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Building Medieval Constantinople

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Abstract

The visitor to modem Istanbul is often struck by the dramatic contrasts of the city: ostentatious displays of wealth appear side by side with poverty and squalor; the decrepid hovels of the poor lie in the shadows of monuments of past glory; at the same time, a new city rises amid the ruins of antiquity. How much has the character of the city changed since Byzantine times?

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Building Medieval Constantinople

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The visitor to modern Istanbul is often struck by the dramatic contrasts of the city: ostentatious displays of wealth appear side by side with poverty and squalor; the decrepid hovels of the poor lie in the shadows of monuments of past glory; at the same time, a new city rises amid the ruins of antiquity. How much has the character of the city changed since Byzantine times? Odo of Deuil, who visited and disliked the city in 1147, described elegant palaces with lavish decoration, but noted:

> The city itself is squalid and fetid and in many places harmed by permanent darkness, for the wealthy overshadow the streets with buildings and leave these dirty, dark places to the poor and to travelers; there murders and robberies and other crimes which love darkness are committed.[1]

He could be describing just about any inner city today. In spite of the vividness and contemporaneity of this and similar accounts, we know precious little about the medieval city of Constantinople—that is, not the Late Antique city built by Constantine, Theodosius, and Justinian, with which we are more familiar, but the city into which it evolved following the Dark Ages of the seventh to ninth centuries. Indeed, when the urban history of Constantinople is discussed, most scholars make a quantum leap from the sixth to the fifteenth century. But it is the medieval city that so impressed visitors. You recall Fulcher of Chartres (writing ca. 1100), who gushed

> O how great is that noble and beautiful city! How many monasteries, how many palaces there are, fashioned in a wonderful way! How many wonders there are to be seen in the squares and in the different parts of the city! I cannot bring myself to tell in detail what great masses there are of every commodity: of gold, for example, of silver . . . and relics of saints.[2]

Ever the curmudgeon, Odo of Deuil found the city "arrogant in her wealth, treacherous in her practices, corrupt in her faith," but had to admit that "if she

did not have these vices, however, she would be preferable to all other places."[3]

The theme of this paper is building the medieval city of Constantinople—or perhaps "constructing" is a more charged and multivalent word, and I shall interpret my theme in several different ways. First, how do we as scholars reconstruct a picture of the medieval city: what is our evidence, and how do we most effectively interpret it? Second, and related to this, how did Constantinople become a medieval city? How was the ancient city in effect deconstructed and transformed during the Byzantine Middle Ages? Third, how was the city conceptually transformed in the medieval period—that is, how did the Byzantines construct their own urban mythology? Finally, and turning to my own specialty, how did the masons of Byzantium actually build the buildings that comprised the medieval city of Constantinople?

Reconstructing the Medieval City.

Visualizing the medieval city is a problematic exercise. In spite of urban decline, the city remained comparatively large, important, and wealthy, and it made a significant impact on visitors from East and West alike. In size, shape, and appearance, it continued to be unique: Only Rome (according to Bertrandon de la Broquière, 1430) and Baghdad (according to Benjamin of Tudela, 1161-62) are claimed to be comparable to it in scale. Equally striking were the triangular plan of Constantinople—most medieval cities were round—and its watery situation—surrounded by the Sea of Marmara, the Bosphorus, and the Golden Horn. Moreover, the city possessed amenities that were unknown elsewhere and thus remarkable. For example, Ibn Battuta (1332) praised the spacious, well-paved streets, and Ruy Gonzales de Clavijo (1403) noted the numerous fountains and wells that cooled the city.[4]

But let us begin with what we know of the Late Antique city and proceed from there.[5] The city refounded by Constantine between 324 and 330 seems to have been based on a combination of urban planning concepts known to Roman and Hellenistic architecture, following in the traditions both of eastern Mediterranean urbanism and of Tetrarchic city planning. The former Greek colony of Byzantion was expanded dramatically, first by Constantine and then almost a century later by Theodosius II, so that it came to encompass the entire peninsula (fig. 1). As with a Hellenistic city, the main streets and public spaces were arranged in relation to the topography, with the main colonnaded street, the Mese, following the high ground leading from the Milion—the mile marker (probably a tetrapylon) at the Augusteon square. Situated by the entrance to the Great Palace, the Augusteon was embellished with an historiated column topped by an equestrian statue of Justinian. From the Milion, the Mese passed through a series of large imperial fora: the round or oval-shaped Forum of

Constantine (of which only the triumphal column remains), then a tetrapylon marking a major cross street, then the Forum Tauri, which may have been modelled on the Forum of Trajan in Rome. The Mese then diverged to connect to the two main overland routes into Thrace. The surrounding areas seem to have been developed on an orthogonal grid.[6] All of this is reminiscent of the better preserved cities of the East, such as Gerasa, which also had an oval forum, colonnades, tetrapylons marking intersections, and gridded residential districts. However, large areas of Constantinople within the walls must have remained pastoral.[7]

Constantine's walls have disappeared, but those added by Theodosius II in the early fifth century still stand.[8] They were kept in constant repair throughout the Middle Ages, only to fall to the cannons of Mehmet II in 1453 and, more recently, to heavy-handed restorations. The repairs, additions, inscriptions, and modifications to the walls comprise a dramatic history of the city. Combining two lines of defense with a moat, the walls are perhaps the most significant work of military architecture to come down to us from the Middle Ages.

