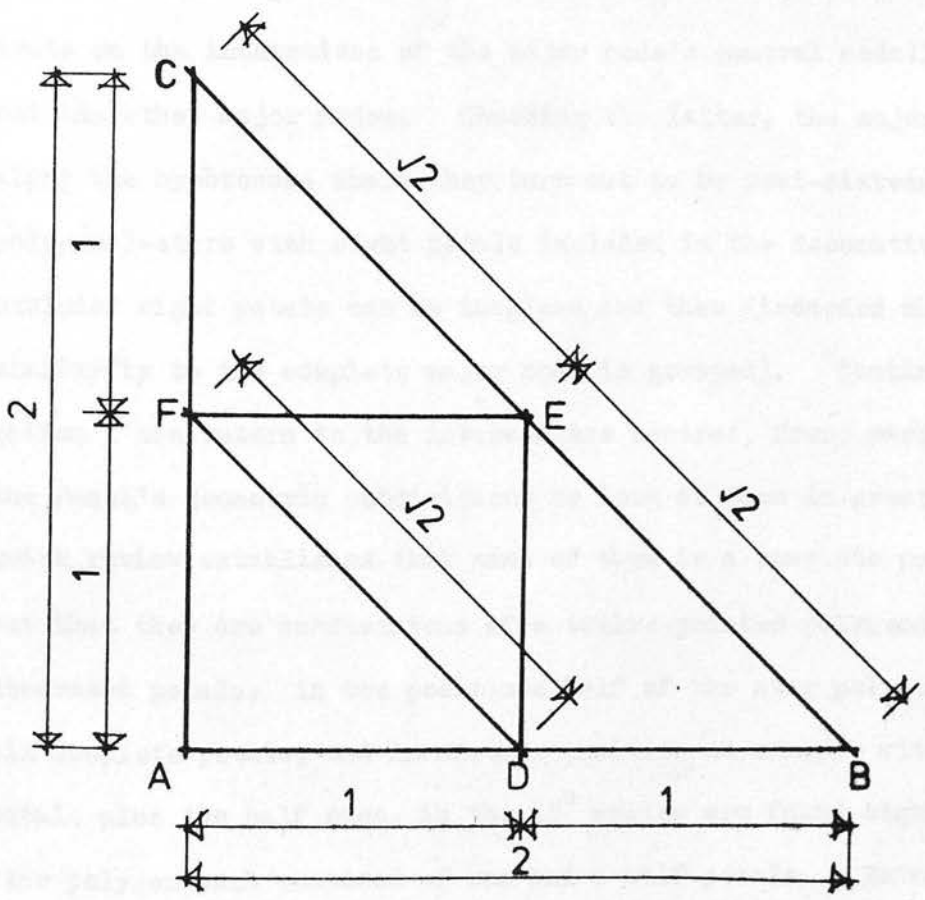
Those people who would rather ignore the mathematical properties preferring to concentrate on the graphical nature of the Principal Side Panels, cannot neglect the influence of the mathematical properties over the graphical. It must be recognised that the designs are dominated by geometry and that within them there are nodes of differing weights and emphasis all of which are derived from mathematics. (Drawings 99 and 104). There are major nodes (L1 and R1), and intermediate ones (L2 and R2), plus a number of minor nodes that need not be identified individually, (Drawings 100 and 105) and which, when compared to Figure 31 are seen to coincide with recognizable points.

From the above it is obvious that whatever route is taken by an observer he must eventually arrive at an appreciation of the Principal Side Panels through an understanding of their geometry, at which point his investigation can end, or he can continue further until overcome by mental exhaustion.

This/



a)Elementary Geometry.





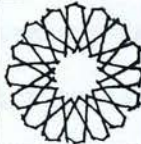
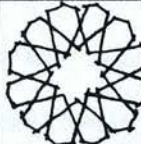
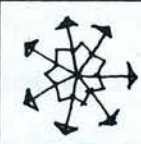












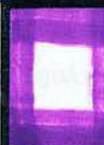

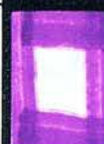
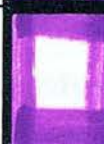


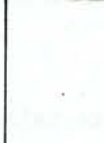
b)Ratios.

Fig.31. Principal Side Panels.

This is at least how I visualise the process, and without the help of some text written by a fifteenth century craftsman describing and analysing the "Do's" and "Don'ts" of Mamlūk decoration I must hope that my stumbling along the road to understanding is in some way related to that taken by the craftsman, he began with a theoretical proposal and produced an artifact, I begin with the artifact and will try to produce a satisfactory theoretical proposal. It must be underlined again, that I cannot be dogmatic about the precise order or route taken by someone else since I can only represent the order of my own reactions to an artifact, while noting the available alternatives.

Returning to the search for further Appreciation Levels: the first element which may be recognised is the solid and interlaced geometric line which is essential to the panel's success; next the eye might be drawn to the complete major node composed of sixteen large radiating petals, each one decorated with vegetal forms. I am now given a choice, either I concentrate on the interstices of the major node's central medallion, or I search out the other major nodes. Choosing the latter, the major nodes are found along the hypotenuse where they turn out to be semi-sixteen-pointed-polygonal-stars with eight petals included in the decorative area. (The excluded eight petals can be imagined and then discarded when the similarity to the complete major node is grasped). Continuing the investigation I can return to the intermediate centres, found earlier when studying the Panel's geometric subdivisions to look at them in greater detail, a quick review establishes that none of them is a complete polygonal star, but that they are subdivisions of a twelve-pointed polygonal star with decorated petals: in two positions half of the star polygon exists with six complete petals, and in another position an example with five complete petals plus two half ones, in the 45° angles are found eight parts of the star polygon each composed of one and a half petals. Extending the search to the minor nodes I encounter irregular star polygons coupled together/

DESIGN ELEMENTS OF MINBAR'S PRINCIPAL SIDE PANELS.

		1st AL	2nd AL	3rd AL	SUPPLEMENTARY LEVELS								
RIGHT PANEL	LEFT PANEL	TRIANGLE	SOLID LINE INTERLACED NUCLEUS	16-GON NUCLEUS	12-GON NUCLEUS	7-GON NUCLEUS	COMPLICATED PALMETTE	TREFOIL WITH BRACTS	TREFOIL	COUPLED TREFOIL TWISTED	ROTATING HALF PALMETTES	COUPLED PALMETTES	SCULPTED FLOWER
													
													

A.L.= APPRECIATION LEVEL

together which then link up with the major and intermediate nodes.

Assuming that the above order of Appreciation Levels is adhere to, and that frequent comparisons are made between the Minbar's left and right sides, the realisation is almost bound to dawn that each of the features so far isolated and described are common to both the Principal Side Panels. As the average observer is unable to carry concise mental images he may mistakenly consider the panels to be identical in all respects. In Figure 32 an attempt has been made to graphically represent the inter-relationships belonging to the two panels, note that their order is consistent with the order of the Appreciation Levels and also that this diagram is intentionally composed to illustrate the inconcise images which predict that the Panels are identical and which are caused by neglecting the more detailed elements. Any further explorations into the hidden qualities of the Principal Side Panels require them to be considered separately.

The previous paragraph concentrated on the negative aspects associated with the features which appear to be common to both Side Panels, if instead the positive qualities are considered then they can be seen as the visual expression of the craftsman's skills not simply his ability to carve well, but his inventiveness in combining similar sets of polygons beautifully but with different results, and his masterly sense of illusion, a quality he uses to great effect when it comes to the balustrade panels.

10.02

A Comparative Analysis

Had the choice been made earlier to attend to a detailed analysis of, for example, the major node and the Central Medallion on one or other side without any attempt at a general investigation the affinities in, and the contrasts in the two Side Panels which are themselves essential design elements/

elements might have remained in obscurity. However, this was not the case and as a result the details belonging to the individual Panels can be seen in the well defined context of one decorative area and at the same time they can be placed into a freer context embracing the two decorative areas. With this purpose in mind the extremely detailed material is best set out in tabular form, and as the Appreciation Levels have been proved to be a useful vehicle they shall be continued in the following order:

- a) Painted Areas
- b) Visual Identities
- c) Geometry of the Nodes

LEFT PANEL

a) Painted Areas.

Not one particle of paint remains, but we must assume the existence of paint at some time as patches of absorbed colours appeared when the stone was wet. On a purely visual inspection the following colours suggested themselves; dark red, blue, blue-black, black, white and gold. Without a chemical analysis to provide proof it is difficult to decipher one absorbed colour from another: such expertise was not available to me in Cairo.

The painted inter-carved petals of Ll beginning at the petal left of top centre and moving in a clockwise direction there follows the alternating colour sequence: blue-black; red; blue-black; etc.

RIGHT PANEL

a) Painted Areas.

Identical to the Left Panel with three exceptions, there is no evidence to indicate the use of blue, white or gold paint.

The same alternating colour sequence is found in Rl, beginning with the top petal painted blue-black; red; blue-black; etc.

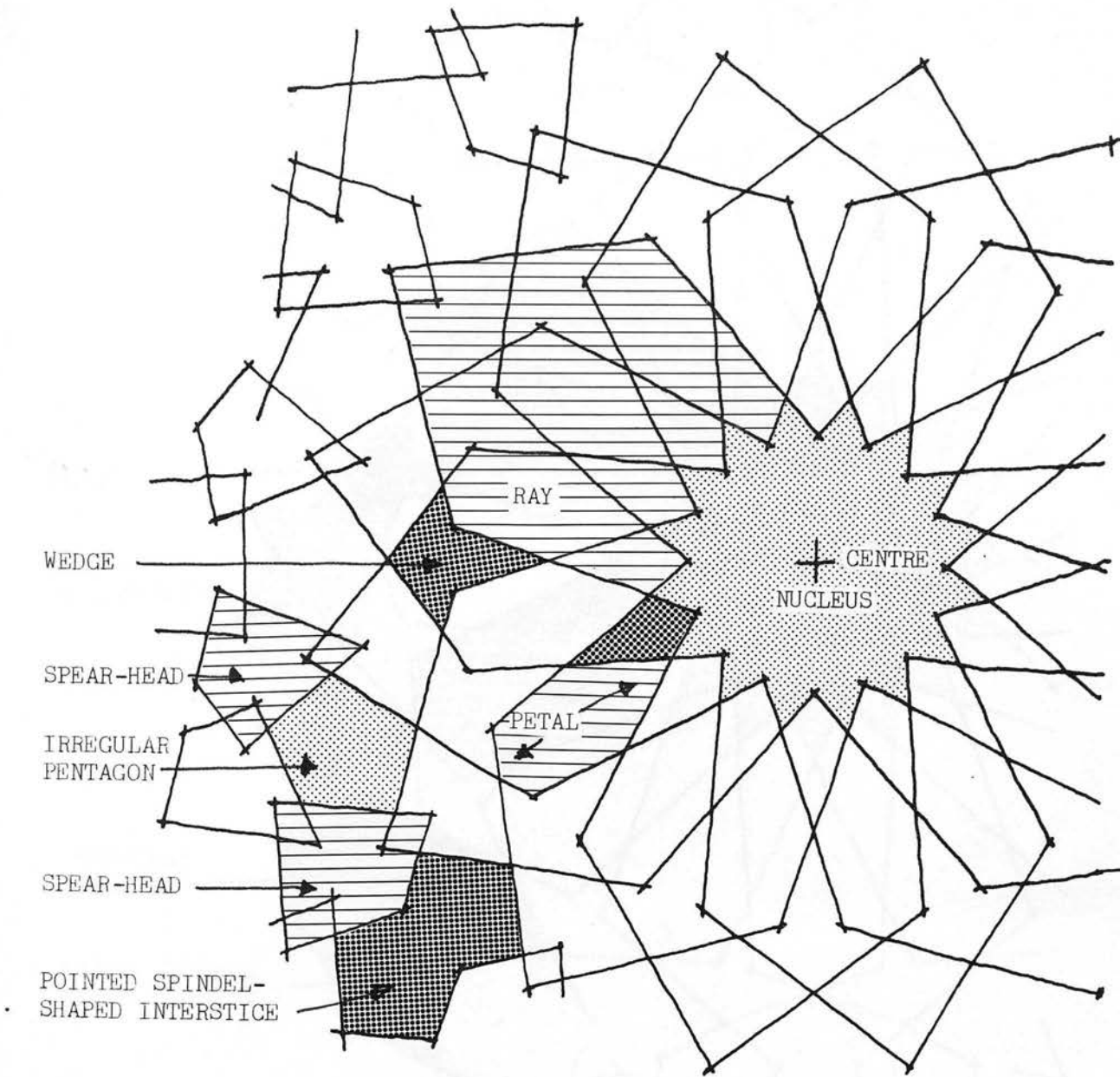


Fig.33. Decorated Principal Panel on the Left Side: showing named interstices.

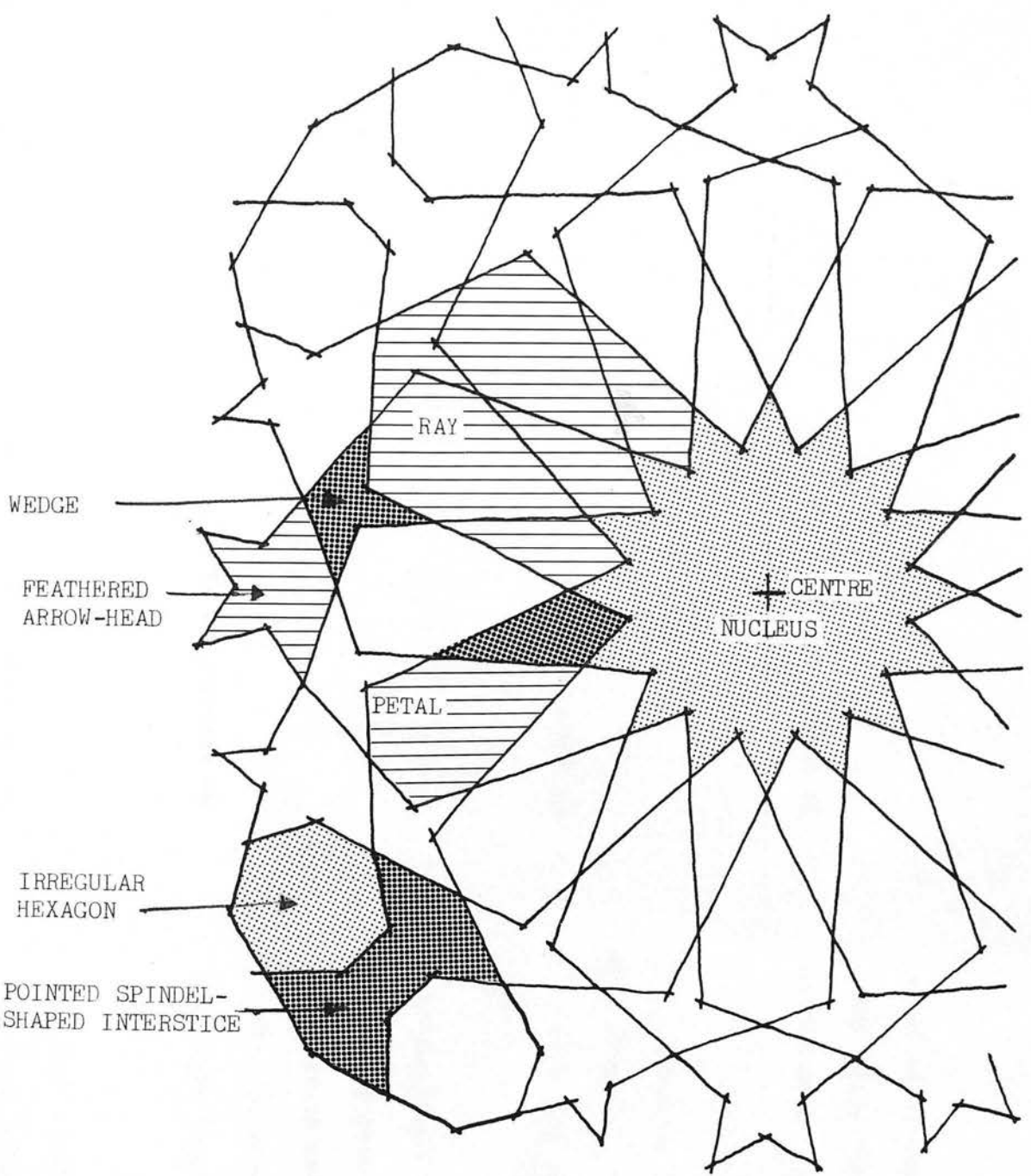


Fig. 34. Decorated Principal Panel on the Right Side: showing named interstices

The small hexagonal wedges separating the outer points of L1's petals are either blue-black or black.

No evidence in R1

The uppermost of the L1's half-Central Medallion indicates an overall coat of white paint with black lines. These black lines are possibly the construction lines of the inter-carved decoration, and were therefore absorbed by the stone before the white paint was applied.

No evidence in R1.

In L2 the petals are painted in the same colour sequence as those belonging to L1. Starting with the top left petal and moving in a clockwise direction they go: red, black, red, etc.

No evidence in R2.

The hexagonal wedges separating L2's outer points are void of any suggestion of colour, while the quadrilateral interstices between the inner points are blue.

No evidence in R2.

The inter-carved spindel-shaped interstices on the axes joining the centres of L1 to L2 are red: those connected to the complete L1 are flanked at right angles by spear-heads coloured black, the adjacent inter-carved pentagons are also black; those spear-heads and pentagons surrounding the uppermost L1 are blue.

The minor nodes formed by the coupled and irregular star polygons show slight indications of colour on their solid geometric lines, either blue or red. (It may seem strange that confusion can arise over the identification of those two colours, but it can). The star-shaped nucleus could have been either black or even gold as could the star polygon's spear-headed points which alternate with red. (Yet again confusion over two colours which normally oppose one another). The colour sequence/

No evidence in the inter-carved pointed spindel-shaped interstices.

No evidence in the minor nodes.

sequence around the left nucleus beginning at the top spear-head is red: at the spear-head common to the coupled nuclei, black: at the quadrilateral interstice joining the two nuclei, black: at the spear-head common to the nuclei, black: the spear-heads completing the circuit are red: black: red: black.

b) Visual Identities.
L1

The radiating appearance of L1's star is created as much by its minimally decorated interstices encompassing its extremities and its nucleus as by its sixteen inter-carved petals.

L1 has two categories of inter-carved petals repeated in a paired sequence with localised variations. This pairing was originally disguised by the application of paint in a 1:1 sequence/

b) Visual Identities.
R1

The radiating appearance of R1's star is created as much by the unadorned quadrilateral wedges encompassing its extremities and the minimally decorated interstices around its nucleus as by its sixteen inter-carved petals.

R1 has two categories of inter-carved petals in an alternating sequence. This sequence was supported by the application of paint in the same 1:1 sequence. Notice that the petals are larger than those of L1.

sequence not a 2:2 sequence.

The inter-carved semi-vegetal forms straddle the vertical and horizontal axes of Ll: the upper and right hand pairs differ slightly from the lower and left hand pairs, half of their number are red and half of them are black. Compare with cells F7 and C2 respectively in the Gateway's

mugarnas.

The inter-carved arabesque forms occurring either side of Ll's 45° axes have extremely slight differences produced by inconsistencies in their cutting; half of their number are red and half of them black. Compare with cell Cl in the Gateway's

mugarnas.

The minimally decorated interstices of Ll have internal relief lines shadowing their outlines.

The/

The inter-carved semi-vegetal forms occur in the petals on the vertical, horizontal and 45° axes of Rl, they are all painted black. Compare this item with cell F7 in the Gateway's mugarnas and note the differences produced by the addition of a top section.

The inter-carved arabesque forms occurring on the $22\ 1/2^\circ$ and $66\ 1/2^\circ$ axes have extremely slight differences produced by inconsistencies in their cutting, they are all painted red. Compare with cell Cl in the Gateway's mugarnas.

The minimally decorated interstices of Rl have internal relief lines shadowing their outlines.

The/

The Central Medallion (Drawings 99-100) at the nucleus of the only complete example of L1 is decorated by superimposed arabesque systems on three planes. Level with the solid geometric lines the upper arabesque system is initially seen as a self-contained system with a top bud and two side leaves forming a droplet, but when the lines of the inter-carving are removed leaving the outlines of the systems it is apparent that this upper system gives birth to the lowest system lying on the same plane as the shadow star outline. This, the lowest system, has two symmetrical halves meandering (cascading?) downwards with knops, single leaves, sprouting leaves, simple buds, bifurcating leaves with scroll ends, and finally, terminal full leaves with single leaf and scroll ends. About the Medallion's centre the last system is linked by knotted scrolls to the third system/

The Central Medallion (Drawings 104-105) at the nucleus of the only complete example of R1 is decorated by superimposed and interlaced arabesque systems on two planes. Level with the solid geometric lines the upper arabesque system is initially seen as self-contained emerging, from a bottom bud as a split stem with bifurcating leaves, the inner leaves continue upward to join and form a scrolled top bud before splitting once again to form arcing tendrils. This upper system is on the same plane as the shadow star outline. Appearing from below the ends of the tendrils on the lower plane are subordinate extensions interlaced with the second independent system; the extensions are composed of split stems, knops, one terminal leaf and one terminal full leaf with a single leaf and scroll ends. The second system is a self-contained and interlaced arabesque which includes bifurcated terminal leaves, terminal full/

system on the intermediate plane which is like C-curves placed back to back with knops, single leaves, terminal leaves, and terminal full leaves with single leaves. Observe that this Medallion is smaller than R1's.

The two half Medallions of L1 are decorated with interlaced and intertwined arabesques whose images are confusing because they do not seem to follow a recognisable and logical path.

The radiating appearance of L2's star is created as much by its minimally decorated interstices encompassing its extremities and nucleus as by the twelve inter-carved petals, this being the total number of petals in a complete L2 unit.

Two/

full leaves with single leaves, plus sprouting side leaves rising to a top bud. The sprouting side leaf on the left side has a half-overlap interlaced with the subordinate extensions. Observe that this Medallion is larger than L1's.

The two half Medallions of R1 are decorated with interlaced and intertwined arabesques whose images are confusing, but surprisingly they are larger versions of those seen in L1 suggesting that in the eyes and opinion of the craftsman they had a recognisable form.

The radiating appearance of R2's star is created as much by its minimally decorated interstices encompassing its extremities and nucleus as by the twelve inter-carved petals, this being the total number of petals in a complete R2 unit.

Two/

Two categories of inter-carved petals are repeated in a paired sequence. This pairing was originally disguised by the application of paint in a 1:1 sequence not a 2:2 sequence. Notice that the petals are slightly smaller than those of R2.

A feeling of tension or opposition is expressed through the placing of the two categories of inter-carving caused by the odd number of pairs to each half. Imagine the star at the mid point of the triangle's vertical side is complete; a pair of arabesque petals straddle the horizontal axis in the right half opposing them in the left half are paired semi-vegetal petals. It is just possible that an attempt was made to silence this expression of opposition by not including stars with more than six petals. As an extra precaution the star half way up the triangle's hypotenuse has a paired sequence mirroring its twin on the vertical side, this/

Two categories of inter-carved petals are repeated in an alternating sequence. This sequence was originally supported by the application of paint in the same 1:1 sequence. Notice that the petals are slightly larger than those of L2.

A feeling of tension or opposition cannot be expressed through the placing of the two categories of inter-carving as they are not paired. (One instance of pairing exists in the star at the mid point of the triangle's vertical side, but I assume this to be an oversight). Compare the semi-vegetal petals with those in R1 and with the cell F7 in the Gateway's mugarnas; and the arabesque petals with those of L1 and cell C1.

this ensures that only pairs of arabesque petals are seen to straddle the horizontal axes of L2 units. Compare the semi-vegetal petals with those of L1 and with the cell F7 in the Gateway's mugarnas, and the arabesque petals with those of L1 and cell C1.

The half petals along the triangle's hypotenuse have internal relief lines shadowing the geometric outlines of the interstices.

The wedges separating the ray's outer points have internal relief lines shadowing their outlines: the quadrilateral interstices between the inner points have incised lines shadowing their outlines.

Shadow half-stars in relief emphasise and concentrate the converging rays on L2's centre.

The inter-carved pointed spindle-shaped interstices

on/

The half petals along the triangle's hypotenuse are decorated in accordance with the inter-carved sequence: is this because they are larger than those half petals in L2 and so more easily decorated?

The minimally decorated interstices have internal relief lines shadowing their outlines.

Shadow half-stars in relief emphasise and concentrate the converging rays on R2's centre.

The inter-carved pointed spindle-shaped interstices

on/

on the axes joining the centres of L1 and L2 are decorated with a semi-vegetal form of the same ilk as the more commonly seen coupled trefoil. In the central areas of the flanking spearheads internal relief lines shadow the outlines. Sculpted cinquefoils with intermediate petals fill the adjacent pentagons.

Minor Nodes.

Unlike L1 and L2 there are no wedges separating the petal's outer points in the Minor Nodes formed by the coupled irregular star polygons, instead they are substituted by the pentagons described above. However, there are quadrilateral interstices void of decoration within the interlacing of the spear-headed petals. The spear-headed petals have internal relief lines shadowing their outlines. The identity of the Minor Node relies

to/

on the axes joining the centres of R1 and R2 are decorated with a split and twisted stems terminating in pairs of opposing half-palmettes. In the flanking heptagon exist a confused composition of three (?) semi-vegetal forms rotating about a central triangle. Filling the feathered arrowheads are simple trefoils, some with minor variations.

Minor Nodes.