The main ceremonial entrance to the city was the Golden Gate, where the main coastal road, the Via Egnatia, met the city. It was a combination of fortified entrance and triumphal arch, sheathed in marble. It also chronicles the history of the city, with the gradual diminution and eventual closing of the arched passageways.[9] It was last used ceremonially by the Byzantines in 1261 for the triumphal entry of Michael VIII Palaeologus into the city, following the departure of the Latins. The whole was transformed into a castle in the Late Byzantine period, with the addition of towers and an outer enclosure.

At the end of the peninsula was the Great Palace of the Byzantine Emperors, begun by Constantine and continually enlarged, upgraded, and renovated by his successors.[10] A series of buildings and pavilions loosely organized in a park-like setting, it formed a precinct of its own, separated from the city by the Hippodrome. In this, it followed the example of Rome and the Tetrarchic capitals, for which a Hippodrome formed the intersection between the palace and the people. And as in Rome, the Hippodrome had a private viewing box for the emperor and his cortege, accessible only from the palace. The *kathisma* is represented on the obelisk base of Theodosius I, in which we see various entertainments in process.[11] Beginning in the late eleventh century, however, the Great Palace was replaced as the primary imperial residence by the Blachernae Palace, located in the northwest corner of the city.[12] Although the reasons for this shift are not entirely clear, the Blachernae was encircled by the Land Walls and also apparently by an inner fortification, and was thus better protected from attack from both within and without—and, it seems, more medieval in character.

In spite of the hundreds of surviving texts that address Constantinople,

its monuments, and its institutions, the city is perhaps most remarkable for what we do not know about it.   Virtually nothing that might be called urban archeology has been attempted.[13]   We know in general the locations of the Mese and the fora that it traversed.[14] But even the sizes of the fora elude us. and we lack the details that a more thorough archaeological examination might provide. Unfortunately, possibilities for exploration are continually lost. For example, last year the Ministry of Mosques wanted to install a new (and certainly illegal) toilet facility in front of Sultan Ahmet Camii—in an area that anyone would expect to be archaeologically rich. By the time the bulldozers were stopped, they had removed two meters of dirt, as well as several rows of seats and a few columns from the Byzantine Hippodrome. Frustratingly, the elements uncovered were never properly recorded, permission was not given for further investigation, and visiting Byzantinists could simply stare into a rough hole and ponder. And right now, in spite of protests, plans procede for an extension of the subway system into the old city.[15]

Historical Geography

Most scholars who address Constantinople today are monument-oriented, focusing on individual buildings. Those who investigate the urban topography are primarily concerned with what went where—that is, placing textual references into a large, incomplete, and constantly changing jigsaw puzzle, for which the evidence is often ambiguous at best. Frequently missing in such studies is some sense of the tranformations of and around the individual monuments through their history.[16] Similarly, archaeologists and architectural historians, like myself, have also been monument-oriented, concentrating on individual buildings without placing them into the larger matrix of urban developments.[17]

From a personal perspective, deciphering the historical geography of Con-stantinople is great sport. Recently my colleague Alice-Mary Talbot of Dumbarton Oaks asked me to assist her in the annotation of the *vita* of St. Photeine, whose text was recently published without commentary.[18] It provides such a wealth of information about the city that it was impossible to resist getting out the maps. Photeine is to be associated with the Samaritan woman of the New Testament, and, according to the *vita*, her relics seem to have been particularly effective in curing diseases of the eyes. The relics are first identified when a herd of cattle are brought along the road that led down the hill from the Milion monument toward the Golden Horn. A blind cow stopped to drink at a spring and was miraculously healed. Further investigation led to the discovery of relics in the water, which were identified as those of Photeine and subsequently enshrined in an adjacent church—a building said to be immediately below the great Early Christian basilica of the Chalkoprateia.

These details help to place our site on the map, somewhere near the entrances to the Gülhane Park and to the Sublime Porte, where, intriguingly, there is now the Post-Byzantine holy well of Aya Therapon, the name of which means the "healing one." In any event, it is tempting to identify this as our site, and, interestingly enough, I discovered a large nineteenth-century painting of *Christ and the Samaritan Woman* hanging at the well—since Photeine was identified with her.[19] Such are the games that urban geographers play, matching textual references with standing remains. Certainly they raise other issues that we have not discussed, such as the nature of the city in this period, when cattle were apparently herded through what were once important ceremonial spaces.

Deconstructing the Late Antique City

If we are to view Constantinople as a city in transition, to my mind the most important urban transformation took place during the seventh to the ninth centuries. This period effectively marked its redefinition from a Late Antique to a medieval city. Constantinople had a population of perhaps 500,000 in the fifth century, which could have only been supported with a well-organized trading network that brought wheat from as far away as Egypt, and this also required sufficient ships, harbors, and warehouses. Elaborate works of engineering, like aqueducts and cisterns, were also necessary to provide and store water for the inhabitants.[20] Without an elaborate system of trade and without quantities of water, a city of this size could not survive, and the population declined dramatically after the seventh century. Prior to the Arab siege of 717-18, Anastasius expelled all inhabitants who could not lay in a three-year supply of provisions.[21] The population must have shrunk to perhaps one-tenth of its former size. The demise of trans-Mediterranean trade on an Imperial Roman scale meant also that the medieval city remained small, with a large area of *desabitato* within the walls.

One result of the de-urbanization of the Dark Ages and one measure of the transformation is that the great public works characteristic of a Late Antique city either fell into ruin or were transformed in function. For example, the Forum of Constantine, which continued to be an important landmark, became the main emporium for the city, surrounded by the quarters of artisans. Perhaps noteworthy, Basil I built a church there, dedicated to the Virgin, having observed that the workers lacked both a place of spiritual refuge and somewhere to go to get out of the rain.[22] Cyril Mango views this statement as significant in that it suggests that the church had replaced all other centers of social gathering. At the same time, it implies that the arcades and porticoes, which were part and parcel of the Late Antique city, no longer existed. Elsewhere in the city, the Forum of Theodosius became the pig market, with

a hay market and a slave market nearby, and further fora were used for the sale of donkeys, sheep, and horses.[23]

Although the period after the year 800 began to witness a revival, and it was characterized by contemporary writers as such, the changes in the nature of patronage are significant—moving away from public monuments to private foundations: churches, monasteries, hospitals, and orphanages are noted, but not new streets, fora, triumphal monuments, and the like. Most of the significant institutions were private rather than public, and most were connected to large monasteries. In fact, the structure of the society, and consequently of the city, had shifted from open to closed, and the unified nature of the early city was gradually replaced with, in effect, a series of villages within the walls.[24]

Accompanying the changes in patronage was a change in scale. One useful point of comparison is found at the Myrelaion. Here the foundations of a huge rotunda from a Late Antique palace were used as the substructures for the tenth-century palace of Romanos Lecapenus. The rotunda was filled in with a colonnaded cistern to form a level platform for the palace, whose general plan has been reconstructed from fragmentary foundations. It is noteworthy that except for the chapel, all components of Romanos' palace were built on the area taken up by just the entry vestibule of its predecessor (fig. 2).[25]

Another visual manifestation that parallels the changes in patronage is the nature of the building materials. After about the seventh century, we have no evidence of quarrying for marble and other luxury stones. Even the nearby Proconessos quarries seem to have ceased operation.[26] Builders relied instead on *spolia* taken from the ruins of the ancient city around them. Columns and capitals were reused time and time again, thus making the dating of both a building and of its parts somewhat problematic. Sculptures from the sixth-century church of St. Polyeuktos, for example, found their way into the templon of the twelfth-century Pantocrator church, only to be recycled one again in the Ottoman transformation of the building.[27] Older pieces were also recarved: look on the unexposed surface of almost any Middle or Late Byzantine cornice, and another relief pattern will be found. Similarly, marble revetments were either recycled or created from cutting up other pieces. At the Chora, the stunning, fourteenth-century revetments are all created from *spolia*, in most instances from columns that have been sliced lengthwise, so that the repeat patterns of the book-matched panels are considerably wider at the center of each set than they are to either side (fig. 3).[28]

The urban foci that emerged in Middle Byzantine Constantinople were the mansions of the wealthy, housing an extended family and their retainers in a sprawling network of buildings and social connections—and these were also the centers of vast economic networks that extended into the provinces. The

oikos, or household, became the dominant social organization, and and the *oikoi* also gave their names to the neighborhoods of the city.[29] This change of focus—from public institutions to private—is also reflected in the organization of the great monasteries of the period, which followed the pattern of the *oikos*—as hierarchically structured centers of vast social and economic interests. In actuality, the similarity was close enough that an *oikos* could be turned into a monastery with virtually no formal changes—as happened at the Myrelaion palace, just discussed, which was converted to a nunnery in the tenth century. The construction of these great houses and monasteries also affected significantly the outward appearance of the city, replacing the "marble piles" of the Late Antique city as the distinctive landmarks. Such units are often described as "a city within a city," or as "resembling cities in magnitude and not at all unlike imperial palaces in splendor.[30]