Unlike R1 and R2 there are no wedges separating the petal's outer points in the Minor Nodes formed by the coupled irregular star polygons, instead they are substituted by the feathered arrow head described above. However, there are quadrilateral interstices void of decoration between the petals inner points. The irregular hexagonal petals enclose simple palmettes. The identity of this Minor Node relies to a great extent on the relieved shadow stars to emphasise its

presence/

to a great extent on the strength of the solid and interlaced lines of the spear-heads, and on the relieved shadow stars to emphasise its presence and concentrate the converging spear-heads towards its two centres.

c) Geometry of Nodes. (Left Panel)

The geometric figures centred on the nodes $L1/R1$ and $L2/R2$ can be combined into one repeat unit, for example, if the centre of the repeat unit is $L1/R1$ the square's four corners become the centres $L2/R2$ of the four quarter polygons, the same is true if the form is reversed with $L2/R2$ as the square's centre the four corners become the centres $L1/R1$ of the four quarter polygons. It follows that the smallest geometric unit housing the essential information is the 45° isosceles triangle whose hypotenuse joins the nodes $L1/R1$ and $L2/R2$ and whose other two sides are the vertical and horizontal axes of the polygons. But this triangle is only a derivative of the repeat unit and requires to be quadrupled to provide a complete repeat unit for analysis, the result is a return to the square repeat unit. (This triangulation does have a practical use when squeezing a decorated area of this size, a squeeze can be made covering only one or two of the triangles and once it is drawn full size can be checked against the other triangles.)

Two identifiable polygonal figures at $L1/R1$ and $L2/R2$ are known to be mutually compatible thus in pursuance

of/

of an understanding of their construction they can be considered as two repeat units without damaging their compatibility. The advantages in this approach are firstly, if the one repeat unit combining L1/R1 and L2/R2 is analysed the multitude of lines which will occur during point joining would obscure each others identity and purpose; and secondly, it is convenient to keep the same drawn scale for all the drawings to enable direct comparisons to be made and by splitting the solutions they can be presented in a standardised drawing.

L1 (Drawing 102)

The Basic Repeat Unit of L1 is a square with an inscribed double square or octagonal star which by extension can divide the circle's circumference into sixteen equal parts.

Through point joining a 16-gon¹ is constructed using the circumference's sixteen divisions, with further point joining the number of the circumference's divisions is increased to thirty two, in the process eight squares are produced.

Example, one of the squares is defined by the points 1, 9, 17, 25, in other words the points

of/

R1 (Drawing 106)

The Basic Repeat Unit of R1 is a square with an inscribed double square or octagonal star which by extension can divide the circle's circumference into sixteen equal parts.

Through point joining a 16-gon¹ is constructed using the circumference's sixteen divisions in the process four squares are produced. Example, one of the squares is defined by the points 1, 5, 9, 13, or in other words the points are joined 4 x 4. By joining

the circumference's even points of division to each other and similarly the uneven divisions joined, two octagons/

of division are joined 8 x 8. The next lines to be constructed only occur at the even circumference divisions. Example, from point 2 a line is drawn to join the intersections of the side 11-19 of the square 3, 11, 19, 27, with the side 5-13 of the square 5, 13, 21, 29, which coincides with the 12-28 diameter. A second line is similarly constructed to join point 2 to the intersection of 17-25 and 23-31 on the 24-8 diameter. Similar pairs of lines are constructed at all the even circumference divisions and will become the Preferred Lines of the ray's outer points in the final 16-gon. The next set of lines join points found along the paired lines to the odd circumference divisions. Example, the first of those paired lines drawn from point 2 intersects with the side 27-3 of the square 3, 11, 19, 27, this intersection is joined to the uneven/

octagons are produced. Continuing to procure the 'correct' repeat unit for R1 the sequence used in L1 has to be reversed, first the sides of the petals are constructed and then the ray's outer points. The sides are found by joining the intersections of the squares defined by the odd points to the intersections of both the octagons adjacent to the even point diagonally opposite the original even point. Example, where the side 16-4 of the square 16, 4, 8, 12, intersects with the odd octagonal's side 15-1, this point of intersection is joined to the intersection of the even and odd octagons' sides 8-6 and 7-9: similarly a second line is drawn from the intersection of 12-16 with 15-1 to the intersection of 8-10 and 7-9. Both of these lines are extended at either end to cut the circle's circumference. The construction of similar pairs of lines is repeated for each of the sixteen divisions and become the Preferred/

uneven point 17, which is adjacent to point 18 diametrically opposite to point 2. This process is repeated for the second line which intersects with the 1-9 of the square 1, 9, 17, 25, this intersection is joined to the odd point 19 which is also adjacent to point 18. This is repeated until all similar lines have been drawn, these lines become the Preferred Lines of the sides of the petals.

Preferred Lines for the sides of the petals. The next set of lines join the points of intersection of the extended lines and the circumference in a sequence more difficult to describe in general terms than in the particular. Example, where the line drawn through the intersections of 8-6 and 7-9 intersects with the circumference this last intersection is joined to the intersection between points 12 and 13 which is nearest to point 12. Similarly the other extension at 8-10 and 7-9 is joined to the intersection between points 4 and 3 which is nearest to 4. This is repeated until all similar lines have been drawn, these lines become the Preferred Lines of the ray's points.

Observe that in the Preferred Lines the 16-gon's rays each enclose three petals and that each petal belongs to three rays. If the Preferred Lines are traced a continuous figure is drawn after/

Observe that in the Preferred Lines the 16-gon rays each enclose two petals and that each petal belongs to two rays. If the Preferred Lines are traced four quadripartite propeller-like figures are drawn each/

after five circuits are completed.

Petals flank the vertical and the horizontal axes, and because there are two petals per ray the orientation of the apexes of the rays equate with those of R1. (This is easily appreciated if Drawing 99 is referred to).

L2 (Drawing 103)

A square with an inscribed hexagon creates the Basic Repeat Unit of L2, the circle's circumference is easily divided into twelve equal parts.

By point joining a 12-gon is constructed using the circumference's divisions, in the process a second hexagon is produced.

Utilising the points of intersection of the two hexagons the circumference's divisions are increased to twenty four. By joining the apexes

in/

each produced after one circuit.

Petals are placed on the vertical and the horizontal axes and because there are three petals per ray the orientation of the apexes of the rays equate with those of L1. (This is easily appreciated if Drawing 104 is referred to.)

R2 (Drawing 107)

A square with an inscribed hexagon creates the Basic Repeat Unit of R2, the circle's circumference is easily divided into twelve equal parts.

By point joining a 12-gon is constructed using the circumference's divisions, in the process a second hexagon is produced.

Pairs of lines are drawn from the apexes to specific intersections of the two hexagons and extended to intersect the circumference. Example, from point

12/

in one of the hexagons 2 x 2 two equilateral triangles are produced. Example, in the hexagon defined by the points 24, 4, 8, 12, 16, 20, the two equilateral triangles are 24, 8, 16, and 4, 12, 20. Having repeated this procedure for the second hexagon a 12-gon star is arrived at, its outer points become the Preferred Points for the ray's outer points. The next set of lines join the circumference's odd divisions to the outer points of the 12-gon star. Example, joining point 1 to the star's outer point at the intersection of 24-12, 6-14, and 10-18, similarly when point 23 is joined to the same outer point the pair of lines become the Preferred Lines defining the sides of the uppermost ray. Repeating the process twice at each of the circumference's odd divisions the ray's sides are found, and consequently the sides of the individual petals.

Returning/

12 a line is drawn to the point of intersection of 3-5 and 4-6 and extended to cut the circumference, similarly point 12 joins the intersection of 6-8 and 7-9 and extended to cut the circumference. Having repeated this process throughout the figure the intersections of the lines become the Preferred Points for the petals. By joining the mid-points of the sides in one of the hexagons, two equilateral triangles are produced. Example, in the hexagon 12, 2, 4, 6, 8, 10, the mid-points of 12-2, 4-6, 8-10, form one equilateral triangle and the mid-points of 2-4, 6-8, 10-12 form the second triangle. Repeating this procedure for the second hexagon a smaller 12-gon is produced near the centre of the repeat unit. The sides of these equilateral triangles become the Preferred Lines of the outer points of the rays. The next set of lines join the apexes of the small 12-gon star to the intersections of the extended lines and

the/

Returning to the 12-gon star, its outer points are now joined to its intermediate points of intersection. Example, from the star's outer point defined by the intersection of the lines 24-12, 2-18, and 6-22, a line is drawn to the star's intermediate point defined by the intersection 2-10 and 4-12, similarly the same outer point is joined to the intermediate point defined by 14-22, 12-20. Having repeated this process at each of the star's outer points the Preferred Lines of the outer points of the rays are found.

Observe that in the Preferred Lines the 12-gon's rays each enclose two petals and that each petal belongs to two rays. If the Preferred Lines are traced out four triradial propeller-like figures are drawn, each produced after one circuit.

A comparison of the Preferred Lines of L2 and R2 suggests that their greatest differences lie in the angles

of/

the circumference. Example, to facilitate this explanation consider the numbering of the small 12-gon's apexes reflects that of the first 12-gon; a line is drawn from the reflected point 12 to the circumference intersection nearest to point 5 in the segment 5-6, similarly a second line joins the reflected point 12 to the intersection nearest to point 7 in the segment 6-7. This is repeated for each of the reflected apexes becoming the Preferred Lines of the sides of the rays and consequently the sides of the individual petals.

Observe that in the Preferred Lines the 12-gon's rays each enclose two petals and that each petal belongs to two rays. If the Preferred Lines are traced out four triradial propeller-like figures are drawn, each produced after one circuit.

of the ray's points which results from the division of the circumferences into twenty four and twelve: the additional twelve points in L2 generate the sides of the rays, while in R2 the generating points are the inter-sections of the extended lines along the circumference.

Minor Nodes (Drawing 103)

As the Minor Nodes link L1 to L2 their construction has to be a combination of these two figures. The centres of the Minor Nodes occur at the intersections of lines radiating from the larger geometric figures and so they have different orientations depending on their positions within the overall design. The lines radiating from L1 are the central axes of the spear-heads on either side of the vertical or horizontal axes, L2's radiating lines are the vertical or horizontal axes. The central axes of the remaining spear-heads lie along the lines joining the centres to the mid-points of the adjacent sides/

Minor Nodes (Drawing 107)

As the Minor Nodes link R1 to R2 their construction has to be a combination of these two figures. This requires the introduction of the outer points of R1's rays into the drawing illustrating R2's Preferred Lines. The centres of the Minor Nodes occur at the intersections of the lines radiating from the larger geometric figures and so they have different orientations depending on their positions within the overall design. The lines radiating from R1 are the central axes of the petals on either side of the vertical or horizontal axes, R2's radiating lines are the vertical or horizontal axes. The central axes of the remaining irregular hexagonal petals lie along/

sides of L2's square repeat unit; e.g. in L2's Preferred Lines the right hand Node's centre is joined to the circumference's divisions 12 and 24.

To attempt to describe verbally the remaining point joining needed to establish the Preferred Lines of the Minor Nodes would only add confusion instead of helping to elucidate their construction as few of the lines are found by common or repetitive procedures, it is preferable to study the constructions of the elements in the drawing of L2's Preferred Lines.

One modification is necessary when combining the repeat unit of L1 to that of L2 and the Minor Nodes: the interlace formed by L2's vertical and horizontal/

along the lines joining the centres to the intersections of the extended lines with the circumference; e.g. in R2's Preferred Lines the right hand Node's centre is joined to the intersection nearest to the circumference's division 3 in the segments 2-3 and 3-4.

To attempt to describe verbally the remaining point joining needed to establish the Preferred Lines of the Minor Nodes would only add confusion instead of helping to elucidate their construction as few of the lines are found by common or repetitive procedures, it is preferable to study the constructions of the elements in the drawing of R2's Preferred Lines.

No modifications are necessary when combining the repeat units of R1 to R2.

horizontal rays with the Minor Nodes' spear-
heads has to be reduced in size to conform to
the actual relationships in the panel.

3
Earlier Analyses of the Principal Side Panels.

The first and the most perceptive of the analyses is that of Prisse d'Avennes which concentrated on the visual qualities and impressions expressed by the Left Panel, this was followed by the geometric analyses of Bourgoïn and more recently by Hankin. None of these scholars provides a satisfactory explanation of the methods used to convert the craftsman's original idea into the finished stone design; Prisse d'Avennes disregards this topic, and although the others by studying geometrical constructions and techniques must have been seeking the definitive answer they did not succeed in finding it, nor to my own regret does this study supply a final answer. However, the three geometrical analyses do provide valuable comparative material showing how the same basic information can be interpreted in a variety of ways.

5.1 Prisse d'Avennes includes all of the elements belonging to the Left Side's Principal Panel within a square (equivalent to the area of Ll's Repeat Unit).¹ (Plate LXXVII). He portrays accurately the geometric skeleton, with the reservation that the tinting technique used to represent the lines enlarges them so that they seem to embrace the shadow lines which, with a certain abruptness, separates them from the interstitial backgrounds. He interpreted correctly the broad categories of vegetal elements, their distribution and their shapes as well as those of the Central Medallion. Unfortunately there are a number of deficiencies in his detailing of these elements caused perhaps by the notational method adopted by him to describe and depict in the most economical way the forms he saw. I suggest that with him, as with any other person truly conversant with a decorative style, there is a direct relationship between the brevity and effectiveness of his notation and his ability to appreciate, recognise, analyse and interpret objects with feeling: ironically if he had not been so expert and knowledgeable he might not have been able to convey immediately/

immediately the visual images offered by the Panel, and consequently he would have had to spend time puzzling over the details before drawing them.

He recorded the self-contained arabesque systems with two palmette heads, and the inverted bottom bud in the central star polygon's petals; but he did not note the bottom single leaves, the side leaves or the extensions to the top palmette. Did he exclude those minor details because he appreciated that they were incidental to the visual needs of the interstitial design? If he did then he was following the medieval craftsman who on occasion ignored the same details as if he too considered them as being incidental to the spirit of the vegetal form, and that he only incorporated them to fill-out the design and provide a satisfactory aesthetic balance between the positive (vegetal) and the negative (background). In addition Prisse d'Avennes disregards the semi-vegetal forms with the bifurcating lower leaves and shows a preference for the more commonly used side buds. In the Central Medallion he recorded the upper arabesque system and the back to back C-curves of the intermediate plane, but when he attempts to describe the manner with which the shadow star's points are filled he once again submits to his proclivity for chinoiserie flowers over the arabesque.

If one conclusion has to be drawn from Prisse d'Avennes' illustration it is that it conveys generally accurate information gathered by an expert with a trained eye and that without actually reproducing the panel's details with all their blemishes he produced a more detailed and clearer image than could be achieved by a good photograph.

03.2

Bourgoïn published a most useful collection of 190 geometric designs along with their constructions and grouped in accordance with their geometric families: hexagonal, octagonal, dodecagonal, combinations of two star polygons, combinations of squares and octagons, combinations of three or four/

four star polygons, heptagonal and finally pentagonal designs.² For a fuller appreciation of Bourgoïn's 'Le Trait' we are indebted to Keene who endeavoured to identify in situ the geometric decorations on which Bourgoïn based his constructions, and having identified them Keene places any duplication of a specific construction in chronological order.³

Keene recognised Bourgoïn's numbers 133 and 134 (reproduced here as Figures 35 and 36) as illustrating the geometry found decorating the Principal Side Panels of the Minbar.⁴ If the two Figures are compared to the Repeat Units Combined (Drawings 100 and 105) it is revealed that Bourgoïn formalised and rationalised his geometric constructions causing disturbances about the major, intermediate and minor nodes as well as imposing a symmetry and regularity on the liminal interstices.⁵

What then are the differences produced by Bourgoïn's rationalisation and highlighted by a comparison of his number 133 with the Right Side's Combined Repeat Units? The most noticeable concern the major node, the equivalent of R1, the diameter of its nucleus' star polygon is reduced with a complimentary increase in the lengths of the petals and of the quadrilateral interstices between them and the latter's increase causes the depths of the wedges to be reduced. These deviations follow directly one of Bourgoïn's most subtle and constant rationalisations, he positions on the same line the mutual sides of the rays and petals with those diagonally opposite them when in fact they are splayed. It might be mistakenly presumed that Bourgoïn's lines are splayed but this is an example of the well known visual illusion which alters a shape by superimposing it on a specific background, it is often illustrated as a circle with radiating lines over which are placed a pair of parallel lines, one on either side of the centre, to produce the illusion of the parallel lines, curving away from each other. At the intermediate nodes, the equivalent of R2, again Bourgoïn disrupts the actual proportions by correcting the splayed/

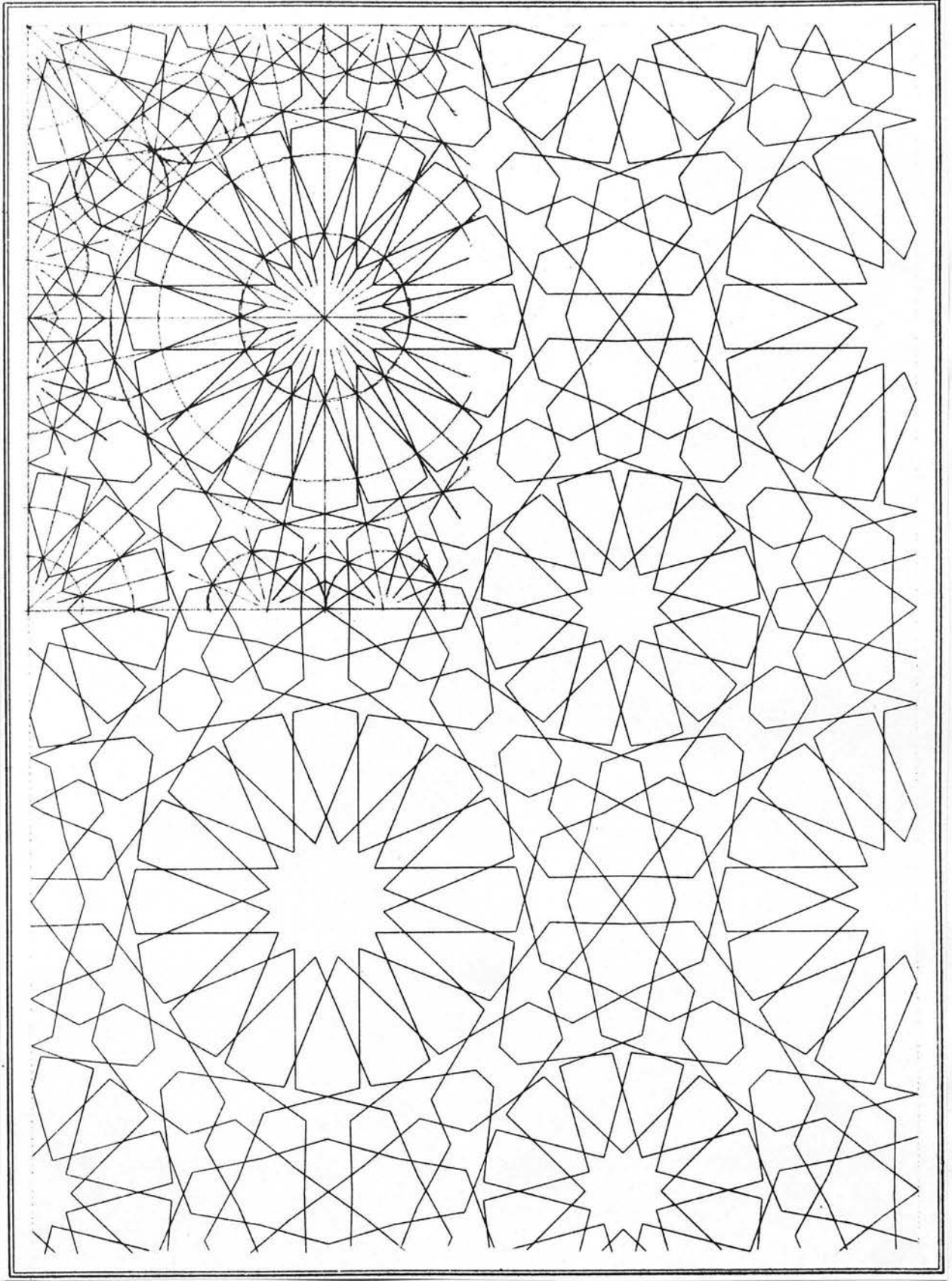


Fig.35. Bourgoin's Geometric Construction 133 the equivalent of the Principal Panel on the Right Side.

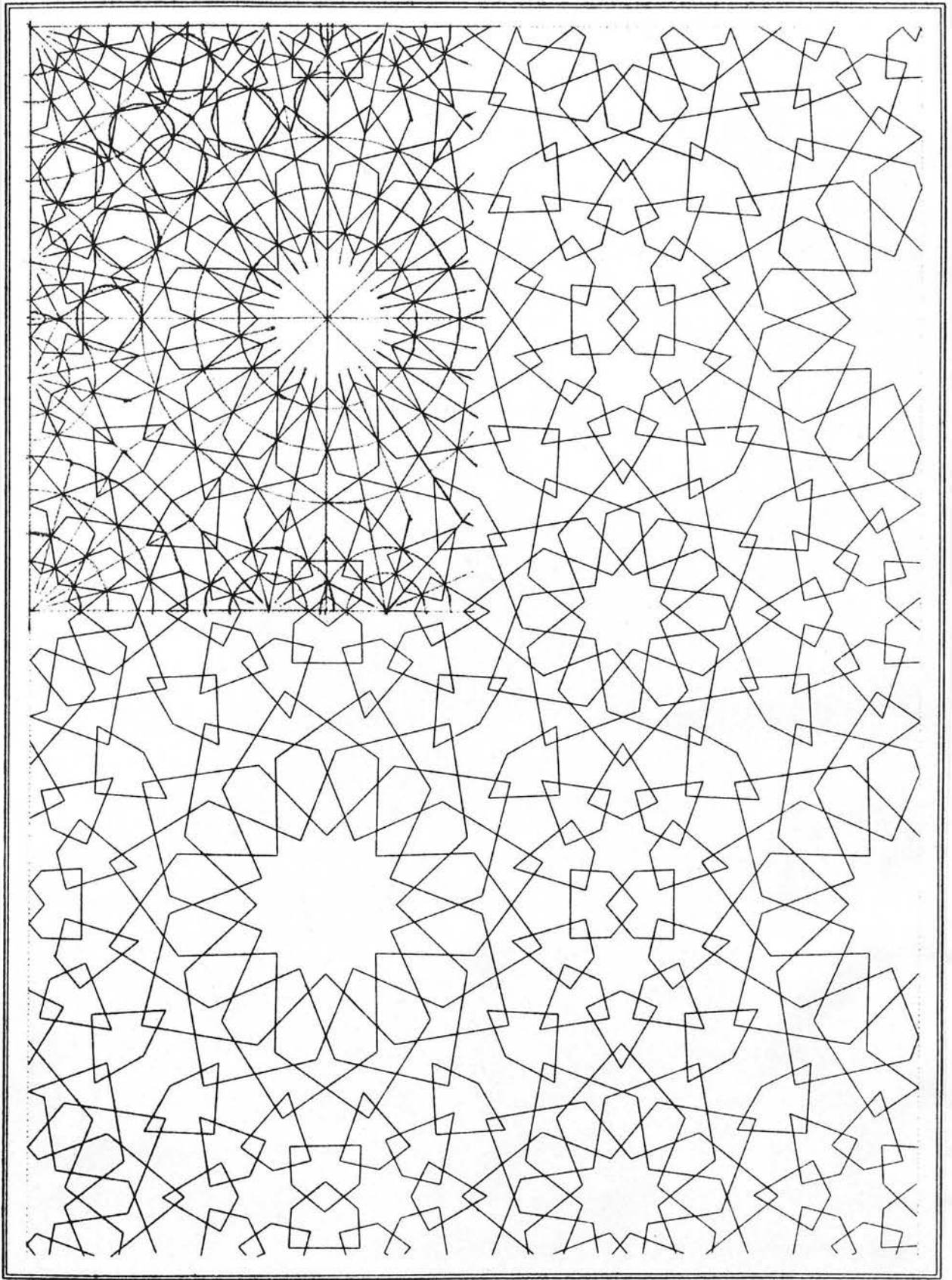


Fig.36. Bourgoin's Geometric Construction 134 the equivalent of the Principal Panel on the Left Side.

splayed sides as well as compressing the wedges' heads and shortening the pointed spindel-shaped interstices joining the petals of the major and minor nodes along the axes of their centres. His various corrections forced him to abandon his program of regulating elements and create in the minor nodes a greater irregularity in the hexagonal petals while reducing the nucleus' heptagonal star polygon to a heptagon with concave sides, an illusion due to the angle between each half side being a few minutes of a degree off 180° .

Similar deviations are found in a comparison between number 134 and the Left Side's Combined Repeat Units. In the major node, the equivalent of L1, the main cause of the deviations is the correction of the splayed mutual sides of the rays and the petals turning them into straight lines paired with their opposites. The diameter of the nucleus' star polygon is enlarged so shortening the lengths of the petals and rays, the quadrilateral interstices are fattened and the outer points of the rays are more acute. Similarly in the intermediate node, the equivalent to R2, the nucleus is enlarged and the length of the petals reduced. Bourgois is correct in the orientation of the outer points of the rays, but here it seems his desire to rationalise overpowered him. Can we assume he knew that in number 133 the petals of both the major and intermediate nodes were paired even though in one figure the petal's central axes coincided with the main axes and in the other the petals straddled them? If so, having already acknowledged the strong similarities present in numbers 133 and 134 did he decide that similar harmonic variations combined the major and intermediate nodes of 134? In his plate illustrating number 134 the petals are tripled at both the nodes, at one node the petals' central axes coincides with the node's main axes, and in the other they straddle the main axes, whereas in the actual panel the petals at the major node are tripled but in the intermediate node they are paired and in both instances the petals straddle the main axes. Other variations of this nature are found in the spear-heads/

spear-heads surrounding the minor nodes which are too regular, whilst the spear-heads flanking the pointed spindle-shaped interstices are blunt and the adjacent pentagons are too regular.

It is probably only to be expected that in both comparisons the more noticeable (and unhappy) deviations occur in the simpler liminal elements as they link the more complicated areas together, as they are likely to be the last elements to receive Bourgoïn's consideration and also because they are the simplest elements their visual images are immediately comprehended.