None of these *oikoi* with their mansions, courtyards, chapels, fountains, and gardens survives, but perhaps some measure of their appearance can be gained from a document detailing the concession of the Palace of Botaniates to the Genoese in 1203. The deed itemizes the contents of an apparently sprawling *oikos* that included two churches, courtyards, reception halls, terraces, pavilions, and a bath. The complexity of the complex is indicated by Michael Angold's futile attempt to diagram its internal relationships.[31] In addition, the great imperial monasteries that sprang up in the eleventh and twelfth centuries also suggest something of the nature of these great mansions. Again, our picture is incomplete because only the churches survive and not the vast complexes that surrounded them, of conventual buildings, hospices, gardens, and the like. At the Pantocrator Monastery, for example, built by John II and Eirene Comnenos in the early twelfth century, three churches were constructed side by side, in rapid succession, of different plans and functions, terminating in an irregular row of apses along its eastern, public facade, and topped by a hodgepodge of domes (fig. 4). Rather than viewing this complex as reflecting the inability of the architect to coordinate the diverse components, I suspect that instead the significance of the monastery is meant to be expressed by the visual complexity of the exterior, rather than by a monumental scale—as would have been the goal of a contemporary Western European architect.[32] We might view the Pantocrator as the ecclesiastical equivalent of the mansions that looked more like cities than houses.

From History to Mythology

The transformation from large scale to small scale, from open to closed society, is paralleled by a transformation of vision, of the popular mentality. Somehow through the Dark Ages the city lost contact with its past, and what had been carefully written as history following in the classical tradition became

the stuff of myth and legend in the subsequent period. If we compare the descriptions of Hagia Sophia by Procopius from the sixth century to those in the *Diegesis* of the ninth century, the difference is striking. We have moved into another conceptual framework, in which "reality is almost completely supplanted by myth."[33]   One measure of the endurance of the myth is that guidebooks, tour guides, and lecturers like myself still tell stories from the *Diegesis*: Justinian exclaiming "Solomon, I have vanquished thee!" at the dedication; the encounter of the masons' apprentice and the guardian angel; the belief that 10,000 masons were responsible for the building, organized into teams of 100 under the supervision of 100 master masons; and so on. Moreover, the names of the original architects had been forgotten, and we are told that the plan was revealed to Justinian in a dream by an angel.

Similarly, the public statuary that adorned the city lost its original meaning and came to be regarded as talismans or sources of magic. With a few exceptions, ancient statues were regarded as vaguely sinister, capable of harm, and at best avoided.[34]   The *vita* of St. Andrew the Fool tells of a woman who became possessed by the demons that inhabited statues in the Hippodrome (which were presumably male and nude) and was urged to have intercourse with them. The *vita* of St. Euthemius relates that then Emperor Alexander, upon becoming impotent, was instructed by magicians to clothe these statues in sumptuous garments, to burn incense before them, and to provide teeth and genitals to a statue of the Calydonian Boar. Some centuries later, the Empress Euphrosyne, who was addicted to magic and divination, cut off the snout of the same Calydonian Boar, and also had a statue of Hercules flogged, and had other statues broken and dismembered.[35]

Statues were occasionally said to have provided useful services. The Serpentine Column at the Hippodrome, for example, was said to protect against snake bites.[36] Equestrian statues by the entrance to the Great Palace were said to calm unruly horses that might disturb the emperor.[37]   At the Forum of Constantine, bronze mosquitoes, bugs, fleas, and mice were claimed to have prevented these pests from entering the city.[38]   Other statues were seen as omens related to the urban history. During the attack on Constantinople in 1204, the populace destroyed a statue of Athena that had stood outside the Senate House in the Forum of Constantine because her gesture was interpreted as beckoning to the crusaders.[39]   What is noteworthy in all this nonsense is that the original purposes and messages of the statues—such as imperial victory, civic virtue, and even urban beautification—had long since been forgotten and had been replaced by a folkloristic significance.

Building Practices

Let me now turn to my own interests, that is, the *actual* building of the

medieval city.[40] The transformation of the city through the Dark Ages affected architectural practices as well. The leading architects of Early Christian Constantinople, including Anthemius and Isidorus, the sixth-century builders of Hagia Sophia, followed in the traditions of the Roman architect: they had both a liberal arts education and a theoretical approach to design. In contrast, a Byzantine mason of the later period was trained within the context of a workshop and was thus conservatively rooted in established practices. Oddly, the few historians who have addressed the architectural profession have either limited their discussion to the period before the seventh century, or they have failed to take into consideration the transformation of Byzantine society and its institutions in the Dark Ages. I am therefore concentrating on the evidence from the ninth century and later.