A most important fact to emerge from the studies of Bourgoïn and Keene is the close relationship between the Left and Right Panels. Bourgoïn in his corpus organised the patterns in an ascending scale of complexity within each of the geometric categories, thus the Right Panel's geometry (No. 133) is simpler than the Left's (No. 134). Keene then produces evidence to show that the geometry of the Right Panel had been used on one previous occasion whilst the Left's geometry was a brand new construction. Combining these factors I conclude that the Left Panel was deliberately created to compliment, and at the same time expand on, the geometry of the Right Panel because it had the more important position next to the Khānaqāh's main mihrab. The idea of the Right Panel acting as a point of reference for the more complicated Left Panel is consistent with the suggested theme connecting the Khānaqāh and the Minbar, as well as the latter's location behind a pillar. (See pp. 212-13).

03.3 In a paper to the Society of Arts in 1905,⁷ E. Hankin gives a 'design' method for the Left Side's Principal Panel based on an illustration of Lane-Poole's.⁸ As an introduction he explains the circumstances which led him to study the subject of complicated geometrical patterns in India.

'At/

'At length, by a lucky chance, I (Hankin) discovered a clue in a small room in one of the palaces of Akhbar, the great Mogul Emperor. Here, nearly hidden by dust and dirt, I found the actual construction lines used by the artist some four and a half centuries ago in producing an arabesque pattern.⁹ By means of the clue thus obtained, it became easy to draw the more complicated of the patterns. The clues to the simpler classes of patterns were obtained for the most part by observation and measurement.'

In this context of the practical application of geometry, how successful is Hankin's reconstruction of the Principal Side Panel? To find the answer his instructions were adhered to and the resulting geometric structure superimposed on the actual geometric skeleton achieved after taking paper squeezes. (Drawing 101)¹⁰. While reproducing Hankin's figure it was necessary to alter the sequence of his instructions along with some minor modifications if his results were to be regained. (Appendix F)

Step 1 - With the centres of the major star polygons, A, B and C (the equivalent of L1) defined and having drawn the radiating lines of their 16-gons the centres N and P (equivalent to the centres of the Minor Nodes) are found by bisecting the angles subtended at A, B and C. Step 2 - The radiating lines of heptagons centred on N and P are constructed, these intersect with the similar radiating lines of the 16-gons at points E, F, K, H, and U; EF, KH, and UF become the sides of the regular 16-gons.

Step 3 - From the centres R and T (equivalent to L2) the radiating lines of dodecagons are constructed to intersect with those of N and P at points D and L: DL becomes the side of the regular dodecagon. Step 4 - Lines EF, FU, KH and DL are almost the same length and when joined together can form a 'visually' regular heptagon.¹¹ Step 5 - The heptagons enclose smaller heptagons found by the intersections of the lines radiating from centres N and P. Step 6 - The described circles of the 16-gons in this reproduction are placed at the extremities of the outer sides of the petals and at the internal points of the nuclei: these circles do not have the same proportional radii as in Hankin's figure but later in his construction/

construction he places the circumferences of these circles the petals extremities and the nuclei's points. Step 7 - Each of the sides of the 16-gons, dodecagons and the heptagons is divided into three equal parts. The points defining the extremities of the petals are now positioned along the circumference of the larger described circles along with the marking of the points of intersection between the radiating lines and the smaller enclosed circle. By joining these points together the lines of the nuclei, petals and rays are constructed.

With the completion of Drawing 101 a direct comparison can now be made between Hankin's construction and my own based on the paper squeezes. Was it a coincidence that when drawing the points of the rays they meet the apexes of the smaller heptagons? This is now revealed as merely a coincidence as this meeting depended on the variable radii of the described circles and by the fact that in the final analysis Hankin's lines can differ dramatically from the actual lines shown in Drawing 101 as dotted. This divergence is attributable to Hankin's adherence to the assumption that the sides of the three polygons are all divided into three, a construction he may have adopted from Bourgoïn, or because of his obvious belief in an underlying symmetry. As a result his liminal interstices must also differ from their actual shapes.

Hankin's real value is his quick and easy method for drawing geometrical designs appropriate to the intent and scope of a sketch book, he does not provide a method sufficiently accurate to allow any statement to be made along the lines of 'This is the geometry of ...'. As such his method and results are comparable with those of Bourgoïn even though he says, 'Bourgoïn's drawings are made with a wonderful skill and industry, but the description he gives of the geometrical construction of the patterns is of little practical use and serves merely to show how his remarkable skill as a draftsman has enabled him to surmount the difficulties of his task'.¹²

11.01 Introduction

The balustrades are enriched by a total of thirteen decorated panels each, composed of six squares, two triangles, a central rectangle, and four other rectangles.¹ It is normal that the external decoration of a pair of balustrades cannot be seen at the same time and so cannot be compared to each other until the observer moves over from one side to the other side. This 'separation factor' is used by the designer of Qāyrbāy's Minbar to great effect, it produces intriguing liaisons dependant on the previous experiences of the observer which are difficult to verify because the separation factor is not only concerned with position, but it embraces the time lapse from an observation on one side and the verifying observation on the other side. During those seconds the mental image of the complete panel will blur forcing a third observation on the observer so involving yet another time lapse.

From the primitive appreciation levels an impression can be gained that the decorative features of the balustrades are identical and that they are symmetrical about the central panels: the irony of this immediate impression will become apparent as the descriptions proceed. On attaining a higher appreciation level doubts arise over whether or not they are identical, and if they do differ how do they differ? Such a dilemma invites the enthusiast to continue the search comparing one panel with another and trying to evolve permutations which might eventually lead to a knowledge of which panels are identical. The interrelationships revealed at the higher appreciation levels are represented in Figure 36.

Much more detailed interrelationships exist which were undoubtedly apparent to the designer, they cannot be explained away as coincidences because they appear in a well structured and contrived format which can either inhibit or/

or lead the observer to a fuller aesthetic awareness. It is the dualistic nature of the clues that express the designer's extraordinary genius.



Figure 31
Integral Identification
Integral Identification
Integral Identification

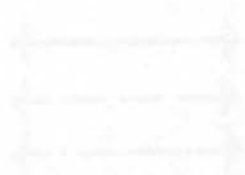
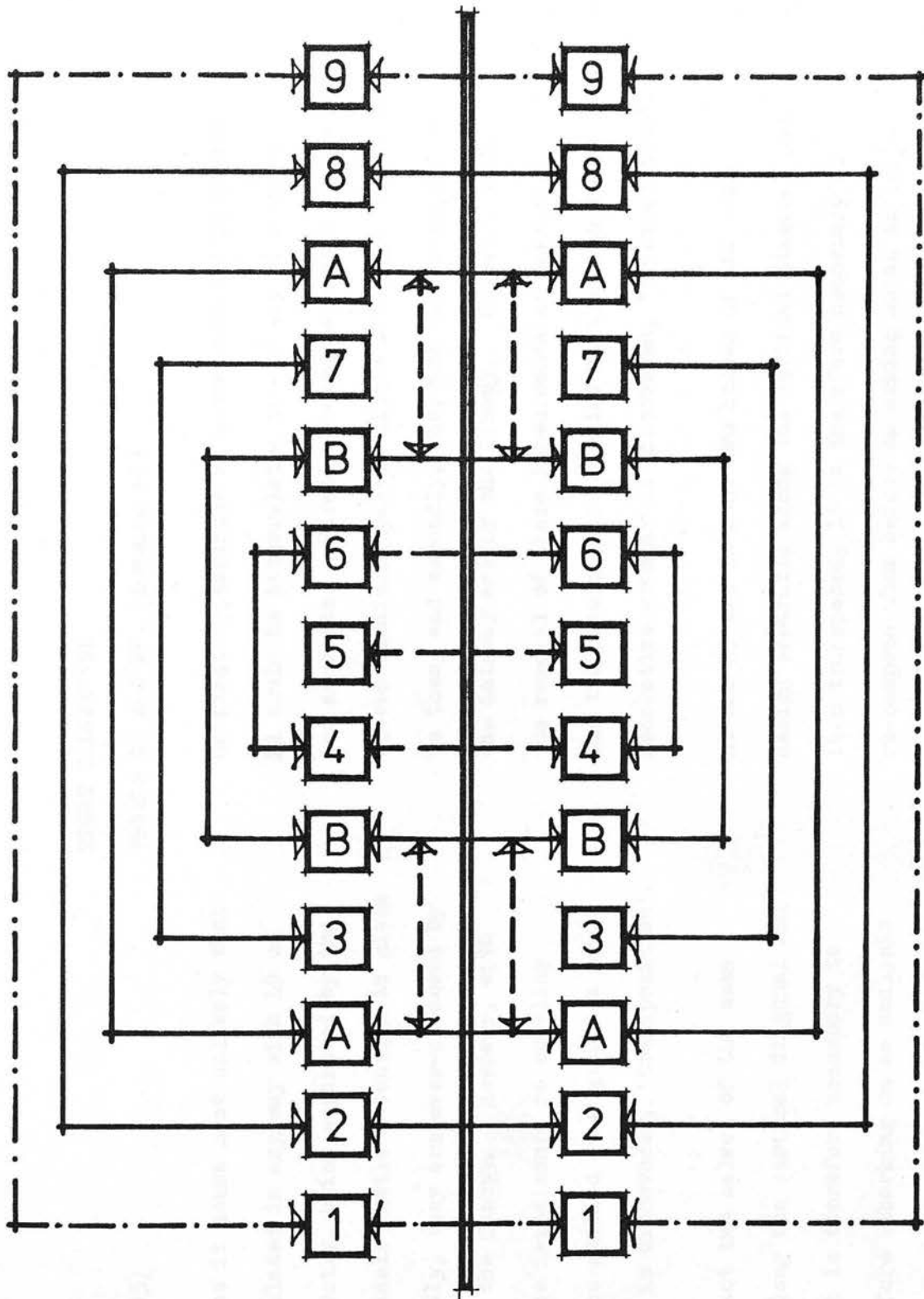


Fig. 31. Integral Identification System, the Mirror's Left






Direct identification 
 Misinformed identification 
 Ignored identification 

Fig.37. Basic Interrelationships between the Minbar's Left and Right Balustrades.

11.02 A Comparative Analysis

LEFT BALUSTRADE

PANELS L1 AND L9, (Drawing 95)

On first appearances it seems most unlikely that L1 could be interrelated in any way with L9 on two accounts. Firstly, being separated by the eleven remaining panels little attention is given to them, and secondly, they are over-shadowed by the Gateway and by the Canopy. However, with the removal of these impediments so enabling the two panels to be studied at a glance a new decorative grammar is discovered, 'transposition'.

L1 and L9 are in fact two halves of the same design separated along the vertical diagonal and then transposed, it is therefore necessary to re-compose them before embarking on an analysis of their mutual geometry.

RIGHT BALUSTRADE

PANELS R1 AND R9, (Drawing 96)

On first appearances it seems most unlikely that R1 could be interrelated in any way with R9 on two accounts. Firstly, being separated by the eleven remaining panels little attention is given to them, and secondly, they are over-shadowed by the Gateway and by the Canopy. However, with the removal of these impediments so enabling the two panels to be studied at a glance a new decorative grammar is discovered, 'transposition'.

R1 and R9 are in fact two halves of the same design separated along the vertical diagonal and then transposed, it is therefore necessary to re-compose them before embarking on an analysis of their mutual geometry.

Visual Identities.

In the Re-composed unit the geometric lines are solid with shadow lines in relief, interlacing occurs only at the two outer points of the octagonal star nucleus on the horizontal diagonal. On the horizontal and vertical diagonals are placed converging feathered darts with bars placed on the 45° axes and emanating from the four droplet terminals of the star nucleus. At the four corners are quarter octagons with a droplet terminal and converging half darts along the panel's adjacent sides.

The above description hints at another grammatical structure involving positive and negative interrelationships between Ll-L9 and Pl-P9, but for a complete answer a detailed analysis of the geometry/

Visual Identities.

In the Re-composed unit the geometric lines are solid with shadow lines in relief, interlacing occurs at four of the outer points of the octagonal nucleus on the 45° axes. On the vertical and horizontal diagonals are pseudo-feathered darts emanating from the octagonal nucleus, i.e., the feathered appearance is given by a droplet terminal belonging to the shadow lines not the nucleus. Separating these pseudo-feathered darts are other darts placed on the 45° axes. At the four corners are quarter octagonal stars with emanating half darts with bars along the panel's adjacent sides.

The above description hints at another grammatical structure involving positive and negative interrelationships between Rl-R9 and Ll-L9, but for a complete answer a detailed analysis of the geometry

is/

geometry is required.

is required.

The Geometry

The Basic Repeat Unit is an inscribed double square or octagonal star with the circumference divided into sixteen.

The Geometry

The Basic Repeat Unit is an inscribed double square or octagonal star.

The procedures used to establish the geometry of the Principal Side Panels involved the subdivision of the overall repeat unit into two compatible repeat units, this process can be reversed with advantage so that by fully developing each corner of the known repeat unit it becomes the centre of a new hidden repeat unit.

The procedures used to establish the geometry of the Principal Side Panels involved the subdivision of the overall repeat unit into two compatible repeat units, this process can be reversed with advantage so that by fully developing each corner of the known repeat unit it becomes the centre of a new hidden repeat unit.

The Hidden Repeat Unit of LL-L9 has the same base as RL-R9, but when its final form is compared to the previously known unit of RL-R9 a number of the Hidden unit's interstices differ from/

The Hidden Repeat Unit of RL-R9 has the same base as that of LL-L9, but when its final form is compared to the previously known unit of LL-L9 a number of the Hidden unit's interstices differ from/

from their counterparts. The reason for these enlargements is that had they not occurred the individual interstices would not have been able to effectively play their part in the role of clarifying and defining L1-L9.

It could be expected that the interlacings would be repeated four times around the nucleus, but they are not: they are only found on the re-composed Unit's horizontal diagonal, and as the interlace in both instances is an 'over' on the downward line there exists a reversed symmetry. As a consequence I suggest that a reversible template including the direction of the interlace was made which fitted both panels.

PANELS L2 AND L8 (Drawing 98)

The panels L2, L8, R2 and R8 are identical to each other and are composed of two design fields, the upper field is a ribbon development and the lower is composed of a self-contained arabesque system.

The/

from their counterparts. The reason for these modifications is that had they not occurred the individual interstices would not have been able to effectively play their part in the role of clarifying and defining R1-R9.

The expectation that the interlacings would be repeated four times around the nucleus is fulfilled. As in both panels the interlacings on the downward line are 'over' and then 'under' there exists a reversed symmetry. As a consequence I suggest that a reversible template including the direction of the interlace was made which fitted both panels.

PANELS R2 AND R8 (Drawing 98)

The cusped ribbon development descends from the panel's two upper corners to a droplet terminal at the midpoint of the panel's base line.

The two symmetrical halves of the self-contained arabesque system can only be traced by one continuous line if the starting point is the top bud, this however may seem awkward initially as it requires the direction of the traced line to oppose the arabesque system's upward direction which is performed by the sprouting side leaves. If any other embarkation point is chosen from which the tracing of the system is to begin then the operation would need to be carried out in opposite directions. The elements encountered in the system are the following: top bud, sprouting side leaves; half-palmette terminal with scroll ends, a single leaf and a half-overlap; trifoliated heads; whorl; split leaves leading to scroll terminal; single leaves; knotted scrolls.

PANELS L3 AND L7 (Drawing 97)

The two panels have solid and interlaced geometrical lines defining a central decagonal star and quarter decagonal stars at the corners. Enclosed in these nuclei are shadow stars and in the liminal interstices shadow lines, with the exception of the quadrilateral interstices flanking/

PANELS R3 and R7 (Drawing 97)

The two panels have solid and interlaced geometrical lines defining a central hexagonal star nucleus and quarter dodecagonal star nuclei at the corners. Enclosed in these nuclei are shadow stars and in the liminal interstices shadow lines, with the exception of the 'dice box' /

flanking the nuclei and the pointed spindle-shaped interstices which are too small.

When the two panels are viewed in situ and therefore separated from one another by other panels they may present an observer with a dilemma. He will recognise that the central and corner nuclei have respectively the same number of points in both panels, suggesting that they are identical. He is then liable to see, lying mid-way between these nuclei, lines consistent with a truncated rhomboid figure, but he will also see that their orientation changes from one panel to the other. This is the clue required to completely understand the pair of panels, their relative axes have been turned through 90° .

box' interstices and the centres of the interlacings which are too small.

When the two panels are viewed in situ and therefore separated from one another by other panels, an observer is most likely to see them as identical in all respects; he will recognise that the central and corner nuclei have respectively the same number of points in both panels suggesting that they are identical. Maybe he will stop his investigation here, but if he does not what reasons would there be to continue?

He could be aware of the grammatical structures and games enjoyed by the Mamluk designers and having already noted the abundance of these 'plays' in the Minbar's decoration he may hesitate before accepting the synonymy of the two panels at face value.

He may on the other hand notice that the central star/

star nucleus is rotated relative to the other. Assume he starts his investigation with the vertical axis of R3 and observes that on this axis are two irregular hexagonal shaped petals, he then makes a comparison between it and R7 and finds that the two irregular hexagonal petals no longer coincide with the vertical axis and that they have been rotated through 30° , in other words through half of the angle subtended by the points of the star nucleus. This is visible demonstrable and therefore must be correct, or is it? This cannot be the answer the designer wished us to find, although no doubt he foresaw this as an impediment thwarting and hindering investigations, but he makes certain that the clue to the two panels is readily found elsewhere on the Minbar and in the most obvious place assuming the Basic Inter-Relationships between the Minbar's Left and Right Balustrades have been uncovered. (Figure 37).

The answer rests in the complimentary panels on the
Left/

Left Balustrade, L3 and L7, like them R3 and R7 have been turned through 90° . (When explaining the characteristics of the Minbar to others involved in, or interested in Islamic art on visits to the Khānaqāh, even after they were told the panels differed from one another it took some time for them to overcome their disbelief and use their eyes to hunt out the changes in orientation).

The geometry of the panels is complicated through using a combination of five rectangles to generate the design of the panels' square area, and unlike most decorative areas a modicum of trigonometry is necessary before the graphical subdivision is begun. In Figure 38A the properties of a decagon are shown: the subtended angle at its centre is 36° and the internal angle at the apexes is 144° ; therefore the angle 0, 5, 4 equals 72° . By producing line 5-4 to intersect the/

Following the practice used to analyse the Principal Side Panels, the differing polygons at the centre and at the corners are separated to provide their own but compatible repeat units. In each case the Basic Repeat Unit is an inscribed double hexagon, with the circumference of the describing circle subdivided into twenty four equal parts. These points of division are joined 7 x 7 and some of the resulting lines become the Preferred Lines of the liminal interstices: this imposes on the repeat/

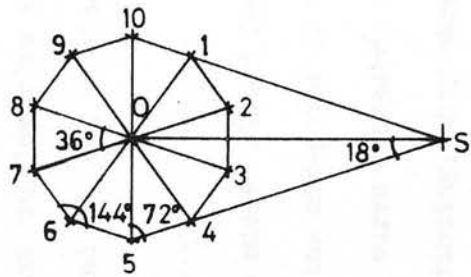
the figure's horizontal axis at point S, the right angled triangle O, 5, S is constructed with angle O, S, 5 equalling 18° . Utilising this information the decagon can be transferred to the square with the assurance that the two geometrical figures are related.

Figure 38B shows how the transference is made. Pairs of lines are drawn from centre O of the square ABCD and from the mid-point of its vertical side, S at 18° degrees to the horizontal axis to intersect at points 2 and 3. The line 2-3 bisects the apotheme O-S in square ABCD, and the length of O-2 and O-3 is equal to the radius of the circle describing the decagonal star.

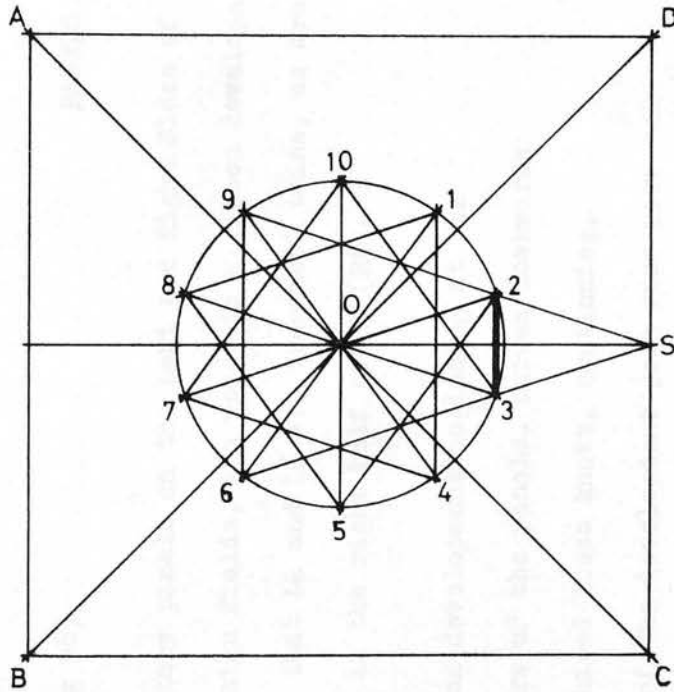
In the Point Joining, (Drawing 97) arcs centred on points 5 and 10 are drawn through the points 3 and 7 and points 2 and 8 respectively. These arcs/

repeat units exactly the same external shape. A slight variation is required in the liminal lines where they form the 90° angles of the intermediate node.

Only the nuclei of the Central Repeat Unit and the Hidden Repeat Unit differ in the Point Joining and subsequently in the Preferred Lines. The Central Repeat/



The Properties of a Decagon.



Relationship of the transferred Decagon to the Enclosing Square.

Fig.38. Panels 3 and 7 on the Left Balustrade: Decagonal Relationships.

arcs cut the horizontal lines passing through points 5 and 10 to produce the rectangular Repeat Unit.²

Repeat Unit's is based on the hexagonal star surrounded by irregular hexagonal petals, and the Hidden Repeat Unit's is a double hexagonal star (dodecagonal star) with radiating spread-heads.

PANELS I4 AND I6 (Drawing 98)

Again complimentary panels on the Left and Right Sides of the Minbar are at first glance taken to be identical; each has two design fields, the upper is a ribbon development and the lower an arabesque. On closer examination it is seen that I4 and I6 are identical twins, as are R4 and R6, and it also becomes clear that the left half of I4 (I6) is the right half of R4 (R6).

The cusped ribbon development beginning at the two upper corners of the panels, curves downwards to form heart-shaped loose knots, continuing, the two halves of the development join once more at the centre of the panels before again bifurcating and continuing their descent in ogival curves to a second set of heart-shaped loose knots and then on to half-droplet terminals at the/

PANELS R4 AND R6 (Drawing 98)

The cusped ribbon development begins by bifurcating at the mid-point of the upper sides of the panels and curve downwards to form heart-shaped loose knots, continuing, they caress the vertical sides of the panels at their mid-points and continue their descent in ogival curves to a second set of loose knots and then on to join finally at the mid-point of the base-lines of the panels.

the lower corners of the panels.

If the ribbon developments of L4(L6) are compared to those of R4 (R6) a significant addition is found in the former pair. The lower terminal points of the developments are half-droplets unlike the simply joined termination in the panels of the Right Side. I think it may safely be assumed that the reason for this divergence is due to the designer's continual search for clarity and definition in his designs, thus by splitting the terminal points in L4 and L6 so that they coincided with the corners of the panels he re-emphasised them by introducing the half-droplets. Another variation occurs in the order in which the heart-shaped loose knots are interlaced, when they were first observed I thought that here was a possible clue to the type of template used, not its material form, but whether two templates were used repeatedly to construct the four panels by turning them to provide the correct orientation of whether one template covering the total panel area was reserved for L4 and L6 and another reserved for R4 and R6. Unfortunately the 'irregularities' in the interlacing are in themselves inconsistent as is shown by the symbols in Figure 39. Each of the panels has been halved allowing the left halves of L4 and L6 which are identical in most respects to the right halves of R4 and R6 to be placed directly above them. To assist in the making of the decision whether or not an interlace is 'over' or 'under' the direction of the ribbon developments' movement is assumed to be downward. Referring to Drawing 98 and to Figure 39 it is obvious that L4 and L6 have the same interlacing arrangements, but it is also obvious that they do not conform to the unwritten law that interlacing should follow an alternating sequence of over, under, over, etc., since if the developments are traced/

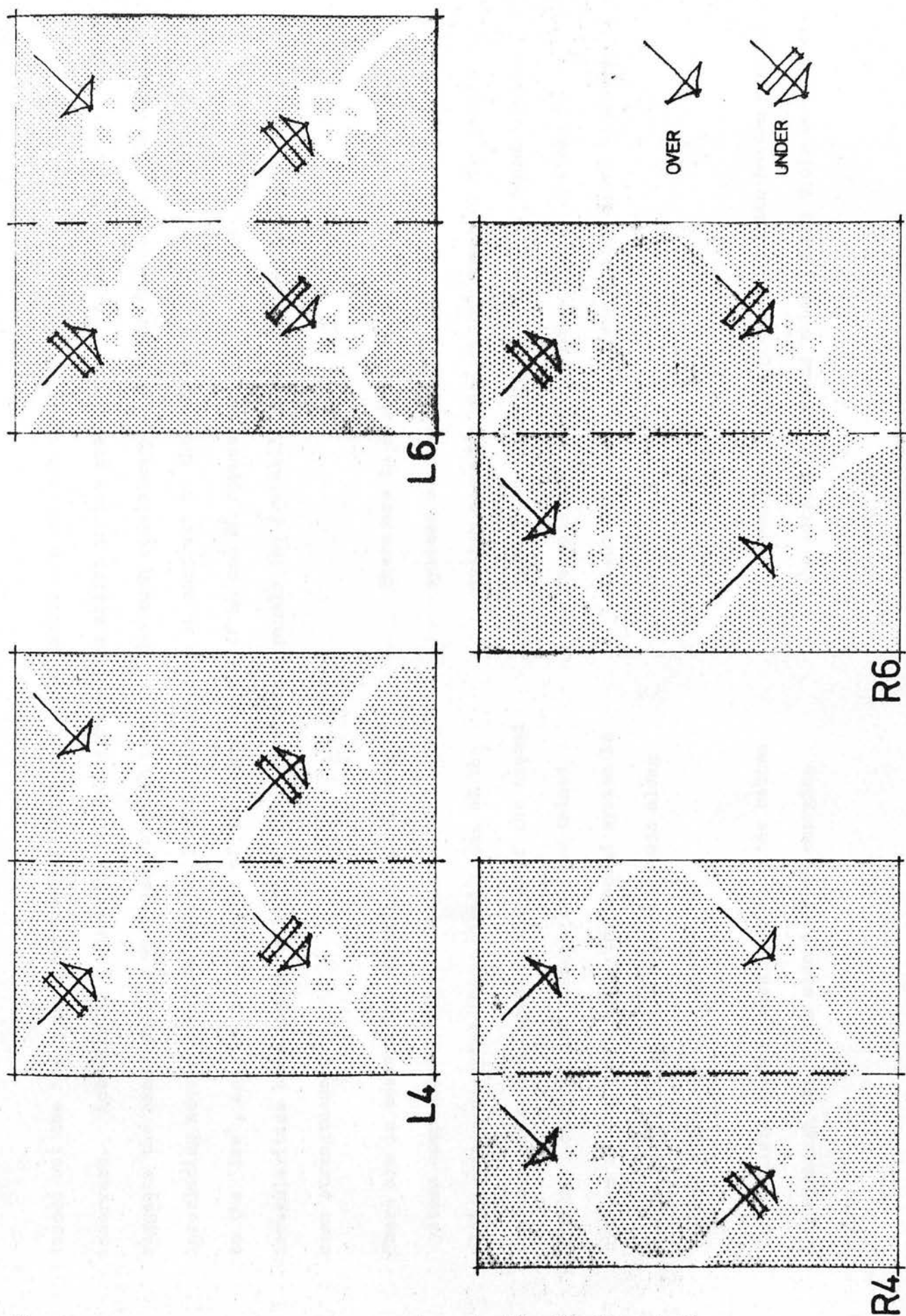


Fig. 39. Direction of the Interlacings in L4, L6, R4 and R6.

traced out the interlacing in the left halves of both panels are correct but those in the right halves are incorrect. Actually in a minor way this discovery does assist in the search for a template form, it suggests the same template was used for both panels. No such consistency appears in R4 and R6. The interlacing sequence in the left half of R4 breaks down in contrast to the left half of R6 which conforms to the 'law', and the interlacings of the right halves of R4 and R6 oppose one another. Had these irregularities been common to both of the Right Side's panels the probability of one template might have been strengthened.