We have a few bits of information from which to record the organization and working methods of a masons' workshop. The tenth-century *Book of the Eparch* provides some of the restrictions and legislations related to builders.[41] For example, under normal circumstances a workshop could not travel but was restricted to practicing within a fixed area. Moreover, a workshop was required to complete one job before taking on another. In addition, it was held responsible for its works for up to ten years after completion.[42] There is no mention of the size or makeup of a workshop, although other evidence normally suggests a small team—in distinct contrast to the alleged 10,000 workers at Justinian's Hagia Sophia. We have many standing remains—primarily churches—from the period of the tenth to the fourteenth centuries, and from a combination of detailed analysis of these and a positivist trawling of texts, we can come to some understanding of how they were constructed.

Although we have no writings of a theoretical nature, or that even address the art of building directly, we can get some direction from the hagiography, which contains the *realia* of building as well as of everyday life. For example, the *vita* of Nikon of Sparta provides an overview of the construction process, including such details as site selection, fundraising, and materials. To built the church of the martyr Kyriake, Nikon first marked the site with three stones, then informed the populace of his intentions. The people cleared the site, gave money, and gathered materials.

> He began the building, having earlier delineated it with a rope; he constructed the colonnades below and above, bringing to bear a technical skill even more ambitious than his physical skill. Then, having enclosed the building on all sides, he affixed the roof.[43]

As is often the case in hagiography, no architect is mentioned, and the saint himself seems to be overseeing the work. In addition, several miracles are

noted: during the digging of the foundations, Nikon is easily able to move a stone that the multitude could not budge, while at the same time driving away demons in the form of wasps that stung the workers. And the building seems to rise miraculously:

> So each day what was found today was more than yesterday's building, sometimes by a cubit [approximately 20 inches] or sometimes even more, an invisible addition was seen on top of the earlier structure. Indeed the material completely expended the day before at dawn was found abundant and more than enough for the building. It had been carried in unseen and entrusted to the holy man in the night. So from this, the work was believed to be divine and being accomplished in accord with God's plan, not least on account of the fiery pillar seen by night at the building site.[44]

A good miracle indicates that the building is part of God's plan, and it is a *topos* in architectural descriptions: one thinks of the varous miracles that became associated with the construction of Hagia Sophia, and even such mundane documents as monastic *typika* can include foundations miracles.[45]

Some points are worth elaborating in the text from the Life of Nikon. First, the plan was delineated with ropes. This seems to have been standard practice throughout the Middle Ages: land measurements were done with ropes, and military camps were laid out with rope measurements.[46] The same practice is known from Western Europe: in the famous Dream of Gunzo, Sts. Peter, Paul, and Stephen use ropes to show a comatose abbot the plan and measurements of the new church at Cluny.[47] To lay out a building, one simply had to know the ropes. No mention is made of architectural drawings, and the planning seems to have been done on the site, "according to God's plan."

Did Byzantine masons utilize architectural drawings? We know from Vitruvius that Roman architects used "plans, elevations, and perspectives," and this practice continued at least through the seventh century, when we still have architects trained in the classical tradition.[48] But after Iconoclasm, there are no clear references to architectural drawings, and I suspect that for most projects, drawings were not used. One example is useful.

In the eleventh-century *vita* of the eccentric stylite, Lazaros Galesiotes, the saint directed the construction of a new refectory: "When the builders were about to raise our refectory, our father, standing on top of his column, indicating with the fingers of his right hand, deliniated the length and breadth for the builders."[49] One of the brothers complained that the "form of the work"—*schematismon tou ergou*—was absurdly large for their small community, to which the saint gave the "Field of Dreams" response: If you build it, they will come. Now, only with the plan delineated on the ground could such an observation on scale be made. One gets the sense that Lazaros is pointing out the coordinates from on high, and the brethren are scurrying around to mᵃʳk them on the site. Taken out of context, the phrase

schematismon tou ergou might sound as if it were referring to a working plan, but in context, it does not.

The closest things we have to architectural drawings from this period are from the *Poliorcetica*, a treatice on siege engines attributed to Heron of Byzantium, for which a tenth-century date seems likely.[50] Heron makes it clear that the source of his information was an ancient treatice by Apollodorus of Damascus, which he claims to be following exactly, except for two aspects. First, he simplified and updated terminology that might be unintelligible to his reader. Secondly, he changed the illustrations for the same reasons: what is called a *schema* in the original has become a *schematismos*. Comparing the illustrations of the surviving text with those of another manuscript closer to the original, we can see that Heron has transformed conceptual diagrams or technical drawings of a basically two-dimensional character into three-dimensional narrative illustrations, including little figures to show how they work (figs. 5-6). The point is that Heron's audience understood illustrations as representational, but they did not understand a working drawing—and that is precisely what an architectural drawing is.