There are in essence two interlaced arabesque systems composed in such a manner that one complete system occupied the central areas of the panels between the opposing halves of the second system. To consider them as self-contained systems is incorrect since the second system is joined to the first by way of half-buds along the base-lines of the panels.

The complete system grows up out of the bottom bud although there are also 'roots' emerging below/

There are in essence two interlaced arabesque systems composed in such a manner that one complete system occupied the central areas of the panels between the opposing halves of the second system. To consider them as self-contained systems is incorrect since the second system flows directly into the first.

The complete system grows out of the bottom buds of the secondary systems which unlike their complimentary/

below the bud to end in full terminal leaves with scroll ends incorporating half-palmettes and single leaves. In between the bud and the full terminal leaves are the half-buds described in the last paragraph.

Instead of listing the numerous but commonly found vegetal elements belonging to both pairs of panels it is perhaps more profitable to continue concentrating on the modifications made to the two systems which were required by the different placings given to the arabesques in I4(L6) and R4(R6). To simplify this exercise I4(L6) will be considered as the standard design. The knotted scrolls either side of the complete system's bottom bud are removed in R4(R6). The whorls on the sides of the panels just below the upper corners are in themselves reversed and in R4(R6) are changed to downward pointing trifoliated heads. The form of the element incorporated by the central buds of the large upward pointing trifoliated heads of the secondary system in I4(L6) are changed slightly when they become parts of the complete system of R4(R6).

The visual form of I4(L6) gives the impression through the ribbon development (if the heart-shaped loose knots are ignored) of the forms seen along the 45° axis of the Decorated Onion Dome.

ary system in I4 (L6) have replaced the full terminal leaves and demi-buds for knops and crescent terminal leaves.

The visual form of R4(R6) gives the impression through the ribbon development (if the heart-shaped loose knots are ignored) of the forms seen along the 0° axis of the Decorated Onion Dome.

PANEL L5 (Drawing 98)

The panel is composed of two design fields, the upper field is a ribbon development and the lower chinoiserie elements.

At the centre of the ribbon development is a medallion with eight cusps, the top and bottom are ogival extending to two fleury terminals.

The chinoiserie system begins at a full flower centred on the ribbon medallion, its bifurcating stalk has side shoots with trifoliated leaves and stipules, the stalks rejoin at a double knop immediately bifurcating to continue up the panel's sides with simple leaves, trifoliated leaves, opposite leaves, and trifoliated flowers. Above the original full flower the two halves of the system each bifurcate so that their lower stalks meet each other before

terminating/

PANEL R5 (Drawing 98)

The panel is composed of two design fields, the upper field is a ribbon development and the lower chinoiserie elements.

At the centre of the ribbon development is a medallion with eight cusps, the top and bottom are ogival extending to two fleury terminals.

The chinoiserie system begins at a trifoliated flower centred on the ribbon medallion, its bifurcating stalk has simple leaves, the stalks rejoin at a double knop immediately bifurcating to continue up the panel's sides with simple leaves, full flowers, leaves with quadruplicated stipules, trifoliated leaves. Above the original trifoliated flower the two halves of the system each bifurcate so that their lower stalks meet each other before terminating in trifoliated flowers: meanwhile the upper stalks

meet/

terminating in trifoliated flowers: meanwhile the upper stalks meet to form a heart-shaped bud, beyond it they split for the last time to end with simple leaves and full flowers.

meet only to bifurcate once again, the inner pair rejoin to form a heart-shaped bud; the outer pair continue on to the panel's sides with trifoliated flowers, below each is a trifoliated leaf and above a trifoliated flower with either side a leaf or a cordate.

In the outer areas of the panel and level with the original trifoliated flower are 'floating' simple leaves and trifoliated leaves, one of the latter elements having an additional side leaf. It seems likely that they were intended as a continuation of the system where it bifurcated above the original trifoliated flower, had this connection been made the already intricate carving would have lost its logical progression.

The changes at the centres of the Minbar's balustrades, which have been found to occur in what are initially assumed as identical panels, are in my view characteristic of the thought, care and the positive-negative balance/

balance found in the best architectural decoration of the Qāyṭbāy Period. The positive space, provided by the combination of the ribbon and vegetal is contrasted with the negative space of the background, which in itself is an all-important ingredient without which the clarity of the design can be obscured. The positive ribbon development is identical in both panels; the weighting of the positive vegetal systems is the same in both panels, but the elements are found to be interchangeable while the linear development or progression of the stalks is partly reversed.

THE COMPARTMENTATION (Drawing 98)

In Mamlūk architecture decorative areas are generally compartmentalised, that is, they are outlined and separated from each other often by lines of red stonework. In the case of the Minbar's sides this function is undertaken by the vegetally decorated borders growing up the sides of the Gateway and along the hypotenuse of the Principal Side Panels where at the upper apexes the decoration meets and combines with the decoration of the vertical borders which isolate the openings and inscription panels from the remainder of the Minbar's sides. A comparison of the three borders shows that their slightly different widths effect the precise form of the decoration and also the frequency of the interlacing of the double growth systems identified by their contrasting plain and split stems.

One area, which can be considered as belonging to compartmentation, is sandwiched between the top baḷus trade panels and the compartmental borders, and it consists of two intertwined systems that are arabesque in character/

character. The simpler system has at one end a bud and at the other a simple half-palmette, and in addition at two intermediate points sprouting leaves lie within concave curves. The second system starts from the panel's base, passes under the stem of the first system and then bifurcates; the minor stem that this produces bifurcates again at a simple bud to continue as a pair of terminal leaves, the lower leaf and its stem lies on top of the first system while the higher leaf entwines itself under and then over the major stem of this system. Returning to the major stem, it continues under the first system before bifurcating once more; here the minor stem, its simple bud and terminal leaves spreads over the first system and its own major stem which after the last bifurcation continued upward under the first system before coming to rest with its terminal leaf lying over the first system.

From the foregoing evidence it is clear that the Minbar does constitute one of the architectural masterpieces of Qāyrbāy's Reign, not only because it is constructed from stone and uses decorative forms consistent with that material in preference to those associated with the contemporary timber minbars, but also because it interprets some of the architectural concepts current at the time.

On a general plane the decorative areas through their detailing and dispositions reflect and expand on the Khānaqāh's planning theme of apparent symmetry leading on to an asymmetry. And, when the individual areas are studied in greater detail using methods based on appreciation levels decorative grammars are discovered which are compatible with my theories concerning the grammars I have highlighted in some of Jerusalem's Mamlūk monuments.

One of my original points concerned the location of the left half of the Minbar behind a pier as it seemed uncharacteristic of Qāyrbāy who had the habit of presenting gifts to existing foundations and having them displayed in a prominent position. Why then did he not give orders demanding an unobscured view of the Minbar even if it required the blocking up of one window in the qibla wall? I concluded that there was some significance associated with the location, and although it was untested I presumed it might have a bearing on the way in which the Minbar was to be read. Later, while discussing the combined evidence of Bourgoin and Keene in relation to the Principal Side Panels, it was established that the geometrical construction of the Right Panel had been used before in Cairo, whilst the Left Panel's construction was new and had been designed as a more complicated version of the Right Panel's geometry complimenting its more important position on the mihrab side of the Minbar. Thus the geometric/

geometric evidence of the Principal Side Panels provides the clue which leads to an explanation of the Minbar's location: the unobstructed right side should be the starting point of any inspection, and in practice the location succeeds in imposing an apparently natural preference onto the majority of people to admire the right side before crossing in front of the Minbar to check on the other side.

This movement from one side to the other could be interrupted by the attractive Gateway with its engaged columns, inscription and rectilinear muqarnas, which it will be remembered involved a variety of appreciation levels dealing with three-dimensional, subject and ethnic groupings plus the indications that previously there were also colour to be considered. From the same position the original purpose of crossing over to inspect the left side could be delayed further by the decorated Canopy with its Onion Dome and 'Mihṛāb' Panel on the rear wall, features which could introduce to the observer new versions of well known combinations, and in the case of the 'Mihṛāb' Panel there is the additional religious symbolism.

Eventually when the left side is viewed a consideration of the detailed interrelationships joining the two balustrades can be begun: my own findings are summarised below, and in Figure 40.

Panels L1 and L9 respectively, are the left and right halves of the same repeat unit and due to transposition they appear reversed, on the left L9 and on the right L1. Panels R1 and R9 are similarly transposed. If the interrelationships had ended here they might have been classed as 'interesting', but no, the subtle syntax is extended to combine together L1 and L9 with R1 and R9 by making each pair the negative of the other, i.e., the centre of the left hand side's repeat unit forms the corners of the right hand side's repeat unit and vice versa.

Panels/

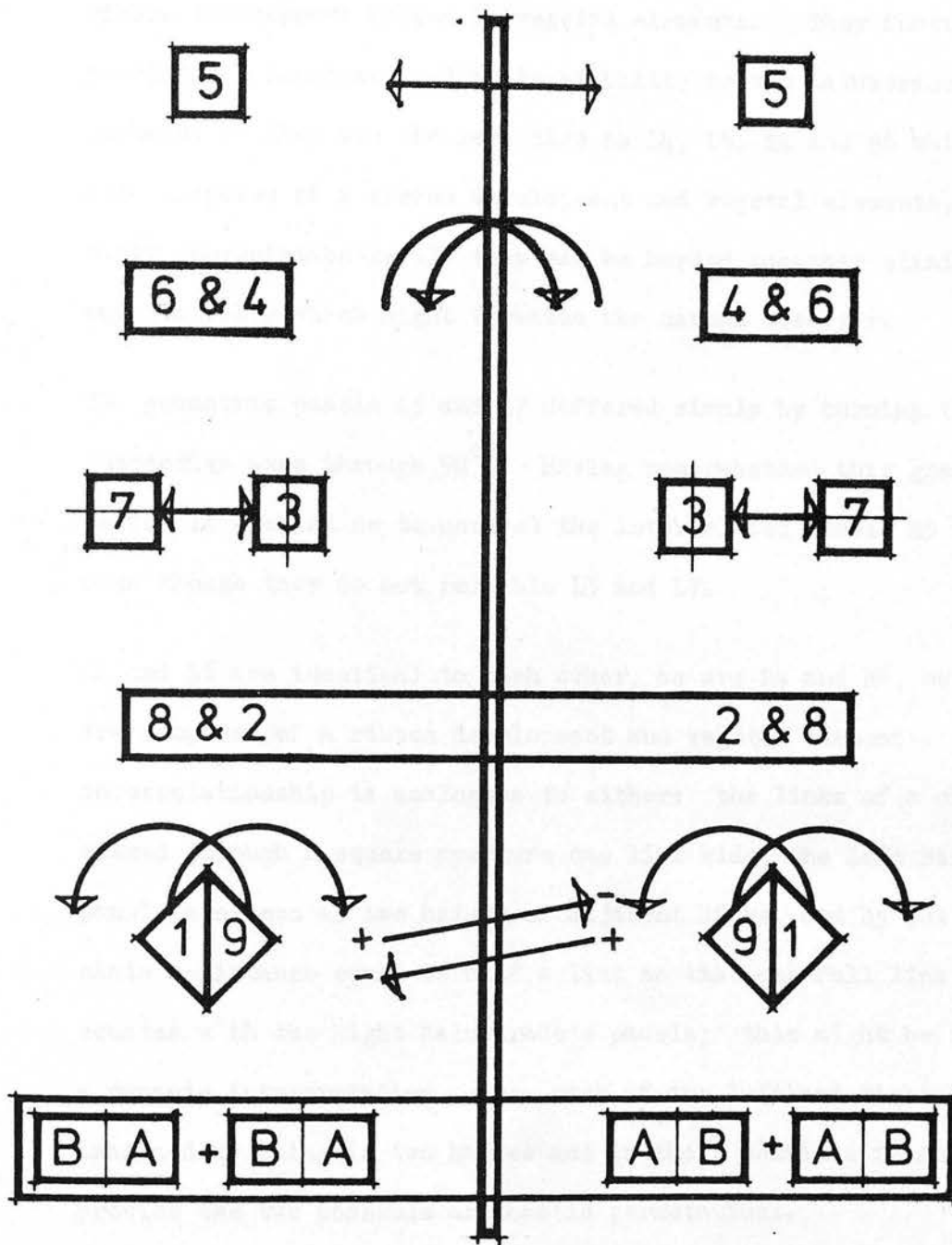


Fig.40.

Detailed Interrelationships between the Minbar's Left and Right Balustrades.

Panels L2, L8, R2 and R8 are identical, they are composed of a ribbon development backed by vegetal elements. They function by providing a necessary and basic stability to the balustrades, and perhaps, as they are the same size as L4, L6, R4 and R6 which are also composed of a ribbon development and vegetal elements, in the early appreciation levels they can be herded together eliminating any contrasts which might threaten the casual observer.

The geometric panels L3 and L7 differed simply by turning their respective axes through 90° . Having comprehended this grammatical device it enabled me to unravel the interrelated panels R3 and R7 even though they do not resemble L3 and L7.

L4 and L6 are identical to each other, as are R4 and R6, both pairs are composed of a ribbon development and vegetal elements. The interrelationship is analogous to either: the links of a chain viewed through a square aperture one link wide, the Left Balustrade's panels are seen as two halves of adjacent links, and by pulling the chain a distance equal to half a link so that one full link is seen equates with the Right Balustrade's panels; this might be classed as a dynamic interpretation. Or, each of the left and right panels is imagined as being in two halves and in their combined forms they provide the two possible arithmetic permutations.

The equilibrium of the balustrades' designs are balanced about fulcrums supplied by L5 and R5 whose design structures are the same.

No mention has so far been made regarding the panels A and B, which are left and right handed versions of the same chinoiserie design. When looking up the balustrades they appear in the same sequences, although in Figure 40 they are seen as mirroring each other. The reason they have been left to the very end of this study is that they/

they act as punctuation marks; they are essential for the recall of a panel's relative position on one balustrade when comparing it to its opposite number, and they are also essential in defining the extent of the phrasing within which specific syntactical forms are at play.

The 'Basic Interrelationships between the Minbar's Left and Right Balustrades,' Figure 37 (p. 281A), symbolised the preconceptions a person might have after looking at a number of other minbars. The same figure attempts to illustrate the interrelationships that could be identified by those not cowed into submission by prolific decoration, but, it is at this stage in the search when, because of the time lap separating the two sides, complications arise to make positive identification difficult. Figure 40 sets out the detailed interrelationships which can eventually be identified by those who do persevere.

A quick comparison of the two figures, 37 and 40, demonstrates just how primitive the first is, and as this approximates the achievements of the average visually aware person it suggests that maybe the full potential of Mamlūk decoration has not been realised. However, if the connections across the Minbar are completed I submit that an understanding of the Minbar's relationship to the Khānaqāh is greatly enhanced and that at least a beginning has been made on the way the Minbar was viewed by the Suffīs who inhabited the Khānaqāh.

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In this study I have attempted to reproduce the design procedures likely to have been followed by the Christian architect and his team when planning al-Ashrafiyya and its decorative areas. Overwhelming support at all levels has been found to support the generally accepted belief of Unity in Islam. The evidence indicated that this Unity in the architectural context does not suddenly end at some arbitrary point during the planning sequence, instead it extends to the apparently simple and insignificant details. It has also become clear, through a use of appreciation levels, that the design concepts controlling decorative areas were conceived in visual, not verbal, terms except in two notable instances; al-Ashrafiyya's brass door revetments, and the stone Minbar's 'Mihrab' panel.

The contemporary sources supply invaluable historical and descriptive data; they provided the dates associated with al-Ashrafiyya's checkered building history ending with its completion in 887/1482, and the physical framework which has to be satisfied by the architectural restoration. They also helped to identify, and occasionally explain the pre-al-Ashrafiyya features incorporated into the final structure, they also supplied evidence on which I calculated the date of the major earthquake as 952/1545.

The sources, however, can only supplement the architectural evidence provided by the actual ruined monument, if this is misunderstood any attempt to seek a responsible restoration will fail. A classic example is given by al-Ashrafiyya's only previous 'architectural' study where a ludicrous height is suggested for the restored east elevation, a height blatantly at odds with the Madrasa's existing details. Fortunately this is an aberration in the annals of architectural history where high standards are generally maintained, but it does underline the importance of a meticulous survey on the extant structure.

Even/

Even on the briefest acquaintance al-Ashrafiyya is, by any standard, a valuable repository of high quality stone decoration, and if this is combined with a fore-knowledge of the important monuments in Cairo at that time it is evident that al-Ashrafiyya is on a par with any of them. It might not be as extensive as some of the Cairo complexes, but what remains of its decoration demonstrates that it was more finished, and without doubt, had a greater variety than either Qāyṭbāy's Mosque and Mausoleum, or his Mosque at Qal^c et al-Kabsh, the two buildings most closely paralleled by al-Ashrafiyya. The calibre of the craftsmen was superb and if one has to choose a detail to illustrate the point I would cite the delicately carved joggled relieving arch above the Recessed Portal's door opening, (Drawing 56) but this choice should not devalue the muqarnas, voussoirs, vault centres, lintels and spandrels, whether painted, gilded or natural stone, they are all first rate examples of the carver's art.

It is to be presumed that the decorative qualities of al-Ashrafiyya were esteemed by the Ottomans, otherwise the expensive conservation measures undertaken after the earthquake of 952/1545 would not have been contemplated. It is conceivable that on grounds of safety the arched openings of the Madrasa would have been blocked-up and the irregularities along the wall-heads levelled off, but to take down the decorated pointed cruciform vault centre of the Porch and later replace it after reconstructing at least twenty five per cent of the fan vault, and disguising the new stones with red and cream paint to imitate the original ablaq, this must be indicative of their appreciation of its beauty, especially as after the earthquake al-Ashrafiyya could no longer function as a madrasa.

The first conclusions provided by my restoration of al-Ashrafiyya concerned its site. Through a historical coincidence Qāyṭbāy, the Prince of Builders, was offered the original madrasa on this prime wite within al-Haram al-Sharīf the Third Shrine in Islam. It was almost adjacent to, and was/

was certainly as near as any building bounding al-Ḥaram could be to the Qubbat al-Ṣakhra; it included stupendous views covering most of al-Ḥaram and extending across the Kedron Valley to the Mount of Olives; it was also beside the Bāb al-Silsila (Gate of the Chain), the entrance to al-Ḥaram at the end of the City's major west-east artery. We know that when Qāyṭbāy visited the site in 880/1475, by which time a new madrasa commissioned by him had been begun, he did not feel the madrasa at that time was commensurate with his royal status, thus later on he ordered its demolition and eventually dispatched a team of craftsmen from Cairo to implement his orders and construct an imposing edifice along Cairo lines.

Faced with this requirement to provide a Cairo type structure the first endeavours had to focus on ways in which the site could accept such a structure. This was solved by extending the Western Riwāq's roof into al-Ḥaram using an elevated platform. The platform had the advantage of raising the proposed madrasa to approximately the same level as the Upper Terrace and so in full view of the Qubbat al-Ṣakhra. The idea of an elevated madrasa was new to Mamlūk architecture, if those raised up half a dozen steps or so are discounted, it therefore introduced a new architectural concept, a processional way which led a visitor through a number of interesting spaces, then up a grand staircase (which was completely at variance with the normal narrow and steep stairs compressed into the corners of Cairo structures) to the Courtyard at the Riwāq's roof level.

This easterly expansion into al-Ḥaram must have been calculated with reference to the north-south site dimension, restricted by the Madrasa ^oUthmāniyya and the Minaret Bāb al-Silsila in view of the results of the Primary Geometry. (Drawing 18). The Primary Geometry, based on a Generating Unit equal to 7.20m, established simple geometric relationships the Mamlūk designers could not have failed to notice, in fact, they are too numerous to be coincidence; I am convinced that they were conceived as/

as the basis of al-Ashrafiyya's architecture. The conclusive proof is that they can be translated by way of the GU from the graphic geometry into metric measurements that either coincide exactly with, or deviate by two or three per cent from the actual measurements of my survey.

The Primary Geometry automatically extends into the detailed geometries controlling the widths and positions of the window openings, as well as the Madrasa's mihrab. Perhaps before the detailed geometries were consolidated the Primary Geometry was extended to the ground floor plan, which, although of secondary importance, did require to function in unison with the first floor. Again the number of coincidence at this or the later detailed levels argue for an overall controlling geometry based on the GU.

It seems logical that the proportional geometries used with success in the horizontal designs are extended by applying them to the vertical architectural elements. This was proved to work for the existing external recessed windows and doors of the Courtyard, and for the ground floor's wall surfaces. This led on to the conclusion that a tripartite relationship existed between the proportional system's geometry in plan, its use in the control of elevational treatments, and thirdly, its relationship to the heights of the stone courses.

The certainty that a relationship had been positively identified between the proportional geometry and the stone course heights was of considerable import as it enabled the tabulation of the number of courses used to construct architectural elements culled from contemporary Cairo structures, the elements being chosen for their relevance to al-Ashrafiyya; external recessed windows, the great arches and side walls of sahns, etc. Using the external windows as a control since in the Cairo examples variations in the number of courses were minimal, the different elements were compared to the number of courses in al-Ashrafiyya's elements. On this basis the number of/

of restored course heights for some of the elements were deduced, others were found with the assistance of some of the debris reused in the rebuilt areas of al-Ashrafiyya. The Sahn's lantern was an exception, it was modelled on the lantern of the Mosque and Mausoleum of Qāyṭbāy where the sahn had a dimension just 0.07m larger than the west-east width of al-Ashrafiyya's Sahn.

The Loggia's design solution was more complicated: the texts described it as having three arches and two marble columns, a description applicable to a number of arcaded windows surrounding al-Ḥaram, or it could equally be applied to the few arcades dividing sahns from their iwans in Cairo; these at least were the two possible models. However my design essays revealed that the Jerusalem and Cairo arcades when drawn to the same scale had basically the same proportions, proportions which were incompatible with the number of stone courses and wall heights I had conjectured for al-Ashrafiyya's other elements. The solution was eventually suggested by the large external loggias present in some of Cairo's buildings, such as the House of Qāyṭbāy, and when this design solution was integrated with the previously restored sections of al-Ashrafiyya's external and internal walls the proportions of the arcades were found to comply with the GU.

With the Loggia's design solved the restoration of al-Ashrafiyya was complete. It provides a unique solution founded on an amalgamation of the historic sources, detailed surveys, and comparative analyses biased towards Cairo's architecture rather than parochial Jerusalem since it was obvious that al-Ashrafiyya followed the pattern of the sophisticated imperial complexes of the capital city, a result which must have satisfied Qayṭbay.

The extant decorative areas of al-Ashrafiyya are all influenced by geometry, it can even be seen to underlie the purely vegetal compositions. These geometries naturally related to the overall shapes of the individual decorative areas, which in turn were related through the tripartite relationships back to the general planning arrangements. An example of this is the engaged/

engaged column to the Porch; its decorated shaft's hexagonal repeat unit was directly related to the curvature of the column and to the height of the shaft, and by way of the shaft to the width of the Porch's pier which approximated the GU.

Associated with the geometric decoration are the interstitial elements which create ripples across the design due to the fluctuations in their positive to negative ratios. This positive to negative balance gave rise to the idea that the choice of a specific interstitial elements in preference to another might be effected by the distance between it and the observer, a hypothesis that might in the future be tested in enclosed spaces.

In addition to the two dimensional decorative areas are the rectilinear and curvilinear muqarnas whose repetitive geometrical forms and decorative elements react to the changing light conditions to create various three dimensional groups, which originally were intensified by the addition of colour.

To understand some, if not all of the above decorative areas I developed a method using a sequence of appreciation levels to read the abstract decorative grammars by graphically recording their characteristics so that they could be directly compared with other decorative areas, some of the comparisons will be unproductive, others will build up patterns which express the grammatical form. In al-Ashrafiyya one grammar was found to link up the vault centres beginning with the Porch's and ending at the second top landing of the Grand Staircase, at this point the lintels seem to take up the 'baton' and continue with it until the final lintel whose 2nd and supplementary appreciation levels corresponded to the appreciation levels of the Porch's vault centre. I see in this grammatical form a progression consistent with my concept of a Processional Way. A much less abstract design concept is found in the brass revetments from the Recessed Portal, the central field is composed of two inscriptions which, in their combined format/

format, evoke thoughts concerning the centrality of Allāh and the earthly Lord's duties and responsibilities to Allāh.

There was one aspect of design which could only be assumed from al-Ashrafiyya's decoration, it concerns the identities of the vegetal sub-groups as recognised by the Mamlūks, the answer I uncovered in Cairo where occasionally the sub-groups were juxtaposed: the following vegetal sub-groups were isolated; arabesque, chinoiserie, arabesque and ribbon development, chinoiserie and ribbon development, arabesque and chinoiserie.

My conviction that decorative grammars were planned for in al-Ashrafiyya and which were visually related to their context and thereby to the general design solution was reinforced by my study of the stone Minbar of Qāyrbāy in the Khānaqāh of Farag ibn Barqūq which provided me with greater insights into the grammatical plays indulged in by late Mamlūk designers. The Minbar was a product of its context, it reflects the symmetry and asymmetry of the Khānaqāh's planning arrangements, through the Gateway and its Canopy topped by an onion dome there is the invitation to acknowledge the symmetry, but this is qualified by the location half hidden by a pillar. The Minbar continues in an audacious fashion to reverse the earlier response of the observer through the decorative interrelationships on its right and its left sides.

My attempts to reconstruct the design procedures of al-Ashrafiyya have not unnaturally highlighted other aspects pertaining to Mamlūk architecture, some I feel sure could be developed for the profit of the art and architectural historian. But my great hope is that such studies will, in the long run be beneficial to the present-day Islamic communities by impressing upon the modern architects in the West, some of whom have never visited an Islamic country, but who are designing for the Islamic world, that there is a wealth of untapped material waiting to be translated into modern terms and so enliven their designs.

The Advantages

A variety of methods can be used to record carved stone decoration; plaster-casts, latex moulds and paper squeezes. Plaster-casts have the advantage of providing a durable and precise three dimensional replica but they are heavy and cumbersome and unless there is an overriding reason for choosing them their application in the field is restricted, at the other extreme, latex moulds have the advantage of reproducing precise three dimensional replicas which can be rolled up and carried in a pocket, but, I am informed by others who have used this method that there can be discolouration of the stone. The paper squeeze lies between the two previous methods, it is neither cumbersome nor pocketable, and its three dimensional qualities depend on the skill of the recorder and on the type and condition of the stone. For the work I have undertaken its greatest advantage cannot be offered by the other methods; simplicity of material and application. Its simplicity is recognisable and understood by the most illiterate onlooker, he knows what paper is, he can feel it and tear it if this will satisfy his doubts, he knows that water does not harm stone, and if he collects the water from his own tap there cannot be any dispute about its purity! For these reasons I have been able to take paper squeezes even within a mihrāb, it is improbable that this could have been achieved using the other methods.

Method

Over the years my technique has changed little, but my understanding of its potential has increased. The equipment and materials required are: two flat handle brushes approximately 15cms. long with moderately stiff bristles, a bucket for water and large sheets of 'W^hatman's Number 2 Filter Paper' obtainable from scientific suppliers. Having assembled the equipment/

ment, the decorated area to be recorded is washed thoroughly with plain water and brushed to remove deposits of dust, earth, mosses, etc. Although it is not always necessary to squeeze the complete decorated area it is essential that the area chosen should include all the decorative elements, it is obviously preferable to encompass three or four examples of these elements. Once the chosen area is clean, the stone is soaked again and the first sheet of paper is immersed in water before it is applied to the stone with a gentle stippling action. It is generally convenient to cut the large sheets of paper up into sizes which can be controlled easily at the top of a seven metre ladder in a blustery wind and while stretching out to one side. Having ensured that the individual papers overlap one another and that this first layer completely covers the chosen area, a second layer is applied ensuring that the overlapping joints of its papers are staggered with those of the first. The papers of this layer are not immersed in water and normally there is a sufficient excess of moisture in the first layer to wet the second, if not small quantities of water can be sprayed on using a brush. When stippling on the layers it is imperative to remove all air bubbles trapped under the layers, this is simply done if the stippling action progresses across the area on a constant front.

The majority of Mamlūk stone carving only needs two or three paper layers to give adequate cover and where the layers are fractured by deeper cutting or a sharp arris patches can be applied. If the amount of water used is kept to a minimum the drying time of the squeeze is short and the paper's fibres keep most of their strength and are less likely to break under the stippling.

A squeeze can be removed while it is still slightly damp and cold to the touch, or when it is bone dry; for preference I remove them in their damp condition because it is easier to remove or ease away the small areas of paper/

paper which are bound to catch on the stone's relief, and also the stone is still damp and may show up particles of old paint. Just before removal a two-fold advantage can be gained from a quick stippling over the squeeze using a dry brush, this can tighten up the impressions of the small details by transforming a convex curve produced when the paper was drying into a correct concave one; and when it produces a hollow sound the action is easing the squeeze away from the flatter surfaces. The actual moment when the squeeze is completely freed from the decorated area can be dangerous, especially with a large squeeze caught by the wind like a boat's sail and falling back over your head and eyes while you are struggling to save the squeeze from tearing, if only by its own weight, and maintaining the tenuous perch on the ladder. If the squeeze is safely removed and still damp it may be turned face down on a dry surface in the sunlight and held down by small stones to allow it to dry completely.

On arrival back in the studio the relieved lines and elements can be picked out with felt-tipped pens, preferably not water based inks as they are liable to spread. If the original's design was eroded by the elements or otherwise damaged to the detriment of the design's impression the three layers of paper can be separated to give three chances to retrieve the lost elements. A full size tracing is now drawn of the squeeze and then it is checked against the original carved area, it is then photographically reduced; throughout this author's work the reduced scale is constantly 1:5.

If the design is composed of arabesque or vegetal forms the reduced drawing can be transferred directly by further tracing to the final drawing on plastic sheets. If the design is geometric the process is longer and more complicated as all the subtle variations inherent in the carved geometric skeleton have to be analysed, thought about and explained as part of the eventual repeat unit's structure: these variations are not considered as lapses/

lapses on the part of the carver from some theoretical geometric 'correctness', whatever the quality of the decoration it is both foolhardy and arrogant to impose some preconceived and overriding blanket decision on a design. In my experience few geometric designs taken from an artifact are uncomplicated no matter how simple they appear to be. The average time taken to establish a particular construction so that the lines are correctly orientated through to the drawing up of the final repeat unit is in the region of two hundred hours. This may seem to be exceedingly slow but each attempt has to be completed in order to identify what elements are right or wrong before it can be discarded. If this is till presumed to be an inordinate waste of time the prize is an accurate drawing to a known scale which can be compared directly with any other example. Consider why the epigraphist squeezes a clearly visible inscription instead of taking a quick economical and inexpensive photograph, it is because with the squeeze he is able to keep a record of the inscription from which he could take precise measurements at any time. The same advantages are available to the Islamic art and architectural investigator if squeezes are made.

An unusually difficult paper squeeze.

The decorated vault centre of al-Ashrafiyya's Vestibule is perhaps the most difficult squeeze in my experience. It was covered with a black encrustation produced by the lamps, which used to hang from the centre, this substance included a chemical which burnt the skin and made any exposed cut rather painful. Add to this discomfort the fact that the area being squeezed was above my head which forced me to look up into this dribbling caustic solution and it was far from pleasant.

Even the act of cleaning the areas was fraught with difficulties caused by considerable quantities of brown froth enveloping my brush; in the hope of flushing it away more and more water was added, this only exacerbated the condition/

condition. Finally, after the froth had died down on its own accord, three layers of filter paper were stippled into place on an ostensibly clean area with all encrustations removed. Yet, after twenty four hours the squeeze's upper layer was as wet as it had been when applied, and it was also badly discoloured by brown watermarks. Having made the decision to attempt its removal to the outside so that it would dry in the sun, I found that the layer next to the stone surface, instead of peeling back cleanly, had lost its elasticity, and in some areas had become charred, not just discoloured. The result was that it was difficult to remove, even with the aid of a penknife, as it was like blackening on the underside of a frying pan.

A second squeeze was successful only because of the first's poultice effect: this by-product whereby the stone is cleaned without damage is a further advantage.

The Sanctuary. (Figure 11)

The notion that the sanctuary was made of a masonry constructed by the
work of his day was extremely common in the 19th century and it only came to

Introduction

The Mausoleum of the amīr Kīlānī, c.753/1352, is an unusual building as it contains two tomb chambers, and each chamber is given an identical emphasis through their elevational treatment, as a consequence the Tomb Block's elevation to the Ṭarīq Bāb al-Silsila (Street of the Chain) is symmetrical about its central axis. The published results included the suggestion that this elevation was generated by the width of the Kilaniyya's street frontage;¹ it is this that I wish to expand and detail more precisely the geometry controlling the elevation.

A Gap Site?

What is the evidence to support the assertion that the Kilaniyya was built within a gap site? At the left hand end of the elevation a vertical straight joint separates the Kīlāniyya's moulded frame or architrave from the lower courses of the Kazzaziyya,² higher up this joint changes course to rise 0.20m to the west of the architrave and at least two of the architrave's stones extend out to this new line. What this means is that some of the Kīlāniyya's stones were built on its neighbour and therefore the Kīlāniyya is younger. At the right hand end the evidence is not as decisive, it has to rely on the resemblance of the four lowest external courses of the Mausoleum of the amīr Ṭāz, 765/1361,³ to some of the internal masonry which, from an investigation of the tooling and the forms of mason's marks, suggests that they form the remains of a structure belonging to the Crusades and which defined the site boundary.

The Geometry. (Figure 41)

The notion that the elevation was based on a geometry generated by the width of the gap site was extremely attractive to me, and it only came to me/

me four years after I had finished surveying the complex and whilst I was preparing the publication, I was playing around on a dyeline print when it all fell into place, it was so very simple. But it was more difficult to prove using precisely drawn geometry because, although the elevational elements give the impression that they are symmetrically placed, unfortunately they are not, even the recessed portal is off to one side of the gap site's central point. Nevertheless I have produced a symmetrical diagram in which the divergences found in the actual elevations are minimised.

Diagram A. The width of the gap site is represented by the line AB. On AB construct the rectangle ABCD with diagonals at $60^\circ/30^\circ$. Along AB the point E is found (BE=BC) and the square CBEF constructed. With centre B an arc is drawn from F to cut AB at G. Therefore $BG=BF=\sqrt{2}$ (this being the ratio of a square's diagonal to the length of its sides --- Pythagorean proposition). The above procedures are repeated with point A as the centre to find point G_1 .

Diagram B. From points G and G_1 verticals are drawn to intersect CD at H and H_1 , the diagonals to the rectangles ADH_1G_1 and BCHG can then be drawn. At the various intersections produced by the diagonals of the three rectangles formed so far five horizontal lines can be drawn, aa_1 , bb_1 , cc_1 , dd_1 , and ee_1 . On HH_1 construct the rectangle $HJKH_1$ with diagonals at $60^\circ/30^\circ$, draw the diagonals HK and JH_1 to find the rectangle's central point through which the horizontal axis ff_1 passes.

Diagram C. (To increase clarity the diagonals and horizontal lines lying in rectangle ABCD in the previous diagram have been removed).

On JK construct the rectangle JKLM with diagonals at $60^\circ/30^\circ$ intersecting at point O.

Centred on O a circle is drawn whose diameter equals the sides of the squares ghjk and jklm, the circumference of this circle rests on the diagonals/

diagonals of the square jklm. The length of the circle's diameter and the sides of the squares is equal to the distance between the outer points of the diagonals' intersection on the line cc_1 in the previous figure. (This relationship can be seen in Diagram D where the diagonals have been reintroduced). Note that in the resulting figure side gh of the lower square coincides with AB; note also that as the circumference of the circle rests on the diagonals of the upper square the centre O is higher than line lm.

In the final design this combination of a circle and two squares defines the recessed portal and its mugarnas head. One might have presumed that the designer would have chosen the simpler solution of dividing the distance between O and the mid point of AB by two, and using this dimension as the diameter of a circle centred still at point O, so that point O would have become the mid point of the line lm in the slightly enlarged squares below. Had this solution been chosen for its simplicity of construction many of the relationships which will be identified later would either have been changed to comply with this design decision or they would have been ignored. An attempt of this nature, where a person imbued with twentieth century notions is trying to start from the finished product and work backwards through the mental hoops the medieval designer jumped or crawled under, is open to criticism, and rightly so, all I can say is that my architectural training and experience lead me along a number of lines. Before I sought to propound the particular solution I found "worked" I had to discard a large number of partial solutions as they led away from the final design which I was attempting to harness with a geometrical structure. How much more difficult was it for the original designer to make his decisions in the opposite direction to my inquiries? Therefore, I cannot discount the possibility that the designer accepted first the simpler composition of the portal's proportions and carried it forward to the moment of realisation that it did not "work" or was aesthetically unpleasing.

Diagram/

Diagram D. (The diagonals in rectangle ABCD are replaced).

The line gh is quartered, and vertical lines constructed at the divisions to produce gg_1 , mm_1 , the central axis pp_1 , and hh_1 . Within the square $ghjk$ the two central quarters combine to form the door opening.

On the line Ag a $60^\circ/30^\circ$ rectangle is constructed with gq as one of its two diagonals. Similarly on line hB a rectangle is constructed with hq_1 as a diagonal. When q is joined to q_1 a new rectangle ABq_1q is formed. Note that if qg and q_1h are produced they intersect at the mid point of ML .

Diagram E. A $60^\circ/30^\circ$ triangular grid is constructed utilising the diagonals gq and hq_1 and the central point of the rectangle $HJKH_1$. Since the grid's apex occurs on the central axis and the points g and h are symmetrically placed about this axis their distance apart must equal the sides of the equilateral triangles produced by the grid. The grid coincides with a number of points that have already been positioned, e.g. the horizontal line rr_1 drawn through a number of the grid's nodes and which is tangential to the circle with centre O .

The grid also provides the following three properties. First, two vertical axes ss_1 and s_2s_3 on which the tomb chambers' windows and domes are position. (The placing of the domes on these axes extends their use from the elevation into the plan). Secondly, the vertical lines drawn from the first nodal points in from r and r_1 respectively define the extent of the west and the east tomb chambers' drums. Lastly, the grid also controls the basic dimensions for the central window, its muqarnas and the smaller flanking windows above the portal.

In rectangle $HJKH_1$ above the horizontal axis ff_1 and starting at the central point two $60^\circ/30^\circ$ rectangles with a horizontal emphasis are drawn: two further rectangles are constructed with the same height of the latter rectangles but with only half their widths. These four rectangles combine/

combine to form the octagonal drum below the central dome.

The height of the cornice along the top of the octagonal drum is found by lines drawn at 45° from the outer corners of the drum's combined rectangles to intersect the diagonals of the rectangle $HJKH_1$.

From point O_1 a semi-circle, tangential to line JK, defines the central dome.

The form of the two side domes is found by describing circles centred at points O_2 and O_3 (the intersections of the line qq_1 with ss_1 and s_2s_3 respectively) so that their circumferences pass through the points along ff_1 which are the extremities of the octagonal drum.

To find the depth of the architrave's horizontal member within rectangle ABCD: first, draw equal and conjoined circles centred on the central points of the rectangles ABCD and $HJKH_1$: second where the $60^{\circ}/30^{\circ}$ grid lines emanating from the upper centre cut the circumference of that centre's circle a line parallel to DC is drawn. The distance between the two lines becomes the depth of the architrave. The architrave's inner line (parallel to DC) turns upward where it coincides with the lines defining the extremities of the octagonal drum: meanwhile the architrave's outer line turns at the intersections of the circle centred on O_1 and the line CD. Thus the depth of the architrave is changed, this new depth remains constant around the elevation's central pavilion. Observe that the architrave along AD and BC is considerably deeper than elsewhere, this is caused by the $60^{\circ}/30^{\circ}$ division of the mitred corners at D and C.

Diagram F. In this figure the completed geometry and the basic elements of the elevation are given; I hope that in the light of the foregoing procedures that the smaller elements in Diagram F can be analysed without further explanations by me, however a number of interesting relationships could be overlooked and therefore require underlining.

i)/

- i) Line aa_1 gives the height of the paired windows to the tomb chambers.
- ii) Line aa_1 gives the height to the top of the doorway's lintel, and therefore to the cut back area between nn_1 and pp_1 .
- iii) Line bb_1 indicates the height of the paired window's lintels.
- iv) Between cc_1 and dd_1 lie the blank inscription bands which occur over the paired windows and across the recessed portal.
- v) Line dd_1 defines the springing of the lowest muqarnas course in the recessed portal.
- vi) Line ee_1 defines the springing of the second course of muqarnas.

Conclusion

Earlier I confessed to making slight adjustments to minimise the differences found in the measured elevation, and later while describing Diagram C I expressed the possibility of the original designer starting on an idea and then discarding it along the road to a satisfactory conclusion, just as I have been faced with occasional dead ends travelling in the opposite direction. However, it cannot be denied that the elevation is fundamentally symmetrical, and that its composition is a simple and satisfying composition built of well finished and detailed ashlar.

The bulk of the elevation is enclosed by the original $60^\circ/30^\circ$ rectangle, on top of it is the central pavilion which fulfills two essential functions. It allows the tall portal to be introduced into the composition without awkwardness, and it adds emphasis to the verticality of the central elements, which effect considerably the Kīlāniyya's townscape value, as in addition to the narrowness of the Ṭarīq Bāb al-Silsila a small lane, ^cAqabat abū Madyan, joins it on approximately the same axis as the portal.

Introduction

A Mamlūk architectural masterpiece may be analogous to a complete literary work, the first impression is one of overwhelming size closely followed by an appreciation of the aesthetic qualities to be found in the structuring and content of its chapters and paragraphs. In the case of a building the chapters and paragraphs are represented by the easily identifiable and recognisable architectural elements chosen from a restricted list which includes such features as recessed portals with ogival heads, recessed paired windows, crestings, domes, etc. As chapters and paragraphs require words, in the architectural context the 'words' are the applied areas of decoration formed of geometrical and/or vegetal forms which may be considered as an established alphabet.

In the above analogy an essential element has been forgotten, syntax and grammar. It is unthinkable for a linguist to discuss a word without attempting to place it in context in order to show how and why it is necessary. Unfortunately, in some publications on Islamic art and architecture too often the unthinkable happens, decorative areas are illustrated and described but with no regard to their provenance, period, or even material, and thus if we return to the analogy the decorative areas have no grammar.

Assuredly there are many 'grammatical' structures to be discovered in Mamlūk decoration. The following is a description of the first two examples I became aware of and isolated, the terms 'Interrelated' and 'Integrated' will hopefully become self-evident. Both the examples occur in Jerusalem.

Interrelated Decoration

At/

At this, the beginning of the search for grammatical structures in Mamlūk decoration, I think it is safe to suggest that the simplest grammatical structures will be those which involve repetition or symmetry using identical decorative units, be they geometrical or vegetal. The next class in the grammatical hierarchy may include Interrelated decoration, in essence it is the bonding together of a number of decorative areas using a common syntax. It requires also from the designer a conscious effort to disguise or camouflage the common syntax to such a degree that the final composition requires from an observer a positive contribution before he can gain an understanding of the interrelationships.

In the small but well adorned Turba Turkān Khatun, 753/1352-53,¹ are three stone panels implanted to the south or gibla wall, and to the west and east walls of the tomb chamber. It is those panels which express the principle of Interrelated decoration using a geometric medium; to enable this to be understood let us reconstruct a logical design procedure which may be close to, if not exactly the same as, that chosen by the designer.

The Proportions of the Three Panels.

In each panel the overall dimensions and the general divisions are the same and are controlled by the same circle and inscribed hexagon: the diagonal of the circle and hexagon provides the overall height of the panel; two parallel sides of the hexagon define the position of the panels' central decorative fields. As the side of the hexagon is equal to the radius of the circle then the combined heights of the upper and lower borders must also equal the radius of the circle. The width of the central field is equal to a chord joining the hexagon's apexes 2 by 2. If this last dimension is added to that of the circle's radius (the combined widths of the right and left borders which equal the upper and lower ones) the overall width of the panels is obtained. The sub-divisions of the central field/

field and borders are found by point joining, the hexagon's diagonals are drawn and its apexes joined 2 by 2, the result is a network of hexagons which can then be described by circles. These hexagons and circles are $\frac{1}{3}$ the size of the generating hexagon and circle, they will become the basic repeat units of the final design.

In the border which surrounds the central field the basic repeat units are used to place the border's first sub-division at the point where the panel's central axis coincides with the repeat unit's circumference. Therefore, this first sub-division or margin is equal to the difference between the radius of the repeat unit and the apotheme of the hexagon. The border's second subdividing line is tangential to the circle of the repeat unit centred on the corner of the central field: note that these tangents create an outer margin equal to $\frac{1}{3}$ of the border which is also equal to $\frac{1}{12}$ of the overall height of the panel.

Up to this stage in our reconstruction of the design procedure the similarities of size, shape and general divisions belonging to the three panels is easily seen. The proportional relationships determining the subdivisions can only be appreciated by those with educated eyes, and even they would require a considerable time to discern the common syntax transferred through the basic repeat units to the differing geometric designs which cover the central fields of the three panels.

The Qibla or South Wall's Panel (Drawing 108)

The Central Field: Of the three designs under investigation this is the simplest as it retains the strongest hexagonal influence in its final form, (the more diversified a decorated area's geometric shapes become their comprehension is less immediate) conveyed by star polygons, derived from the repeat unit's hexagons, which, when combined together, create small hexagons between their points. Visual definition is enhanced by contrasting the planes of relief.

The/

The first step required by the design procedure is the division of the repeat unit's hexagon by drawing the diagonals and the chords which join the apexes 2 by 2. The resulting figure is further divided using point joining to produce a regular hexagonal star polygon whose apexes coincide with the mid-points of the sides of the repeat unit's hexagon.

The Border: There are three unequal units; the plain margin separating the central field from the decorated area of the border, the middle unit which is decorated and the outer unit with a cyma reversa moulding. The border's middle unit is decorated with pointed T-shapes which are combined to make a zigzag outer profile, this profile is accentuated by the addition of a small channel. Up the panel's right and left sides are four T-shapes, and along its upper and lower ones are seven T-shapes. The widths of these T-shapes are not exact if measured since they are found by dividing the sides by 4 and 7 respectively, but visually the difference is inconsequential. Observe that the extremities of the T-shapes' arms coincide with the border's major axis.

The West Wall's Panel. (Drawing 109)

The Central Field: If compared with the central field of the qibla wall's panel the hexagonal content of this design is weaker, and it seems that this is effected by the distractions provided by the regular and irregular polygons, some bobbin like, created by the overlapping rectangles. Note that where the previous panel had hexagonal star polygons, here they have been exchanged for hexagons. With the exception of the central hexagon, each encloses a carved six petalled patera. Again the diagonals, and the 2 by 2 chords are drawn for the repeat units' hexagons followed by point joining to complete the required geometric figure.

The Border: Alternating T-shapes placed along the outer and inner edges of the middle unit are separated by a zigzagging channel punctuated by circles centred/

centred on each zigzag. Regard the different sizes of T-shape, the small on the inside and the large on the outside; this is attributable to the relative positions of the zigzagging channel and the punctuating circles. Unlike the channel's inner line its outer one is continuous, turning through 90° at the edges and arcing around the outsides of the punctuating circles. The centres of those circles are found where the middle unit's major axis intersects with the line of zigzag channel's outer edge. Thus the isosceles triangles, enclosing the large and small T-shapes, are respectively formed by the continuous zigzag line and by tangents to the punctuating circles.

As in the Qibla wall's panel the sides of the border are divided into 4 and 7, but with this difference, here the T-shapes occupy 2 divisions not just 1. At the centres of the upper and lower borders a further modification occurs to allow for this double occupancy, the zigzagging channel is stopped before it reaches the middle unit's outer edge and it is arced inwards to meet a similar arc coming in the opposite direction at the central axis, and the expected two inner-T-shapes are removed and replaced by one irregular figure which encloses a flat carved vegetal motif.

The East Wall's Panel. (Drawing 110)

The Central Field: The hexagonal content in this design is minimal, when compared with the two previous panels, for a number of reasons. First, the large overlapping pointed quadrilaterals emphasise the vertical and diagonal axes of the rectangular area producing initially a puzzling symmetry and inverse symmetry which discourage the thought of hexagons. Secondly, the 'true' repeat unit for this design is actually one and a half times larger than the previous units: this fact, however, does not deny the possibility that the designer arrived at the final solution combining, as I have done, two differing repeat units based on the same inscribed hexagon, there is even the possibility that he first constructed/

constructed the final solution within the normal sized repeat unit and then scaled it up by a factor of one and a half. Whatever the method chosen he utilised at some stage in the design's evolution the, by now, common hexagonal network. An impression of the hexagonal content is retained through the inclusion of hexagons which enclose smaller hexagons with carved six petalled patera at their centres, although the hexagons occupy the same positions within the central field as the hexagons with patera in the West Wall's panel their axes have been turned through 90° . At the centre of this decorative field is a small unadorned hexagonal star polygon instead of the unadorned hexagon at the centre of the West Wall's panel, but it is similar to the star polygons of the Qibla's panel.