I suspect that instead of drawings builders relied on a combination of geometry and memory for the design of a building. By memory I mean the accumulated expertise of a master mason gained through his training and the participation in a workshop, as well as an awareness of the architectural landscape around him. This can explain why Byzantine architecture tends to be conservative in overall form but individualized through the manipulation of the details. For church architecture, the cross-in-square or four-column type was standard—a nine-bayed naos flanked by a narthex and a sanctuary, with a central dome raised above four piers or columns (fig. 7). It was a structural system that a builder would have known thoroughly from experience, but also one which could be altered to the special necessities of the foundation—that is, in response to the structural requirements, liturgical practices, type of decoration, the available materials, and so on. Thus, when we look at the plans of cross-in-square churches from a single region, such as Bulgaria, the differences are so dramatic as to defy easy categorization, although each works according to the same basic schema (fig. 8).[51]

When we calculate the overall measurements in Byzantine feet (approximately 0.327 m.), we find that a surprising number of churches have as a module of 10, 12, or 15 feet that can be calculated as the diameter of the dome.[52] Moreover, this measurement could also form the basis for the entire plan and for the elevation, either through the application of a simplified form of *quadratura* or with a grid system (figs. 9-10).[53] This would have allowed the masons to lay out the plan on the site using very simple tools. Basically, I think we have to understand design and construction as interconnected parts of the same working process, rather than separate activities, as they are today.

The surviving foundations of the buildings of Byzantine Constantinople actually add another level to our understanding of the medieval city. Almost invariably these included cisterns. A vaulted cistern created a level platform on the irregular terrain, onto which a building could be constructed. In the area of Topkapi Palace alone, a recent study has counted more than forty cisterns—all substructures for lost buildings.[54] In some of the better preserved examples, such as the cisterns below the fourteenth-century funeral chapel at the Chora Monastery, conduits led from the roof to collect rainwater.[55] With the demise of the ancient aqueduct system—that is, the public system or waterworks—private institutions included their own systems for the collection and storage of water. One can only wonder about the healthiness of water stored beneath tombs. Moreover, in an area plagued by earthquakes, any tremor would have cracked the waterproof lining of the cisterns. Consequently, most buildings suffered, and continue to suffer, from dampness.

Walls were made of brick and stone. During the construction process, a variety of scaffoldings were used to support the builders on high. This work was particularly dangerous, and a number of accidents are recorded due to the collapse of scaffolding. In fact, construction accidents are a *topos* in hagiographical literature. But from the texts it is often difficult to determine what exactly has collapsed. The word most frequently used is *klimax*, which normally means a ladder. However, as I noted when my neighbor's house was painted recently, there is often little difference. The same is apparent in medieval illustrations, as in a mosaic showing the construction of the Tower of Babel from S. Marco in Venice (fig. 11). At the church of St. Photeine in Constantinople, for example, the painters

> were embellishing the ceiling with their art when the plank of wood on which the weight of the entire ladder (*klimax*) was supported broke—and this ladder was skillfully made of many pieces of wood—and suddenly collapsed, bringing the artisans down with it. And surely they would have been stabbed by these <pieces of wood> and crushed to death, had not the helping <Photeine>. . . caught everything on a tiny nail, and checked the collapse and saved the men.[56]

In this instance, it sounds as if the scaffolding was attached to the structure of the building rather than supported from below. Such scaffolding was employed in both East and West.[57] In such examples, the supports were built into the walls, leaving a tell-tale pattern of putlog holes on the facades (fig. 12). As the wall construction rose, new rows of supports would be added. We may note that in the S. Marco mosaic the scaffolding is not supported from below but rises above putlogs.

In perhaps the most famous incident, and a remarkable reversal of the *topos*, Athanasios of Athos met his end. Apparently in the habit of ascending to the level of construction to oversee the work, he fell to his death when the

"carpenter's ladder" (*tes technikes klimakos*) collapsed under the weight of him and six other monks.[58] His biographer would place the blame neither on the inexperience of the workmen nor on the freshness of the mortar—but it is curious that the mortar is mentioned. If it appeared solid but was not yet firm, simply leaning a ladder against the wall would not cause a collapse; however, if the excessive weight was is placed on a platform resting on beams in putlog holes, the stress on the wall would have been much greater, and the collapse can easily be envisioned. Moreover, Athanasios and his companions were buried by wood rather than by masonry—the horrified onlookers struggled to remove the fallen timbers—"mixing their tears with the wood"—to release the injured. Clearly, it was the scaffolding that collapsed.

Erecting columns could also be problematic, as the stonemason Katakalos learned, in an incident related in the *vita* of Photeine:

> Once when he was setting up columns on the upper floor of a nearby building, and was pouring lead into a wet hole, the lead was suddenly splashed backwards by the presence of moisture, and he suffered terrible damage to his eyes and was blinded.[59]

Photeine cures him, of course, but the incident requires some explanation. It was common in Greek and Roman architecture to connect the bases, shafts (or drums), and capitals of columns with bronze pins set into lead. Molten lead would be poured into a carved channel in the stone surface to secure the pin as the column was erected.[60] This practice continued into Byzantine architecture, and the cuttings for pins may be observed in the once-joined surfaces. Occasionally the pins are still preserved. The lead poured by Katakalos splashed when it came into contact with moisture because the water vaporized instantly, and the sudden explosion of steam propelled the lead upward. Such accidents still happen, but, alas, the miraculous cures usually do not.