The Border: Contrasting with the complicated camouflaging pursued in this panel's central field the border's decoration displays, with even greater simplicity than the Qibla's panel does, its underlying divisions of 4 and 7 using positive and negative fleur-de-lis which are terminated at the corners by square panels with carved eight petalled patera.

Conclusions

In each of the three panels which combine to form this grammatical structure I propose calling Interrelated decoration are found the following:

- i) The general divisions of the panels are the same being derived from an identical inscribed hexagon.
- ii) The inscribed hexagonal repeat units are basic to the three central fields.
- iii) The borders all have the identical three units running longitudinally with either 4 or 7 divisions to a side.

Although one of the criteria of Interrelated decoration is that the final designs are not identical, there should be in every case some visible key directing a viewer to a deeper appreciation and understanding. The very first/

first features described above as being common to the three panels were the overall dimensions and the general divisions. With hindsight they may in this instance be considered as keys, but this acceptance cannot be taken as the rule, more often than not these features would be very misleading if searching for this grammatical structure. For keys to be effective they must be motifs repeated in two or more decorative areas, and even this could be misleading.

The keys discovered in the three panels are:-

- i) In the Qibla's and West wall's panels.
 - a) The similar T-shapes decorating the borders.
 - b) the rhythm of the pronounced vertical lines in the central fields.
- ii) In the West and East wall's panels.
 - a) The similar hexagons incorporating the six petalled patera within the central fields.
 - b) The identical disposition of these hexagons and patera across the central fields.

I am convinced that decorative interrelationships do form a common bond between the three panels, also, I hope that the above resume of a possible logical and practical reconstruction of a design procedure is sufficient evidence that this form of grammatical structure can and does exist in Mamluk architecture.

Integrated Decoration

It can be assumed that every skilled designer takes pride in his work and strives for the most satisfactory and aesthetically pleasing solution while applying decoration to architecture. He has to consider numerous factors, e.g. the distance from the viewer which bears on the size of the component parts, the compatibility of the proposed materials. We have seen how one designer/

designer in the Mamlūk period utilised the grammatical structure of Inter-related decoration to enhance and unify the three internal wall panels in the Turba Turkān Khantun and thus extend their aesthetic content. Ascending the grammatical hierarchy another class of structure, Integrated decoration, is discovered. This translates into visual terms the structural loads of a particular architectural element.

The Integrated decoration under consideration is displayed by the Romanesque style doorway at the western end of the Turbat Barakat Khān, c. 680-90/1280-90.² (Drawing 111). The doorway is recessed with two pointed arches, the upper composed of godroons and the lower of chevrons. Above the door opening (it is only in the last fifty years that it has been changed into a window) is a joggled straight lintel surmounted by a pseudo relieving lintel. The recess' outer corners are bevelled with pointed terminals. Earlier this century at least one elbowed column existed within the recess. However none of the above elements exhibit Integrated decoration, for this the hood, impost and jamb mouldings require study.

The Hood Moulding

Whether plain or decorated a hood moulding has two roles to fulfill, one visual, the other structural. Its visual role is the enclosure and the defining of the composition; the structural role is the partial removal of the loads from the arch below by conveying them into the abutments.

The moulding is divided into two decorated fields. The upper one of close and deeply cut triangular and lozenge billets gives useful support to the overall shape of the hood moulding in its attempt to satisfy its visual role. In the lower decorative field S-forms linked together create circles, each circle contains four half-palmettes and four single leaves with one exception, the small plain circle at the hood's zenith. A feeling of perpetual movement is communicated by this composition; the circles seem/

seem to spin due to the slight curves given to the half-palmettes' longest leaves juxtaposed with the floating single leaves. (The singletons may either be considered to be at right angles to, or parallel to the half-palmettes). The spinning effect develops the tension required to bind the S-curves together and give stability to the design. To appreciate the subtlety and correctness brought to this design by the designer, consider the result had he reversed the direction of the half-palmettes; automatically the direction of spin would be reversed to destroy the needed tension and give the impression of the S-curves disengaging from one another and so annihilating the design's stability. Each space between the circles is emphasised by two trefoils asymmetrically placed above and below the S-curves, this accentuates the sliding or sideways movement of the S-curves. Returning to the triangular and lozenge billets they do not express any movement and can therefore be imagined as a chain along which the S-curves travel.

Having completed a description of the various decorative components and their movements and remembering the essence of Integrated decoration is the expression of the structural loads within the architectural element, can it be stated that the hood moulding displays this grammatical structure? The conclusion must be "Yes", since the transference of loads is clearly expressed by the S-curves beginning at the plain or inert circle at the hood's zenith and flowing down both sides finally turning through 90° to continue into the abutment. Note that the direction given to the S-curves depends on whether they are to the right or left of centre.

The Impost Moulding

The components used in the two decorative fields are similar to those in the hood moulding, but their treatment is very different. In the upper field the billets have no individuality or movement; they are like a line of soldiers shoulder to shoulder each giving and receiving strength from his/

his neighbour's relieved only by their alternating positive and negative halves as if the order, "Odd numbers; knees bend and shoulders straight! Even numbers; knees straight and shoulders back!" had been given. In the main decorative field circles are formed by knotting a pair of continuous waving lines, at the centre of each circle is a hole surrounded by four small petals and behind them four larger ones divided by lines which emphasise the circle's horizontal and vertical axes. A similar hole occurs at the centres of the knots which tie the circles together to prevent any suggestion of movement. Above and below the knots are symmetrically placed trefoils, they too are immobile.

None of the components described gives any hint of movement; is this consistent with Integrated decoration? I propose that it is consistent. Structurally the impost acts as a solid platform from which the arches spring, this has been translated by the designer into bulky, strong and immovable components with the added vertical orientation lent by the billets.

The Door Jamb Moulding

This jamb moulding, at the rear of the recess, has on its chamfered plane the main decorative field flanked by double rows of isocetes billets which are so small that they amalgamate to form a continuous line. The main field has two weaving lines with trefoils and bi-foils placed along their inner and outer sides. The effect is passive, neither showing movement nor resistance to movement.

As in the two previous mouldings the question of whether the term Integrated decoration is appropriate must be poised. The answer on this occasion must undoubtedly be "No". A jamb moulding acts as the area of transition between the wall plane and the opening's darkness, therefore, it has no structural function and this surely explains why the designer made his design/

design weak and impotent.

Conclusion

For any designer to be able to successfully translate the structural loadings in an architectural element into a visual form, and at the same time maintaining an aesthetic harmony, is the hallmark of greatness. Consider the work of the modern architect and engineer Pier Luigi Nervi, especially that for the Rome Olympics, and the acclaim he received - is not the work of this anonymous designer just as great? He builds up interest in his designs through a series of clues (which in their own right are a fine example of Interrelated decoration composed of vegetal elements) to the point where the grammatical concept of Integrated decoration is revealed.

I am convinced that this achievement is, in artistic terms, on the highest level, which may explain why I have only isolated this one example during my years in Jerusalem and Cairo although I was always on the alert.

Resulting from the relationships which were found to exist between an architectural element's proportional geometry and the number of its stone courses I decided to look at Mamlūk portals round about the period of Qāyṭbāy to see what evidence they might provide. The portals, unlike the previous elements come in a great variety of sizes which I find very understandable because they are the elements on a building which express and transmit the building purpose, and I believe that now I can gauge the quality and quantity of the internal spaces and their decoration from the portal. This may have something to do with the work sequence during the construction, for it seems that after the qibla was orientated correctly along with the īwān and sahn in front of it, the portal was arranged, in the latter stages when the carved decoration was to be cut again the qibla was first followed closely by the portal, and therefore if it was left unfinished or hurried over one cannot expect that the internal decoration is better. Thus portals are characteristic of an individual building and any attempt to compare them could be predicted as a failure, but there is the ever present 'Unity' to help redeem the study.

Twenty-two portals of various shapes and sizes are given in chronological order beginning at Plate LXXVIII. At this early stage in the development of this thought, the indications are that during this period the portals were designed using a number of stock components, but the components were not based on a measured standard, instead they maintained the same proportions.

Imagine, a designer is asked to design a tall narrow portal such as the principal entrance to [99] the Mosque and Mausoleum of Qāyṭbāy (Plate LXXXI), he has to obviously include a door opening in the lowest unit flanked by the ubiquitous mastabas or benches, and high above them he may construct a trifoliated head, the intermediate spaces he will, by trial and/

and error fill up with a variety of components until they neatly connect his base and top units. If a portal at the other extreme is imagined, such as [322] the remains of the Palace of Qansūh al-Ghūrī (Plate XCIII), where he is faced with a very wide portal which has to have a base unit with door opening and an upper unit of trifoliated arch he can combine the components directly to each other. These components are generally defined by either red stone compartmentation or by mouldings, and so when one looks at a portal the component parts are obvious.

To help advance this embryonic idea, six portals have been drawn so that the widths of their recesses are constant, and so that they can be overlaid on each other. These drawings are found in the back pocket of Volume II.

I think that the two relationships to notice are: the connection between the bottom and top components where the widths of the door opening and the trifoliated arch's semi-dome are equal except in 'A' and 'F'; the other is that the full height of the door does not necessarily constitute one component, a break generally occurs at the bottom of the lintel's compartmentation (this feature is also commonly found in window openings).

Here I think is a possible line for future research because it may be that if the study is extended to portals built at intervals of fifty years, before or after Qāyṭbāy's Period, changes may suddenly develop in the proportional geometries which could indicate some new artistic or political influence. In my opinion such a change occurs about the time of the Ottoman conquest: I would say that Mamlūk architecture from a distance is two dimensional, but the closer the observer gets the more three dimensional the architecture becomes, for example the curvilinear muqarnas grasp out and entrap space; in Ottoman architecture the reverse applies, from a distance it is three dimensional with the walls zigzagging back and forth, and the closer in the more two dimensional and flat it becomes, the curvilinear muqarnas have lost their concave character. The Ottoman example is a very obvious change, there may be others that are more subtle.

The continued influence of Mamlūk architecture, especially that of Qāytbāy, on the buildings of Cairo long after the Ottoman annexation of Egypt in 922/1516 is evident to any visitor. What is not so visible are the changes produced by their reproduction and which illustrate attitudes current at the time of reproduction.

An Engaged Column

One design which was copied by later designers in the engaged column on the north west corner of 76 the Sabīl-Kuttāb of Qāytbāy, opposite al-Azhar. (Plates, LXXXV, XCIV and Drawing 113). The shaft has three decorative registers; above the base an arabesque and ribbon development with a chinoiserie band separating it from the major decorative area, the geometrical design above it is another arabesque and ribbon design with its own chinoiserie band along its top edge. Around the column's collar are the names and titles of Qāytbāy in two lines, and in the rectilinear muqarnas capital's cells are vegetal elements. The design whether considered in total, or as a number of parts is visually satisfying.

Both the areas of arabesques and ribbons have a clarity of form enabling the individual paths of the systems to be traced easily. Regarding the ribbons, they have two angles of slope, in their lower halves it is steep and in the upper it is more gentle. Combine this feature with their decorative grammar, analogous to a linked chain (previously found in the Stone Minbar of Qāytbāy's Balustrade Panels 6 and 4 of the Left and Right sides), and the reasons for their visual success are understood. They bring the upper and lower portions of the Column in towards the geometrically decorated area. It may also be possible to read into their arrangement a concentration of forces at the top of the column and their dispersal at the bottom. Had their positions been transposed their overall effectiveness,

I feel, would have been weakened.

The interlaced solid line geometry of the central area, with its interstitial elements also conveys clearly and effectively its content. This, of course has been one of the recurring themes throughout my dissertation. The scale of the design's elements is essential to their success and relates back to the fact that the complete decorative area represents one (hexagonal) repeat unit; about the central node one half can be identified, and above and below it are two quarters of the unit.

This engaged column was reproduced at the South West corner of 378 the Mosque of Sayyida ^CA'isha, 1175/1762. It is presented in a truly Ottoman manner, there is a general flattening out of the various elements.

In the arabesque and ribbon panels the ribbon maintains a constant slope of 45° , and at times it is transformed into or coincides with the lines of the arabesques. Both systems appear to be floating in an undecided fashion over the background because the design is so loose. In the upper area the ribbon peters away at the centre, but somehow manages to reappear suddenly across the top corners: here then is a complete distortion of the directions followed in the Mamlūk model.

A second reproduction was repeated three times along the west and south elevations of the 13th/19th century extensions to al-Azhar. Two of the reproductions can be seen from the Sabīl-Kuttāb Qāyṭbāy, so there is no argument over how the inspiration arose. This engaged column has been stretched out to a point where any thought of it acting as a structural member is destroyed. The arabesque and ribbons no longer contrast with each other, they look like a piece of knitting immortalised in stone. The geometry of the shaft is little better, it seems to be never ending, and the distances between the nodes are too big to enable the comprehension of the geometric structure.

Had either of the reproductions been the first of its type then it may have been given credit for its design content, but knowing that they are copies the outcome is pitiful. There was obviously no thought given to find the explanation why the Mamlūk design was successful which is presumably the reason for the plagiarism in the first instance.

A Lintel and a relieving arch

In a slightly modified form the arabesque and ribbon design from the Sabīl-Kuttāb's engaged column is used to decorate a number of lintels over the shopping booths of its neighbour, [75] the Wekālat Qāyṭbāy. Not all of the booths had decorated lintels because they were alternated with decorated relieving arches. Whenever the lintels were decorated the relieving arches were simply joggled and in ablaq and vice versa. (Plates XCVII, XCVIII). I conclude that, firstly, Qāyṭbāy's designers acknowledged once more the necessity of an effective positive and negative equilibrium, and secondly, they could judge precisely just how much decoration could be placed around any given point before a change is required to stimulate further interest.

It should not come as a surprise to find that these designs were also reproduced. They, and others, were used to decorate the Mosque of Sīdī al-Rafa^ci, 1329/1911. I think that they show that in the late Nineteenth and early Twentieth centuries there was an academic awareness of Cairo's Islamic heritage, for unlike the reproduced engaged columns, they copy very accurately the Qāyṭbāy originals as shown by the example illustrated in Plate IC. There is the difference that the two architectural elements have been combined and surrounded not by plain compartmentation, but by a linked Mamlūk inspired moulded frame.

APPENDIX F: THE MINBAR OF QĀYTBĀY, HANKIN'S SOLUTION

An Extract from 'On Some Discoveries of the Methods of Design Employed in Mohammedan Art' by E.H. Hankin, Journal of the Society of Arts (March 1905), pp.461-477 with special reference to pp.468-470, Figures 14-15.

"In Figure 14¹ is represented a panel from the side of a stone pulpit in Cairo, copied (with some modification) from Stanley Lane Pool's (sic) work on Saracenic art.

For drawing this pattern two templates are required. One is a regular sixteen-sided polygon. The other is a regular heptagon, the length of whose side is the same as the length of the side of the sixteen-sided polygon. Perhaps for convenience of description I may be allowed to refer to the latter as the "16-gon".

With the 16-gon template draw the outline B shown in Figure 15 reproduced in Drawing 101 above. Place the heptagon template with one side touching B at K H. By this means draw in the heptagon DEFGHKL. Two sides of this heptagon, F G and G H, are indicated merely as dotted lines as they are not further required. The centre of this heptagon is at N. A second similarly situated heptagon is now drawn in having its centre at P. The 16-gon template is now placed touching the sides E F O of the twinned heptagons, and a 16-gon is thereby drawn shown at A. Twinned heptagons are similarly drawn at symmetrical intervals round the original 16-gon B, and on one side the twinned heptagons indicate the position of another 16-gon which is shown in the figure drawn round C.

Between the 16-gons A, B, and C, is left a space which is filled up by a dodecagon R. Similar spaces are filled up by similar dodecagons at S and T, and also (partly drawn) at the three corners of the panel. These dodecagons are not quite symmetrical, but must be drawn as regular as the space available permits.

In/

In each of the twinned heptagons smaller heptagons have now to be drawn, such as those shown with centres at N and P. Each of these heptagons has its centre identical with the centre of its larger surrounding heptagon, and is drawn of such a size that one of its sides touches, or is the same as, the side of its fellow.

The primary construction lines have now been completed. The secondary construction lines consist of the radii of the different polygons, and of one or two circles drawn in each of the polygons. Within limits the exact sizes of these circles do not matter. By trial and error a suitable size can easily be found.

In the previously described arabesques,² the pattern lines were drawn through the centres of the construction lines. In the arabesque now under construction this is not the case. Each primary construction line, that is to say, each side of a polygon, is to be divided by two dots into three equal parts. The pattern lines are drawn through the dots. Some of the pattern lines have been drawn in as dotted lines in part of the figure. These will serve as a guide to enable the student to complete the pattern with facility.

Supposing it is required to discover the construction lines of any given arabesque, proceed as follows. Mark the centres of all the larger spaces included in the pattern, excepting, as a rule, the star-shaped spaces. Join these centres. The polygons thus produced are the primary construction lines. Supposing it is required to copy an arabesque that exists on a ceiling, or in some other inaccessible position, a similar method will suffice. On looking at the pattern, it is easy to imagine lines joining the centres of the larger spaces, which lines describe polygons. A rough sketch may be made of these imagined polygons. From this, at leisure, an accurate drawing may be made. In doing so it is necessary to make the different polygons as symmetrical as possible, and, so far as possible, having/

having their sides all of an equal length. Guided by this rule, and after a little practice, any complicated arabesque pattern can usually be solved in ten minutes. On the other hand, I personally have failed to solve some of the apparently more simple patterns despite a more extended study.

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44	Mosque and Mausoleum of an-Nāṣir Muḥammad ibn Qalā'ūn	695-703/1295-1304.
149	Khānaqāh of Farag ibn Barqūq	803-13/1400-11
60	Mosque of Qādī ^c Abd al-Bāsit	823/1420
119	Mosque of Gānī Bek	830/1426-27
192	Zāwiyat Fayrūz	830/1426
204	Mosque of al-Qādī Yahyā	856/1452
82	Mosque of Sidi Madyan	c.870/1465
97	Al-Azhar Mosque (Qāyṭbāy Entrance)	873/1469
216	Mosque of Timrāz al-Aḥmadī	876/1472
99	Mosque and Mausoleum of Qāyṭbāy	877-79/1472-74
101	Maq ^c ad Qāyṭbāy	879/1474
104	Rab ^c Qāyṭbāy	879/1474
223	Mosque of Qāyṭbāy at Qal ^c et al-Kabsh	880/1475
76	Sabīl-Kuttāb of Qāyṭbāy, opposite al-Azhar	881/1477
75	Wekālat Qāyṭbāy, opposite al-Azhar	882/1477
129	Mosque and Mausoleum of Gānem al-Bahlawān	883-916/1478-1510
49	Mosque of Abū Bakr Muzhir	884/1479
324	Sabīl-Kuttāb Qāyṭbāy	884/1479
114	Mosque of Qagmās al-Ishāqī	885-86/1480-81
	Al-Ashrafiyya, Jerusalem	886-87/1481-82
519	Mosque of Qāyṭbāy, Rōḍa	886-96/1481-90
	Sabīl of Qāyṭbāy, Jerusalem	887/1482
149	Stone Minbar of Qāyṭbāy	888/1483
228	House of Qāyṭbāy	890/1485
235	House of Aḥmad Katkhudā ar-Razzāz	before 900/1494-95
211	Mosque of Azbak al-Yūsufī	900/1494-95
239	Mosque of Sultān Shāh	before 901/1496
	Mosque of Princess ^c Aṣalbāy, Medīnat al-Fayyūm	905/1499

322	Remains of Palace of Qānṣūh al-Ghūrī	906-22/1501-16
67	Mausoleum and Sabil-Kuttāb of al-Ghūrī	909-10/1503-4
64	Wekālat al-Ghūrī	909-10/1504-5
378	Mosque of Sayyida ^C A'isha	1175/1762
---	Mosque of Sidi al-Rafā ^C i	1329/1911

Arabic Terms

Amīr: Often translated as 'Prince' it was a title given to the top military commanders.

Ablaq: Polychrome stonework generally alternating reds and whites although occasionally black stone is used.

Bāb: Gate.

Dīwān: The equivalent of a government ministry.

Haram: A sanctuary or inviolable area. Here refers to al-Ḥaram al-Sharīf, 'The Noble Sanctuary'.

Īwān: Each of the four divisions of a cruciform mosque or madrasa surrounding the sahn. The īwān containing the qibla and the minbar represents the sanctuary.

Jamī^c: Originally applied to the great mosque in which the sermon could be given on Fridays by the ruler or his representative. Here it refers to al-Jamī^c al-Aqsa.

Khānaqāh: An endowed foundation somewhat similar to a European medieval convent for Sufi mystics.

Kufī: A square and often elaborately decorated Arabic script.

Kufesque: A word coined by the American numismatist George Miles as a synonym for pseudo-kufi.

Kuttāb: A primary school for the teaching of the Koran which is often reserved for orphans. As an architectural element it is regularly placed above a sabīl.

Madrasa/

Madrasa: A theological school or college teaching the Koran, exegesis, the Traditions and canon law.

Mamlūks: Literally 'owned'. Two dynasties of manumitted slaves reigning in Egypt and Syria from 1250-1517.

Majma^c: Meeting hall for sufīs.

Mastaba: Raised platform. Here refers to the bench seats within a portal recess and on either side of the door opening.

Mihrab: Niche indicating the qibla or local direction to Mecca in a place of prayer.

Minbar: Pulpit from which the Friday prayer is given in a mosque, in a madrasa it was used for sermons.

Muqarnas: An architectural element sometimes described as stalactites.

Qibla: The direction to Mecca on which a Moslem should turn when praying.

Qubba(t): Literally 'dome'. Here it refers to al-Qubbat al-Ṣakhra, 'The Dome of the Rock'.

Riwāq: The arcaded ambulatory along the west and north sides of al-Ḥaram.

Sabil: Fountain built to provide the poor with free water for drinking and for ablution purposes, hence the sabil-kuttābs associated with Cairo's mosques and madrasas.

Sahn: Central court of a mosque or madrasa.

Silsila: Chain.

Sufi: Mystical or ascetic orders in Islam.

Tariq: The 'way'. Here it refers to a street.

Turba(t)

Turba(t): Mausoleum.

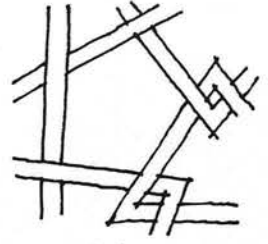
Waqf: Land or other property endowed in perpetuity for the benefit of a pious foundation.

Waqfiyya: The signed legal document constituting a pious foundation which specifies the foundation's physical boundaries and its endowments.

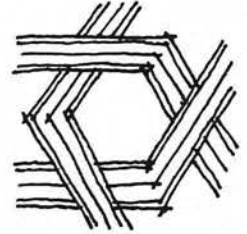
Wekāla(t): Used in Egypt as a synonym of khān, a market building. In the Mamlūk Period they were used as royal customs houses for the levying of duties.

Geometrical Design Terms

Solid and interlaced geometric lines



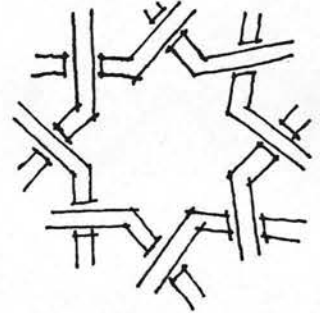
Split and interlaced geometric lines



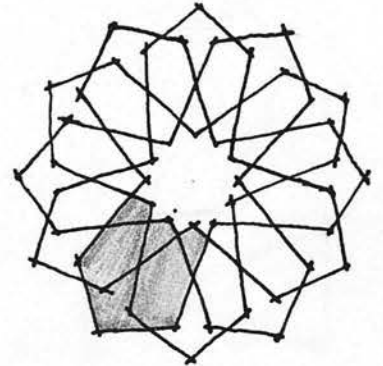
Shadow lines



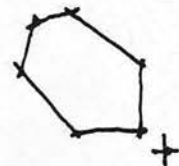
Nucleus



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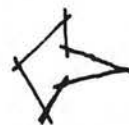
Petal



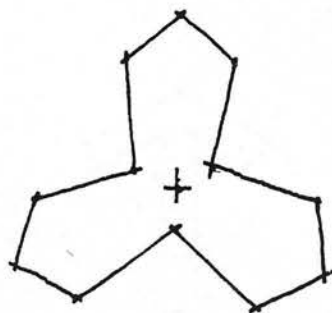
Quadrilateral separator



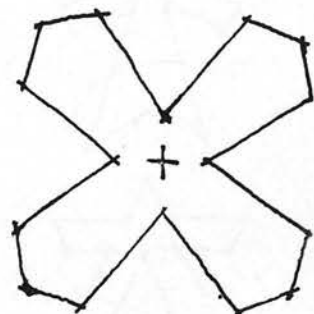
Wedge



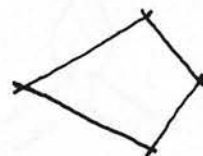
Triradial propeller-like figure



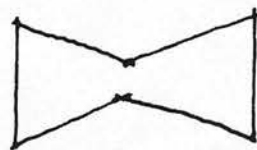
Quadripartite propeller-like figure



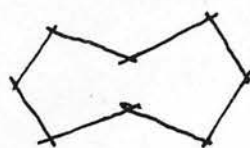
Spear head



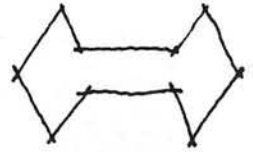
Dice box



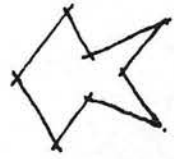
Pointed spindle-shaped interstices



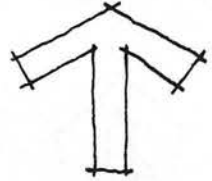
Pointed spindle-shaped interstices



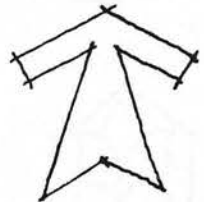
Feathered arrow head



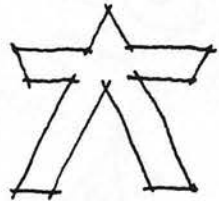
Dart



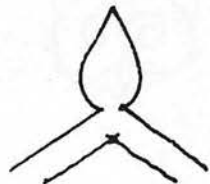
Feathered Dart



Feathered Dart with Bar



Droplet Terminal

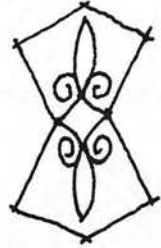


Interstitial Elements

Simple trefoil



Coupled trefoil



Trefoil with bracts



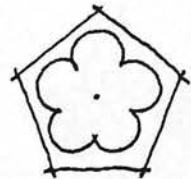
Palmette



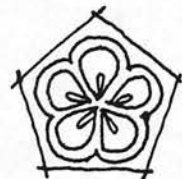
Complicated palmette



Solid cinquefoil



Sculpted cinquefoil



Arabesque Elements

Interlaced and self-contained arabesque system



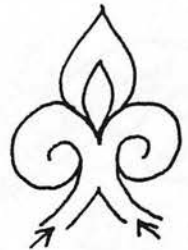
Double growth arabesque system



Semi-contained arabesque system



Trifoliated head



Palmette incorporating half-palmettes and heart-shaped palmette top bud.



Half-palmette incorporating half-palmettes



Couple half-palmettes incorporating half-palmettes



Split palmette



Full terminal leaf with scroll ends and single leaf



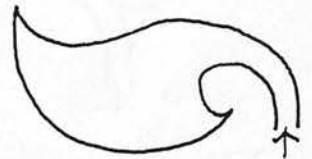
Full terminal leaf with scroll ends incorporating a half-palmette



Half-palmette terminal with scroll ends and simple leaf.
(The single leaf is a variation)



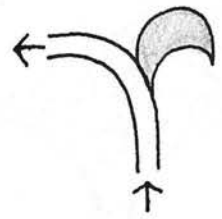
Crescent terminal leaf



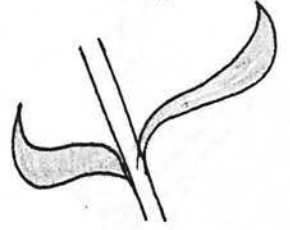
Terminal leaf incorporating half-palmette



Simple leaf



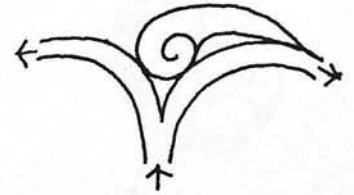
Opposite leaves



Side leaf



Sprouting leaf



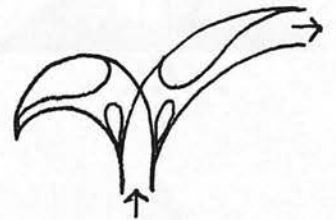
Sprouting leaf



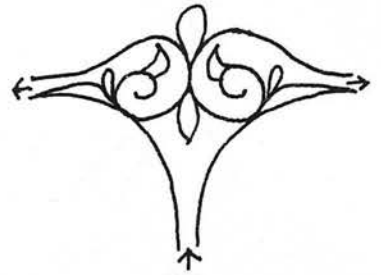
Sprouting side leaf



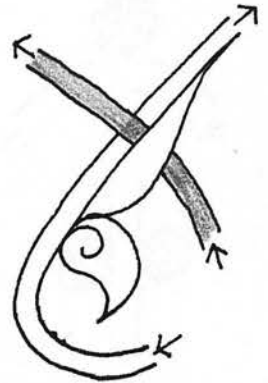
Split leaves



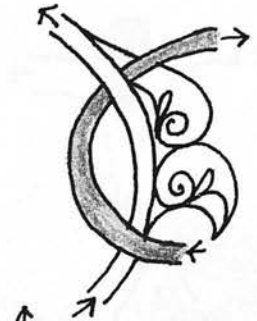
Bifurcated leaf incorporating half-palmettes



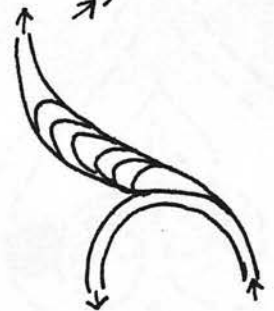
Half-palmette with half-overlap



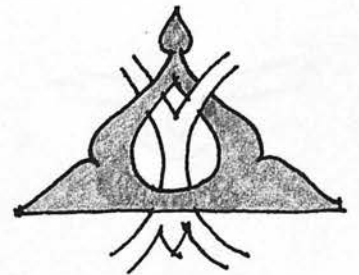
Half-palmette with half-overlap, and incorporating half-palmettes



Seed pods



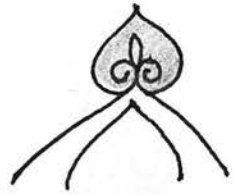
Vegetal collar



Heart-shaped bud



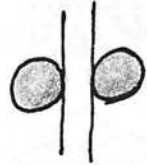
Heart-shaped palmette bud



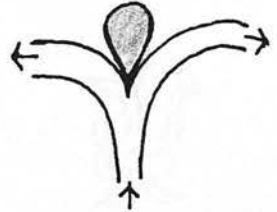
Knop



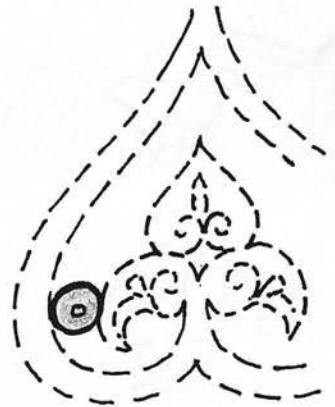
Double knop



Simple bud



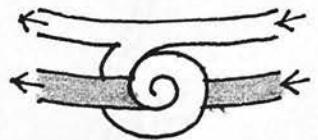
Knotted scroll



Whorl



Whorl with half-overlap



Full flower



Full flower with bifurcating bracts



Trifoliated flower without ovules



Trifoliated flower



Trifoliated flower with side leaf



Trifoliated flower with cordate



Trifoliated leaf



Trifoliated leaf with side leaf



Trifoliated leaf with stipules



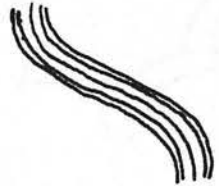
Leaf with quadruplicated stipules



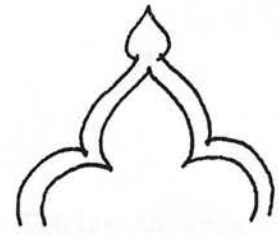
Globular



Split stem



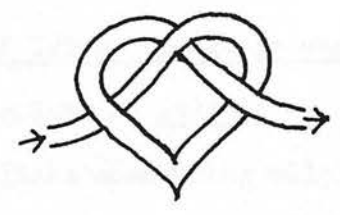
Ribbon development



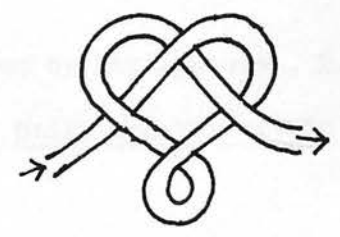
Trilobate unit



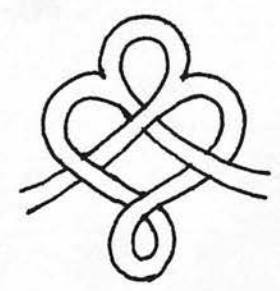
Heart-shaped loose knot



Heart-shaped loose knot with a twist



Bifurcating loose knot with a twist



'Introduction' (pp 1-9).

1. The format of the World of Islam Festival held in London in 1976 expressed this unity, the very fact that it was a festival composed of numerous exhibitions meshing together to present as much of the spectrum of Islamic culture is indicative of the general acceptability of this unity. The publications associated with the Festival attest to the inter-disciplinary nature of unity: El-Said and Paraman in Geometric Concepts in Islamic Art apply their findings naturally to geometric decoration but they extend them to include Arabic calligraphy, poetry, and music; Burckhardt in Art of Islam: Language and Meaning takes unity as his central theme; while Nasr in Islamic Science: An Illustrated Study investigates the links connecting all spheres of Islamic knowledge.
2. Specific instances of this transference are given by Ettinghausen, R. 'Interaction and Integration in Islamic Art'. Unity and Variety in Muslim Civilisation. 1955 pp109-14.
3. Grabar, O. The Formation of Islamic Art. pp.195-196
4. Ettinghausen, op. cit. p.109.
5. Nasr, op. cit. p.88
6. Nasr, ibid. p.88
7. Grabar, O. 'What makes Islamic Art Islamic', AARP, 1976, p.3.
8. Concise Oxford Dictionary.
9. The abbreviation CIA will be used throughout.
10. An archive has been created in the Ashmolean Museum, Oxford, to house the/

the hundreds of photographs taken by Sir Archibald Creswell.

11. Clermont-Ganneau, C. Archaeological Researches in Palestine. London 1896.
12. Vincent and Abel. Jerusalem. Paris 1912.
13. Ashbee, C.R. Jerusalem 1918-1920. ; and by the same Jerusalem 1920-1922.
14. Harvey, W. 'A Native House', The Builder 1910, pp.74-75; 'Saracenic Vaulting', AR 1911, pp. 241-45.; 'Jerusalem Doorways', AR 1912, pp.201-06.; 'Native Street Architecture', The Builder 1914, pp.4-7.
15. Briggs, M.S. Muhammadan Architecture. Oxford 1924.
16. Tamari, S. 'As-Sultaniyya al-Ashrafiyya - An Imperial Madrasa in Jerusalem' Bar Ilan Departmental Researches I. 1973.

'Al-Ashrafiyya from Textural Sources'. (pp 10-17)

1. I am indebted to Miss Amal Abul-Hajj for providing a translation from Arabic of, Ibrāhīm, ^cAbd al-Latif. 'Wathīqa as-Sultān Qāyrbāy: al-Madrasa bil-Quds wa al-jami^c bi-Ghaza'. ('Contract of Sultān Qāyrbāy: the Madrasa in Jerusalem and the Mosque in Ghaza'). Silsilat ad-Dirāsāt al-wathā'iqiya, II. (Series of Studies concerning Documents, II). The Third Congress for Archaeology in Arab Countries, Fez, November 1959. Cairo, 1961. pp.389-444 and 16pls.
2. Mujīr al-Dīn al-^cUlaymī, Al-Uns al-Jalīl bi Ta'rīkh al-Quds wa'l-Khalīl, Cairo, 1866. Trans. from the Arabic into French by Sauvaire, Histoire de Jérusalem et d'Hebron. Paris 1876.
3. Van Berchem, M. CIA I - 'Ville'. pp352-73, 'Madrasa de Malik Ashraf Qayt-Bāy (Ashrafiyya)'

4./

4. Tamari, S. op. cit. Hebrew text pp. 9-40 with an English Summary on pp. LI-LII. Plates 1-40, Plans I-V.
5. Previously the only published plans were the two sketch plans of van Berchem used by him to locate his inscriptions. CIA I - 'Ville'. Figure 61 (p. 352) and figure 62 (p.354).
6. I admit to having a personal interest in this due partly to the working climate of an Armed Occupation and partly due to his statement in 'A resume of past studies' that, 'After the great work of van Berchem we must not overlook the work done by the BSAJ, they started a scientific survey of the schools in Jerusalem, some have been published with maps, plans and photographs of just their facades. This research has been poor in the textural aspect and the Ashrafiyya was not part of this study.' I am taking this opportunity to counter his criticisms, the textural aspects may have been neglected but van Berchem was available, and the BSAJ employed two qualified architects not arabists on the Architectural Survey. I shall henceforth refrain from criticising the written offering since my translation was obtained through the circuitous route of Hebrew to Arabic and eventually to English, instead I will concentrate on what could have been a great contribution to the study of Jerusalem architecture, Tamari's drawings.
7. I will refer to this as the 'Old Madrasa'.
8. For this inscription see No. 105 in the CIA I - 'Ville', p.358: see also Mayer, L.A. Saracenic Heraldry. p.162: and Walls, A.G. The Positions of Arabic Inscriptions in Jerusalem for its location relative to other inscriptions. Van Berchem admits to being suspicious of this inscription and suggests that it is the result of tampering by the amīr Muhammad who replaced an older date and the names/

names of his predecessor the amīr Birdibak, Ibid. p.365.

9. The amīr Muḥammad constructed in this year the south west staircase and the Qanāṭir to the Upper Terrace of al-Ḥaram, CIA II - 'Haram', pp. 156-59.
10. Van Berchem attempts to resolve this anomaly by pointing out that the Old Madrasa, and therefore the demolition, was situated in the south adjacent to the Minaret while the new work was farther to the north. CIA I - 'Ville', p. 366.
11. Van Berchem writes, 'Ce passage est curieux à deux points de vue: D'abord, il confirme le rôle important joué par les chrétiens dans l'art musulman; sur les artisans chrétiens employés aux travaux de la Sakhra au XVe siècle ... belles madrasas contemporaines au Cairo'. Ibid. p. 362.
12. This is inscription No. 106, Ibid. pp.358-59.
13. Ibid. p.367.
14. See Rogers, M. The Spread of Islam. In The Making of the Past, edited by John Boardman et al. Oxford, 1976, p.16 and plate on p.17 (credited to the Bodleian Library, Oxford) a detail of which is given as Plate I.
15. Hamilton, R. A Structural History. See p. 7 and Plate IV, also Plate V (3) where he illustrates the relevant part of Breydenbach's drawing.
16. Mayer, L.A. 'A sequel to Mujīr Ad-Dīn's Chronicle', JPOS XI/2, 1931, pp. 85-97 (pp.1-13 in the separatum).
17. Freeman-Grenville, G. The Muslim and Christian Calendars. Oxford O.U.P. 1963.

18. Walls and King, 'The Sundial on the West Wall', to be published AARP.
19. The Architecture of Islamic Jerusalem. Published by the British School of Archaeology in Jerusalem. London, 1976. This will be abbreviated to AIJ.
20. Stephan, St.H. 'An Endowment Deed of Khāṣṣeki Sulṭān dated the 24th of May 1552'. QDAP X, 1944, pp. 170-94.

'A Description of Today's al-Ashrafiyya' (pp 18-61)

1. For the elevation and section lines of the drawings of al-Ashrafiyya's survey reference should be made to Figure 8 at the end of this Chapter.
2. Mayer writes that Mujīr al-Dīn's Dhayl 'goes on describing the damage done by that earthquake. High buildings suffered most, Jerusalem and Hebron being specially mentioned; at Nablus 500 men were buried under the ruins. The top of the minaret at the Bāb as-Silsia was damaged, also the madrasa of Qāyṭbāy in Jerusalem (This madrasa, known as al-Madrasa al-Ashrafiyya was badly shaken in 1927 also, and some walls on the upper floor had to be thoroughly restored)'. Mayer, L.A. Op.cit., p.3 in the separatum.
3. An indication of the pace at which this deterioration is escalating can be judged using Sir Archibald Creswell's photographs taken almost sixty years ago. In a general photography (Plate X) of the first floor Madrasa the carved stone details are clear, or at least the shadows cast by their relief are visible, these same details in the mid-seventies were impossible to photograph even in close-up and they were with the greatest difficulty deduced from paper squeezes. This is a classic example of the total mechanical breakdown of stonework due to the washing out of the softer grits from in between the harder strata/

strata. Seen in terms of Islam's architectural heritage it is a catastrophe since it is but one in hundreds of monuments silently deteriorating for some reason or another. To think that fifty years ago the carved decoration was still visible after three and a half centuries of exposure and that now it is all but obliterated, I find it extremely depressing.

4. All of the measurements given on the drawings relate to my surveys with the exception of those inside the majma^c which were scaled off drawings provided by the Supreme Muslim Council. In the areas outside the West Wall of al-Ḥaram, which form the Madrasa Baladiyya, and those areas of ancillary accommodation above which formed part of the final al-Ashrafiyya, I have with grave misgivings adopted the arrangements indicated by Tamari in his plans Plates I-IV, the reasons for my reluctance will be manifest later.
5. The mihṛāb in the Madrasa of Muḥammad b. Muzhir is illustrated by Burgoyne, M. 'Ṭarīq Bāb al-Ḥadīd' Levant V, 1973, Plates XXIVB.
6. For the direction taken by this and the joint further to the south see Drawing 9.
7. The ancillary accommodation is detailed in Hebrew text of Tamari, Op. cit. p. 20
8. Two of Creswell's photographs show the wall prior to its integration and will be used in the more detailed analysis below.
9. It might seem strange that such a simple mistake could be made and not corrected, but in my presence Dr. Michael Meinecke was confronted by a mason with a similar problem during the restoration of the Tomb of al-Shaykh Sinān. An external corner was under construction, it was neither an exact right angle nor was it vertical on either of its/

its faces, even so the mason had laid three to four courses, realised the discrepancy, complained about the disgraceful workmanship of the past while resisting any attempts to separate him from his beloved plumb-bob and square with which he kept trying to overcome the problem without any success.

10. Admittedly I am relying on a hunch, but one founded on the experience that the quality of the average Mamlūk or Ottoman extension or rebuild existing in Jerusalem is poorer than the original work.
11. Unfortunately, I do not possess a close-up photograph of this interesting detail for either this or the southern archway.
12. The 'silent links' articulate the red stone surrounds at the apexes of the arched openings. One such silent link is illustrated in Plate II and another in Drawing 86; see also Hautecoeur, L. and Wiet, G. Les Mosquées du Cairo, Deuxieme partie, figure 10 (p.326)
13. Somewhere in this wall were placed the royal decrees of Jaqmaq, 853/1449; Khushqadam, 870/1465; and Qāyṭbāy, 881/1476 which are respectively inscription Nos. 184, 185 and 186 in the CIA II - 'Ḥaram', pp. 150-57: see also Walls, A.G. The Positions.
14. The inscription commemorates the Minaret's restoration (by the amīr Tankiz) under Malīk Nāṣir Muḥammad in 730/1329-30 and is No. 175, ibid. pp. 123-27.
15. For an example of this type of window supported on two or three courses of consoles see Walls, A.G. 'The Turbat Barakat Khān', Levant VI, plate XV A and B.
16. Burgoyne suggests that this formed part of Khushqadam's royal decree of 870/1465 and that its present position indicates a reuse rather than/

than a relocation, I disagree with him because the northern half of the window recess, in which the shield exists, still retains some of the original ablaq and muqarnas decoration and that it is the southern half of the recess which is the rebuild. If I am correct then the position of this shield has further implications: did the Old Madrasa, which before it was offered to Qāyṭbāy had as its patron Khushqadum, extend so much farther south beyond the Minaret than has previously been considered? This may only be answered after this southern property has been thoroughly inspected. Bourgoyne, M.H., 'Twenty-four Medieval Arabic Inscriptions', Levant XI, pp.134-35, Plates XXIII A and B; and in Walls, A.G., The Positions, No. XLVIII.

17. One such joggled keystone is found in the rebuilt area at the centre of the East Elevation's wallhead.
18. Through the kindness of the Supreme Muslim Council scaffolding was erected to enable me to make paper squeezes and it was during the squeezing operations that this evidence was noted by me.
19. This stone minbar of Qāyṭbāy's is analysed below. pp. 208-305.
20. The word 'compartmented' has been chosen to describe the individual decorative areas which are isolated by, and defined by coloured stone bands.
21. A similar sequence of events must have taken place in Cairo for on the Minbar of the Khānaqāh I found specks of gold leaf on the light red coloured base in some of the areas where the dark red overcoat had come off. The technical term for this base on which the gold leaf is applied is 'bole', it is a fine, compact, earthy clay, and as it is red it will give a rich ruddiness to the gold leaf. Although the Sabīl-Kuttāb of Qāyṭbāy, 884/1479 (Cairo Monument Index No. 324), does not exhibit the same sequence a parallel exists in the small shields of/

of Qāyṭbāy found above the north west corner's engaged column and the three shields inside the recessed portal. The uncoloured and high-relief letters and divisions are displayed against an ochre background.

22. This same pinkish stone is found on many of the Mamlūk buildings of Jerusalem and without exception is indicative of twentieth century restorations.
23. Stone built on 'cant' has the natural bedding vertical.
24. Burgoyne, M.H. 'Some Mameluke Doorways' Levant III, pp. 23-26: and AIJ No. 138.
25. Van Berchem, M. CIA I - 'Ville', pp.358-59. Inscription No. 106.
26. I think that there is the possibility that this joggled lintel at the rear of al-Ashrafiyya's Portal Recess was modelled on the earlier joggled ablaq sill and lintel of the second window in the portal recess of the Sabīl-Kuttāb in Cairo.
27. An 'umbrella' is a dome on a circular base, but also divided into individual webs, each of which, however, has a base-line curved segmentally in plan and also curved in elevation. Fleming, J. The Penguin Dictionary of Architecture. On this basis the muqarnas' topmost cell can be likened to a cross-section through the centre of an umbrella dome.
28. Although my study does not embrace the Madrasa Baladiyya in any detail it seems appropriate that while surmising about the possibilities of a lost inscription that I should add two inscriptions rediscovered by me and given in The Positions as:-
Family tomb of Qunuqbāy al-Aḥmadī
Nos. XLIII. Epitaph of Sayf al-Dīn Qunuqbāy al-Aḥmadī. 797/1395
A five line inscription at the west end of the southernmost/

most of three cenotaphs.

XLIV. Epitaph of Ṣafar and Zahra, daughters of Qunuqbāy al-Ahmadi. 797/1395.

A six line inscription at the west end of the central cenotaph.

I have also illustrated them in Drawing 72; see also Burgoyne, M.H. 'Twenty-four Medieval Arabic Inscriptions', pp. 130-32, Plates XX A and B and XXI A.

29. In an attempt to forestall any future complications when the decorated window lintels are discussed the numerical sequence will start with the eastern window lintel in the Corridor at the top of the Grand Staircase, thus the first lintel in the Courtyard will be that of the most southerly window in the Madrasa's West Wall and it will be Number 3. The sequence will end with the northern most lintel, Number 6. On all other occasions the windows will be referred to by their relative positions to each other and not by the numerical sequence.
30. A 'safety lintel' is a lintel which carries a load to protect another more decorated lintel. Scott, J. A Dictionary of Architecture.
31. I have discovered safety lintels in the Mausoleum of the amīr Kīlānī, c.753/1352 (AIJ No. 69) and in the Madrasa and Mausoleum of the amīr Tashtamur, 784/1382 (AIJ No. 88)
32. Walls, A.G. and King, D.A. 'The Sundial on the West Wall' to be published in AARP.
33. Vestigial-terminals describes accurately the vertical breaks occurring in the top horizontal mouldings of a recessed portal's mastabas. See Plates Ll and Lll for the terminal form on which this is based.
34. The photographs were kindly supplied by the Creswell Archives, The Ashmolean/

35. Van Berchem, M. CIA I - 'Ville', figure 62 on p.354 and p.368.
36. Whatever the reason is for the unusual split voussoirs they are repeated in Cairo in the Mosque of Abū Bakr Muzhir (Plate XLII) framing the semi-dome of the portal recess as well as the Sabīl-Kuttāb of Qāyṭbāy (Plate XXXIII).
37. The inscription band in the three existing iwāns are from the Qur'an 48/1-2, and another verse in the Qibla iwān. Van Berchem, M. Ibid. pp. 373-74.
38. This small detail of a double spandrel bending around a corner has lead to the uncovering of a first class piece of counterfeit inside the Sabīl of Qāyṭbāy in al-Ḥaram. I hope to publish this as a separate article.
39. Van Berchem, M. CIA II - 'Ḥaram', pp.123-27. No. 175.
40. Van Berchem, M. CIA I - 'Ville', pp.252-61; see also Walls, A.G. The Positions. and AIJ No. 57.
41. Stephan, St. H. 'Evila Tschelebi's Travels in Palestine, VI'. QDAP IX, 1939, p. 100.
42. Walls, A.G. 'Two Minarets' Levant VIII, 1976, Plates XX A and B.
43. 'The first datable examples (of the inscribed shield) ... are attributable to the later Bahri Mamlūk sultans like Muḥammad, the son ... of Qalāūn ... in two lines:
- (a) Muḥammad
 - (b) ^cizz li-maulānā as-sultān al-malik an-nāṣir.
 - (c) ornament.
- Mayer, L.A. Saracenic Heraldry. pp. 34-5. Words in brackets added.

44. Van Berchem, M. Op cit. pp.262-65. Inscription Nos. 80-81; Mayer, L.A. Op. cit. pp. 222-23; AIJ Nos. 57 and 63; and Walls, A.G. Op. cit.
45. My thanks are due to Dr. Kessler for this reference; Wilson, Ch. W. Jerusalem the Holy City. 1889.ill. p.53.
46. AIJ. No. 49.; for an illustration see Folda, J. 'Three Crusader Capitals', Levant, X.1978. Plate XV A.

'A Restoration of the Physical Form of al-Ashrafiyya (pp. 62-114)

1. Kessler, K. 'Funerary Architecture' Colloque. p.263.; Walls, A.G. and King, D.A. 'The Sundial'. in a forthcoming AARP.
2. This is a study in itself which I would like to undertake if the opportunity ever arises.
3. In fact the way I solved the riddle of the plan proportions of the Triple Windows did not follow the logical path I am now trying to tread, it began as a by-product of a 1:20 scale elevation of the external Triple Window Recess. While playing with the drawing I felt that it demonstrated attributes traceable to a $60^{\circ}/30^{\circ}$ rectangle which instinctively led to experiments with hexagons and eventually to a satisfactory conclusion. Later when I unearthed the Madrasa's hexagonally based proportional system it appeared logical that I should try out the elevational solution, or part of it, in the geometrical constructions of the Madrasa's plan.
4. This arch with $3/5$ radii is popular in Mamluk architecture probably because it is aesthetically pleasing and because it was easily constructed by finding the centre of the span and then measuring out on either side of it $1/10$ of the span.