The construction of vaulting is a bit more problematic, but good evidence is provided in surviving buildings. In Constantinople, arches and vaults were invariably of brick, and were normally tied with wooden beams at their springing. These would secure the vault until the mortar dried to its ultimate hardness, but the beams were normally left in place and decorated with paint (fig. 13). Occasionally there were additional structural measures: at the tenth-century church of the Virgin tou Libos, for example, an iron collar was provided around the tall apse, buried in the masonry just behind the cornice.[61] Marble cornices also could be tied together with metal pins, or secured with a system of wooden beams behind them, so that they could act as structural stabilizers.[62] In addition, wooden chains that formed tension rings were built into virtually every Byzantine dome—this was not simply the Renaissance invention of Filippo Brunelleschi for the dome of the Florence Cathedral.

Byzantine vaults could have been constructed with or without formwork, depending on their scale.[63] A large barrel vault, for example, would have

required substantial formwork. Byzantine masons preferred smaller vaults that could be constructed of pitched and corbelled bricks without formwork. In fact, most vaults in secondary spaces were clearly done this way (fig. 14).[64]

Because the scale of most Byzantine churches was small, the vaults would have required little or no formwork. Often this was limited to the arches that divided the space into smaller bays, where the bricks were laid in a radiating pattern; whereas in the groin or domical vaults, the courses of brick were laid close to horizontally—in effect they were corbelled. In a section drawing from the Mangana you can see the pattern of both the radiating arches and the corbelled vaults (fig. 15).[65]

Many of the domes were laid without formwork or with minimal formwork.[66] A ribbed dome, for example, could have been laid with formwork only for the ribs (fig. 16). Normally these are quite precise in their construction, whereas the webs between them are not. A pumpkin dome—formed by a series of interlocking curved surfaces—could have been built without any formwork. Actually, the geometry of a pumpkin dome would have created a uniquely rigid form, and this would have added the necessary stability for unsupported construction.[67] The sloppiness evident in an example from the Chora is a good indicator of the absence of centering (fig. 17). What is perhaps interesting is that both these types of domes are normally discussed in aesthetic terms—that is, in relationship to mosaic or fresco decoration. Clearly they satisfied both the constructional and the decorative concerns of the builder.

As we have moved from large scale to small scale, from an open to a closed society, it is perhaps appropriate that at the end we have moved indoors, with our view framed by the decorated walls of a Byzantine church—which was, after all, more than just a construction of brick and stone (fig. 18). It was also a framework for a complex, multi-level program of figural decoration in mosaic or fresco. Christ the Judge oversees all from the centrally-positioned dome; the Virgin appears in the apse, above the altar; scenes of their lives, which were ritually re-enacted in the liturgy, envelop the space. The selection and placement of images would have interacted with the services celebrated in the church to express the order within the Christian cosmos.[68]

Our focus has shifted from the megalopolis to the microcosm—from the large scale of the city, which in later centuries was neither unified nor ordered, to the small scale of the church interior, whose hierarchical form and decoration comprised a concentrated expression of the spiritual order that had replaced the physical order of the Byzantine world. In effect, the historic greatness of Constantinople had become distilled and conceptualized. Still today, based on the scattered remains of what Yeats called its "monuments of unageing intellect," we know Constantinople more as a concept than as a reality.

Notes

1. V.G. Berry, *Odo of Deuil, De profectione Ludovici VII in Orientem* (New York, 1948); English quoted from J.P.A. van der Vin, *Travellers to Greece and Constantinople: Ancient Monuments and Old Traditions in Medieval Travellers' Tales*, 2 (Leiden: Nederlands Historisch-Archaeologisch Instituut te Istanbul, 1980), 519.

2. *Fulcheri Carnotensis Historia Hierosolymitana (1095-1127)*, H. Hagenmeyer, ed. (Heidelberg, 1913); English quoted from van der Vin, *Travellers*, 2, 503-504.

3. Berry, *Odo of Deuil*, quoted from van der Vin, 2, 518-521.

4. For a summary of visitors reactions to the city, see van der Vin, 1, esp. 249-291; for texts, 2, passim.

5. For a convenient summary, see Richard Krautheimer, *Three Christian Capitals: Topography and Politics* (Berkeley and Los Angeles: University of California Press, 1982), 41-67; also, in more detail, Cyril Mango, *Le développement urbain de Constantinople* (Paris: de Boccard, 1985); Gilbert Dagron, Naissance d'une capitale (Paris: Institut Français d'Études Byzantines, 1974); Wolfgang Müller-Wiener, *Bildlexikon zur Topographie Istanbuls* (Tübingen: Wasmuth, 1977).