5./

5. Very early on in this aspect of my work Prof. S. Michaelson of Edinburgh University kindly tested on a computer my conjecture that the course heights might be a multiplication or a subdivision of the mode of measurement used in Al-Ashrafiyya. In the test fifteen controlling dimensions were chosen from al-Ashrafiyya, the results unfortunately did not give support to my theory. But now that I have ascertained an abundance of evidence validating my assumptions using graphical techniques available to Qāyṭbāy's craftsmen, it would be intriguing to run the experiment again in order that the original proportions and dimensions might be supported by mathematical data.
6. This canon whereby the centre of the semi-dome of a recessed portal differs from the natural centre of the recess is adhered to not only in Jerusalem but also in all of the Mamlūk recessed portals in Cairo, Damascus and Aleppo. This canon would also seem to hold good for most periods of Islamic architecture. Examples are to be found in: Bourgoin, J. L'Art Arabe. vol. I. Plates 20-44; Burgoyne, M.H. 'Some Mameluke Doorways', Levant III Figures 7, 8, 16-19, Plates VIb, VIIb, IXa, XIb, XIIIb, XIVa and b, XVIIIb; Walls, A.G. 'The Mausoleum of the Amir Kīlānī', Levant, VII, 1975, Figure 22.; refer also to Drawing 112 below.
7. This emphasises the problem of arithmetically calculating a larger dimension from a smaller; there is understandably no problems involved when using a large dimension to find a smaller one because division is used and therefore any discrepancies are being reduced in size.

'The Restored Course Heights and Proportions of al-Ashrafiyya' (pp 115-133)

1. Hautecoeur and Wiet, Les Mosquées. 'Album', Plate 197.

2./

2. Observe that in the Mosque at Qal^c et al-Kabsh the ablaq coursing extends across the engaged columns to the window jambs.
3. Van Berchem edits the inscriptions of both complexes in MCIA, 1894, those of the Mosque and Mausoleum are Nos. 295-304, pp.431-39; and of the Mosque at Qal^c et al-Kabsh are Nos. 308-315, pp. 460-63. The wallhead inscriptions surrounding the sahns are: for the Mosque and Mausoleum, No. 297. 'Construction of the Mosque'. Ramadan 877/February 1473; and for the Mosque, No. 310. 'Construction and Completion'. 1st Sha^c bān 880/30th November 1475.
4. Ibid. Inscription No. 299. 'Construction of the Sanctuary or East (Qibla) īwān'. Rajab 877/December 1472. This timber inscription is located at mid-height along the three walls, starting on the east wall it continues on to the south wall where it is broken to enable to to continue along the north wall of the īwān.
5. Note that the qibla for Jerusalem is approximately south and that in Cairo it is approximately east, thus in Cairo the opposing īwān is the West īwān and to avoid any confusion with the Jerusalem directions I prefer to use here a non-directional adjective; the inscription is given by van Berchem. ibid. No. 299. 'Construction of the West īwān'. Rajab 878/November - December 1473, this timber inscription is located at mid-height along the wall facing the Qibla īwān and above five windows.
6. This two line inscription repeats the verse Q 33/56. Ibid. p.463.
7. I should remark on the fact that subsequent to seeing both of these inscriptions I noted that in the Mosque of Abū Bakr Muzhir there exists a more elaborate kufesque inscription in a series of units with lobed terminals characteristic of the more conventional inscriptions running around the wallheads of the sahns in Cairo. Also, I am now very aware of/

of the many kufesque inscriptions carved in timber or engraved on brass revetments that form part of the decoration of Cairo mosques.

8. Van Berchem. CIA I - 'Ville' p.355; for his full discussion on the problems surrounding the East īwān or Loggia's design see also pp.355-57, 369 and p.372.
9. Ibid. p.355
10. Ibid. p.356 and figure 62.
11. Tamari, S. 'As-Sultaniyya al-Ashrafiyya', Plan IV; Tamari goes further as in Plan V he provides an indication of what he must consider to have been the height and appearance of al-Ashrafiyya's East Elevation. I have reproduced this last drawing as Plate XXIV since it emphasises unfortunately Tamari's total inability to think architecturally; the blatant errors are, i) the overall height is too small, imagine the effect on the Sahn's Great Arches; ii) the window heads are arched contradicting the evidence of the existing West Wall of the Madrasa; iii) for some inexplicable reason the outer columns of the Loggia arise from the ablaq jambs and the surrounding frame.
12. Van Berchem. CIA I - 'Ville'. p.355.
13. The decorated pillars of Sultān Shāh deserve close scrutiny. They form two groups, geometric and vegetal, and I surmise that the original dispositions would have had the four geometrically decorated pillars at the corners of the sahn contrasting with the vegetally decorated intermediate pillars and those of a second arcade within the qibla īwān. Under the centuries old dirt and accumulated grime I found traces of red paint or bole along with tiny specks of gold leaf about the base of one of the pillars in the south east part of the mosque, the/

the pillar also revealed painted construction lines in black which follow the vegetal form's outlines, I presume the carver worked to the painted line. The pillars should be compared with the decorated columns of the sabīl-kuttāb of Qāyṭbāy's Mosque and Mausoleum, see Plate XXVII.

'Notes on the existing decoration of al-Ashrafiyya (pp 134-207).

1. Compare this with el-Said, I. Geometric Concepts, figure 74. With the publication of this work in 1976 there was available to the westerner for the first time an easily followed and reproducible 'point joining' method for the construction of geometric designs, it forced me to revise or redraw from scratch all of my previous drawings in my quest for clarity.
2. To illustrate the point compare the definition of the carving seen in two sets of panels set above engaged columns in 76 the Sabīl-Kuttāb of Qāyṭbāy, 881/1477, (Plate XXVIII), and in 67 the Mausoleum and Sabīl-Kuttāb of al-Ghūrī, 909-10/1503-04, (Plate XXIX).
3. In Appendix E, 'The Engaged Column to 76 the Sabīl-Kuttāb of Qāyṭbāy, 881/1477,' and Drawing 113, parallels are drawn between it and the Ottoman derivatives which in my view debased the Mamlūk honesty of the original.
4. Hautecoeur and Wiet, Les Mosquées. p.277 and figure 3. In the Creswell Archives there is a photograph which adds information to Hautecoeur's figure; the profile of the fan vault where it meets the side walls is trifoliated and therefore the vault's soffit must also be trifoliated, but this does not alter the straight line geometry of the plan. At the cruciform's crossing there is a double square or/
or/

or octagonal star with sides equal to the crossing's width, inside it was a smaller octagonal star differentiated from the first by changes in level.

5. Ibid. p.277. Hautecoeur remarks that this motif was in origin Syrian because it existed earlier in the Madrasa Tankiziyya, 729/1328-29, (AIJ 57), which coincidentally is adjacent to al-Ashrafiyya, and that it existed also in the Madrasa Arghuniyya, 759/1357, (AIJ 74).
6. Harvey, W. 'Saracenic Vaulting', AR Nov. 1911. pp.241-45. This is an interesting paper, it discusses this category of fan vaulting and includes a well drawn plan of al-Ashrafiyya's vault and a fine perspective of the Porch, the latter appearing later in Briggs, M. Muhammadan Architecture. figure 175.
7. In order to avoid disrupting the description of al-Ashrafiyya's existing details I will not explain the minutiae of the geometry of this or any succeeding repeat units instead the construction sequences for all of the repeat units appearing on the Stone Minbar of Qāyṭbāy will be given.
8. El Said. Op.cit. p. 8. The words in brackets are additions.
9. Mayer, L.A. Saracenic Heraldry. p. 36. 'The Fact that the three-fielded inscribed shield had originally only one, a middle line of text, to which at a later stage the first line containing the name was added, shows without need of further explanation that these rows of text must be read in the order of b, a, c, and why they must be so read in most cases.'
10. Mayer, L.A. 'Saracenic Arms and Armor,' AI 1943, figures 15 and 17. provide two examples of the curved axes.
11. Van Berchem. CIA I - Ville. pp. 358-59.

12./

12. When discussing voussoirs and how their decoration can extend over from the extrados to the intrados there is one arch which cannot be ignored, it is the arched door opening to 75 the Wekālat of Qāyṭbāy. (Plate XXXVIII).

Prior to my visiting this building, photographs of the arch and its decoration made little sense, there was an awkwardness to the radiating lines of the curvilinear muqarnas, in fact they were just wrong. The fault was that none of the photographs had captured the intrados, and it is essential to the comprehension of this particular architectural element and its details, even to the alternating pure vegetal elements with vegetal elements with ribbon developments in the largest cells.

The vine motifs decorating parts of the compartmention are most unusual for Qāyṭbāy's period.

13. Batanouni, H. Catalogue of Mamlūk Doors. p. 10. 'The terms bronze and brass are applied to alloys, the first of copper and tin with some lead, while in the second copper and zinc are the chief constituents. Brass is malleable and can be turned at the sides of doors without fear of breaking'.

14. Van Berchem. Op. cit. p.373.

15. Q.9/18. 'He only shall tend Allāh's sanctuaries who believeth in Allāh and the Last Day and observeth proper worship and payeth the poor-due and feareth none save Allāh. For such (only) is it possible that they can be of the rightly guided.'

16. An early example of arcaded script linked by knots is to be seen in 44 the Mosque and Mausoleum of an-Nāṣir Muḥammad, 695-703/1295-1304. Bourgoïn's illustration from *Precis*, vol. IV, plate 46 is reproduced below as Plate XLIII.

17./

17. The appearance of the arcaded thuluth script is closely related to the script on the body of a beaten brass candlestick interrupted by shields giving the name and titles of Qāyṭbāy. The candlestick, which is dated to 887/1482-83, was made for the Prophet's Shrine at Medīna and it now belongs to the museum of Islamic Art, Cairo, inventory number 4297. For illustrations of this candlestick see: Tarchi, U. L'Architettura, tav. 104; Wiet, G. 'Objects en Cuivre', p.118; The Arts Council, The Arts of Islam. p.195 and No. 226 (reproduced below as Plate XLIV); Safadi, Y. Islamic Calligraphy, plate 39 which shows a close-up of the shield.
18. Unlike the unfortunate craftsman who incised his drafting lines, but got them wrong, when decorating the inlaid Mamlūk basin which now forms part of the Edward C. Moore Bequest in the Metropolitan Museum, New York, inventory number 91.1.589.
19. The candlestick referred to in 17 above and illustrated in Plate XLIV has on its body the shield of Qāyṭbāy which like the shields of the revetments is cusped around its outer edge. A comparison of the letters, vegetal elements and ground decoration suggests workmanship of greater precision than that exhibited by al-Ashrafīyya's revetments, even allowing for the scouring effect of the dust and winds in al-Ḥaram during four and a half centuries. Certainly, there is to be found a greater variety of vegetal elements on the candlestick, but I think this is only to be expected as the differences which exist in the details and in the execution of the two artifacts are compatible with their respective positions and functions: the candlestick was small and being the sultan's gift to the Prophet's Shrine it was on permanent display; on the other hand the door revetments are surrounded by many colourful decorative areas all are eye-catching and not one is automatically singled out for admiration because/

because it is the specific gift of the sultan, they are all representative of his power and might.

Knowing that the height of the candlestick is 0.45m, an exciting comparison was revealed when I measured from Tarchi's illustration the diameter of the shield, it appeared to be exactly the same size as the al-Ashrafiyya's shields. Did they therefore have a common template? This is an attractive idea but unfortunately a definitive answer must await a direct comparison of the candlestick and my full-size drawing of the revetments.

20. This ubiquitous tribluate ribbon was applied to other materials as is proved by the 'Mamluk leather binding with an arabesque ornament on the flap. Egypt, 13th-14th century'. Kuhnel, E. The Arabesque. Plate 13.
21. Again I wish to express my thanks to Mr. J.G. Beckwith, the Keeper of Architecture and Sculpture, and his staff in the Victoria and Albert Museum, without whom I would not have been able to rediscover and then draw full size the plaster casts of this decorative panel, and others, taken from Qāyṭbāy's buildings in Cairo now forming part of the St. Maurice Collection and which were originally illustrated in, Lane-Poole, S. The Art of the Saracens.
22. In Drawings 108-11, the 'Subdivision of the Central Field and Borders' takes as the width of the inner border the difference between the mid-point of a hexagon's side and the circumference of the inscribing circle.
23. I am obliged to Mr. Peter Dorrell of the Institute of Archaeology, London, who provided me with a superb enlargement of this photograph.
24. Three, out of the five stones originally forming the left half of the inscription/

inscription were rediscovered by Miss Amal Abu-Hajj and identified by me in the Islamic Museum in al-Haram.

25. The inscription reads:

Bismillāh. He only shall tend Allah's sanctuaries who believeth in Allāh and the Last Day and observeth (5) proper worship (6) and payeth the poor-due and feareth (7) none save Allāh. For such only is it possible that (8) they can be of the rightly guided.

26. In Keene's treatise Geometric Art in Islam two further examples of curvilinear geometry are listed, both of them decorate the main side panels of wooden minbars in the Mosque of Abū Bakr Muzhir and the Mosque of Qagmās al-Ishāqī. On p. 115 the Muzhiriyya's panel is given as Bourgoïn, Le Trait des Entrelacs. No. 118, Example 28, with an additional reference to Hautecoeur and Wiet, Les Mosquées. Plate 202. On p. 121 al-Ishāqiyya's panel is identified with Bourgoïn's No. 135, Example 1, along with a reference to Mosques of Egypt. vol. II, Plate 226 (bottom). Although neither of these panels surpass the qualities of the stone curvilinear designs it is a measure of their exclusiveness that they are restricted to the same pair of Cairo monuments.

27. One or two people have expressed to me the idea that flat carved decoration and inter-carved decoration were treated differently from each other, and that their appearances were planned. Occasionally it may have been the case that one was chosen in preference to the other on design grounds, but almost certainly in the majority of cases it was not so much a planned and deliberate choice as one forced by practical considerations. One of the consequences of cutting decoration in situ is that even when it is proposed and allowed for it may not be embarked upon: if my interpretation is correct this explains the projecting/

projecting rectangular panels on either side of the window in Plate XLI, a feature which is far from uncommon. Another consequence is that a start is made and then not finished like the spandrels in the sahn of the Mosque of Abū Bakr Muzhir. However, on their own, neither consequence disposes of the arbitrary division separating flat carved and inter-carved decoration, to this end Plates LX and LXI illustrate a pair of wall panels that were intended to be identical and compliment each other. In one, guide lines have been cut around the outlines of the pattern, and in the other the design was completed and includes inter-carving. It is self evident that it is not some typological difference which separates them into flat carved and inter-carved categories but the time allotted to their cutting.

28. Notice that in one of the leaves near the centre of the tympanum inter-carved designs were considered.
29. Illustrated in Hautecoeur and Wiet, Les Mosquées. Plate 211.
30. In the time that has elapsed since this second design method was deduced by me, an article has appeared which provides evidence that one of the aspects of the traditional decorative methods still employed in Fez relies not on a geometric network but rather on the form of the element. Betsch, W. 'Fountains of Fez', AARP 12, p.40.
31. Lapidus, I.M. Muslim Cities, p. 101. The material in brackets is added.
32. Betsch, W. *ibid.* p.40. The material in brackets is added.
33. Kessler's findings regarding the contortion of internal plans to suit the surrounding street patterns do not contradict my contention that the élitist building's external features maximised their town-
scape potential.

34. The lintel design is found on the following buildings: [60] Mosque of Qādī^c Abd al-Bāsīt, 823/1420; [192] Zāwiyat Fayrūz, 830/1426-27; [119] Mosque of Gānī Bek, 830/1426-27; [178] Mosque of al-Gamālī Yūsuf, c.850/1446; [217] Facade of the Mosque of Gaqmaq Lagīn as-Saifi, 853/1449; [180] Mosque and Sabīl of Muḥammad Sa^cid Gaqmaq, 855/1451; [204] Mosque of Qādī Yaḥyā 856/1452; [171] Tomb of Gānī Bek, 869/1465; [82] Mosque of Sidi Madyan, c.870/1465; [97] al-Azhar Mosque 'Qāyṭbāy Entrance', 873/1469; [227] Mosque of Tamīn ar-Raṣāfi, before 876/1471; [216] Mosque of Timrāz al-Aḥmādī, 876/1472; [235] Beit ar-Razzāz 'Qāyṭbāy Doorway', before 900/1494-95.
35. Keene, M., Geometric Art in Islam, pp.186-86 provides some extremely interesting statistics:

"For designs having their first Egyptian occurrence in the entire remainder of the Mamlūk period (1350-1517), I am able to find only nine motifs for which I have recorded an occurrence earlier in another Islamic Country. But lest anyone think that there are fewer designs which make their first Egyptian appearance in the 1350-1517 period than that of 1250-1350, we must observe the following facts. By my count, I have recorded a total of one-hundred-fifteen designs which are used in Egypt in the Mamlūk period at all, whatever their place or date of first occurrence. Of these, one-hundred-two appear in Egypt for the first time in the Mamlūk period. Of this 102, 40 have their first Egyptian occurrence between 1250-1350, and the remaining 62 appear in Egypt between 1350-1517. So it is from this 62 that I can show only 9 to have previous occurrences outside Egypt."

36. Lane-Poole, S. The Art of the Saracens, p.99, illustrates the panel from the Wekālat at 1/9th full size and so it can be deduced that its overall height is approximately 0.66m. Plaster casts of this and some of the other decorative elements illustrated in the same work were not found in the Victoria and Albert Museum collections possibly as a result of the 'culling' which took place in the cast collections during the '39-'45 War.
37. By pure coincidence this geometric design, chosen as an example of the transmittance of a design from one site to another, happens to flank/

flank in the Wekalat a lintel with a geometrical design identical to al-Ashrafiyya's Engaged Column and Lintel 4. (Plate LXX).

'The Stone Minbar of Malik Ashraf Qāyṭbāy, Cairo: An Introduction (pp 208-13)

1. This is the date given by the inscription on the left side of the Minbar. van Berchem, M. MCIA I, pp.326-27, see Inscription numbers 222 and 223.
2. The following is a selection of the published illustrations of the Minbar: Coste, P., Architecture Arabe. (1837), Plates IX-XII; Prisse d'Avennes, A., L'Art Arab. (1877), Plate XLIX, this is the only attempt on the part of an author to present clearly the superb designs adorning the Minbar; Lane-Poole, S., The Art of the Saracens. (1886), Fig. 16; Migeon, G., Le Caire. (1928), p. 52; Hautecoeur and Wiet, Les Mosquées, (1932), Plate 157; Devonshire, Mrs. R., Rambles in Cairo. (1947), figure 55; Survey of Egypt, The Mosques of Egypt. (1949), Plate 101; Rogers, M., The Spread of Islam. (1976), p.85 in colour.

I would like to believe that the Minbar was chosen by the various authors because they appreciated its visual qualities; it was therefore slightly irksome to be told by Dr. Michael Rogers that it was not he who included the photograph in his book but his publishers who had a colour photograph in their archives. Notwithstanding this I remain hopeful that this was not always the reason for its inclusion.

3. This is a description attributed to Lane-Poole by Mrs. Devonshire in her Rambles in Cairo. p.9.

'The Gateway' (pp 214-229)

1. Van Berchem, MCIA, I, p.327.
2. Compare cell F5 with cells 4, 5, 8, 10 and 12 in al-Ashrafiyya's Window Wall's mugarnas (Drawing 50).
3. For a statement on the geometric properties relating to the Golden Ratio, and for further designs utilising the rhombus as a repeat unit, see El-Said, I., Geometric Concepts. pp.82-97.
4. Ibid. pp.8-49.

'The 'Mihrāb' Panel on the Rear Wall'. (pp. 230-238)

1. Examples of mihrab panels at the rear of the timber minbars are found in [190] the Mosque of as-Sultan al-Mu'ayyad, 818-23/1415-20, and in [49] the Mosque of Abū Bakr Muzhir, 884/1479-80. See illustrations in Survey of Egypt, The Mosques of Egypt. II, Plate 227.
2. Designs of this nature appear in numerous illustrations, e.g. Ettinghausen and others, Prayer Rugs. pp. 19-23, Plates XIV, XV, and XXVII.
3. Fehervari, G., Islamic Metalwork in the Keir Collection. p.107.
4. See Plate XLIV reproduced from The Arts Council, The Arts of Islam. No. 226.
5. Devonshire, Mrs. R.L., 'Some Mihrāb Candlesticks', Burlington Magazine. XLIII, pp.270-76.
6. Prisse d'Avennes, A., L'Art Arab. Plate XLIX.
7. In each of the three sides of the extremities of the arabesque systems
as/

as they near the Canopy's central axes are masked by roughly applied cement renders, and so I have relied on Prisse d'Avennes' illustration for the arabesque terminals.

8. Under the entry of KĀ'IT BĀY in the *Encyclopedia of Islam* (New Edition) the following information is given:

Since the Mamluk sultans had never succeeded in establishing a regular system of taxation, Kā'it Bāy was obliged to exhort arbitrary contributions, known as musādara, from his subjects. When he was in need of money and the treasury was empty he levied contributions from the leading citizens, from merchants, from non-Muslim communities and even imposed new taxes on various branches of commerce and property in mortmain.

9. I attempted to record the kufesque inscription and the joggled shapes using the materials available in Egypt, but the results were all unsatisfactory and in addition the shutter mechanism on the camera I reserve for colour photography broke down.

'The Decorated Principal Side Panels' (pp. 242-279)

1. Prisse d'Avennes, A., L'Art Arab. Plate XLIX.
2. Bourgoïn, J. Le Trait. This work has recently been reprinted by Dover Publications which is most welcome as the original edition is hard to find, unfortunately Dover have meddled with the original format by omitting the French text on the grounds that '(it) consisted of an art-historical statement of no particular value today, and of incomplete instructions on drawing the patterns. In view of the shortcomings of this text, it seemed best to let the magnificent plates speak for themselves.' (See 'Publisher's Note').
3. Keene, M., Geometric Art in Islam.
4. Ibid., p. 121.

5./

5. There is the question of whether this comparison is valid or not.

Bourgoin in his other published works refers to his sources but in Le Trait, this is not the case, and therefore one must consider why references were omitted. One explanation is that Bourgoin did not intend that his constructions should be precise renderings of specific decorative areas and that instead he saw Le Trait as a tool which could influence late 19th century Europeans and possibly some Egyptians as well. Whatever the purpose of Le Trait was, the discrepancies separating his constructions with those of the assumed models should be looked at in conjunction with Le Trait General which combined different polygons in accordance with certain simple rules governing the number of polygons which can be assembled around a point, after which they can cover an unlimited surface. To illustrate Bourgoin's rule using polygons of two forms, consider first the combinations of the dodecahedron (12-gon) and the trigon about a point; two dodecahedrons and one trigon can be assembled in this way as the ratios of the dodecahedron's angle is $5/3$ and the trigon is $2/3$ (fractions based on $90^\circ = 1$ and therefore $30^\circ = 1/3$) the equation is $5/3+5/3+2/3 = 4$ right angles. A second example using a decagon and the pentagon, one decagon and ten pentagons can be assembled together as the ratios of their angles are, the decagon $8/5$ and the pentagon $6/5$ the equation is $8/5+6/5+6/5=4$ right angles. Bourgoin extended these rules to the assembly of three forms.

These rules may be suitable for European consumption but they cannot satisfy the intentional variations and unintentional irregularities which are inherent in Islamic geometry. Notwithstanding the anonymity he gave his constructions it is valid to make the comparison because it can focus on the complexities and nuances of the models.

6. E.G., Vernon, M., The Psychology of Perception. p.56.

7. Since Hankin is the only scholar to have proposed and explained a detailed construction of this decorated area the relevant passages from his paper entitled 'On Some Discoveries of the Methods of Design Employed in Mohammedan Art', JSA (1905) are given in Appendix F.
8. Lane-Poole, S., The Art of the Saracens. Figure 16.
9. This term Hankin later combines with the word 'geometrical' to produce 'geometrical arabesque' a term he reserves for the 'class of patterns of the first importance in Saracenic art that is particular to this school'. 'The Drawing of Geometric Patterns.' MAST XV, p.3.
10. This drawing is the equivalent of Hankin's Figure 15 in 'On Some Discoveries of the Methods of Design Employed in Mohammedan Art', JSA (1905).
11. The heptagon so constructed is not mathematically regular but is perceived to be so.
12. Hankin, E., 'The Drawing of Geometric Patterns', MAST p.3.

'The Panels Decorating the Balustrades' (pp. 280-300)

1. In the drawings they are numbered from 1 to 9 beginning with the lowest triangular panel and rising up the balustrade, the four other rectangles are designated A and B.
2. For further designs based on this rectangular repeat unit see, el-Said, I., Geometric Concepts, pp. 82-97 'The Pentagon and the Golden Ratio'.

Appendix B: The Geometry Underlying the Kilāniyya's Elevation. (pp. 318-323)

1./

1. Walls, A.G., 'The Mausoleum of the Amir Kīlānī', Levant VII p.47,
Figure 21: This building appears in AIJ as no. 69.
2. The Kazzaziyya is of unknown date and has not been included in the AIJ.
3. The Taziyya appears in AIJ at no. 79.

Appendix C: Interrelated and Integrated Decoration (pp 325-35)

1. The Turbat Turkan Khatūn appears in AIJ as no. 70.
2. Walls, A.G. 'The Turbat Barakat Khān or Khalidi Library.' Levant VI,
the description of the Romanesque door appears on p. 26 and p. 30,
Figures 4 and 6, and Plates VII, VIIIA, and IX A and B: the monument
appears in AIJ as no. 30.

Appendix F: The Minbar of Qāyṭbāy, Hankin's Solution. (pp. 341-43)

1. Hankin's Figure 14 is his version of Lane-Poole, S., The Art of the Saracens. Figure 16, 'Stone Pulpit in the Mosque of Barkuk: Early Fifteenth Century.'
2. Hankin uses the term 'arabesques' to describe geometrical designs.

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