6. For attempts to reconstruct the pattern of streets in Constantinople, see Albrecht Berger, "Die Altstadt von Byzanz in der vorjustinianischen Zeit," *Poikila Byzantina* 6 (1987), 7-30; and id., "Überlegungen zur frühbyzantinischen Stadtplanung in Konstantinopel," *Aspects of Late Antiquity and Early Byzantium*, eds. Lennart Rydén and Jan Olof Rosenqvist (Stockholm, 1993), 163-165 (an expanded version of the latter will appear in *Istanbuler Mitteilungen* 44,[1994]).

7. Although they are often overlooked by scholars today, throughout the Byzantine period, the gardens and orchards of the city are lovingly described; see, among others, Anthony R. Littlewood, "Gardens of Byzantium," *Journal of Garden History* 12 (1992), 126-153; Leslie Brubaker and Anthony R. Littlewood, "Byzantinische Gärten," in *Der Garten von der Antike bis zum Mittelalter*, ed. M. Carroll-Spillecke (Mainz: von Zabern, 1992), 213-248; Henry Maguire, "A Description of the Aretai Palace and Its Garden," *Journal of Garden History* 10 (1990), 209-213; id., "Imperial Gardens and the Rhetoric of Renewal," in *New Constantines: The Rhythm of Imperial Renewal in Byzantium, 4th-13th Centuries*, ed. Paul Magdalino (Aldershot: Variorum, 1994), 181-194.

8. For the extensive bibliography, see Müller-Wiener, *Bildlexikon*, 286-319.

9. Müller-Wiener, 297-300.

10. Müller-Wiener, 229-237.

11. Gerda Bruns, *Der Obelisk und seine Basis auf dem Hippodrom zu Konstantinopel* (Istanbul, 1935).

12. Jean B. Papadopulos, *Les palais et les églises des Blachernes* (Thessaloniki: Société Commerciale & Industrielle de Macédoine, 1928); Müller-Wiener, 223-224.

13. See David Talbot Rice, ed., *The Great Palace of the Byzantine Emperors. Second Report* (Edinburgh: Walker Trust, 1958).

14. Müller-Wiener, 248-270.

15. See my comments in *The International Center of Medieval Art Newsletter* (1993/no. 3), 6-7; also "The Plundering of Istanbul," *The Economist* (25 June 1994), 99-100.

16. For example, Raymond Janin, *Constantinople byzantine* (Paris: Institut Français d'Études Byzantines, 1964).

17. A few scholars should be singled out in this respect. Cyril Mango, who was born and raised in Istanbul and who knows the city like no other, has addressed the issue of urban transformation, at least for the early centuries, in his *Le développement urbain de Constantinople* (Paris: de Boccard, 1985), and he promises a similar study for the medieval period. Thoroughly grounded in the archaeology of the city, Mango is able to judiciously relate standing remains to textual evidence. See also Albrecht Berger, *Untersuchungen zu den Patria Konstantinopoleos*, Poikila Byzantina 8 (Bonn, 1988). Similarly, Paul Magdalino has dealt with medieval Constantinople in several articles and in his excellent biography of the Emperor Manuel Comnenus, and in a small study of the medieval city; note particularly "The Byzantine Aristocratic *Oikos*," in *The Byzantine Aristocracy*, British Archaeological Reports, International Series, 221, ed. Michael Angold (Oxford, 1984), 92-111; id., *The Empire of Manuel Comnenos* (Cambridge: Cambridge University Press, 1993), esp. 109-123; and id., *Constantinople médiéval* (Paris: de Boccard, 1996), the last of which appeared too late to be considered here. Although his work is based primarily on texts, Magdalino has a remarkable ability to evoke a visual image of the city.

18. François Halkin, "Invention des reliques et miracles de Sainte Photeine la Samaritaine," *Hagiographica inedita decem, Corpus Christianorum*, Ser. Gr. 21, (Turnhout-Leuven 1989), 111-125; Alice-Mary Talbot, "The Posthumous Miracles of St. Photeine," *Annalecta Bollandiana*, 112 (1994), 85-104, with additional notes by Robert Ousterhout.

19. Nikos Atzemoglou, *T'Agiasmata tes Poles* (Athens: Resos, 1990), 17-19.

20. Mango, *Développement*, passim.

21. C. Mango, "Constantinople," *Oxford Dictionary of Byzantium*, 1 (Oxford: Oxford University Press, 1991), 510.

22. Cyril Mango, "The Development of Constantinople as an Urban Centre," *The 17th International Byzantine Congress, Major Papers* (New York: Caratzas, 1986), 117-136, esp. 131.

23. Mango, *Développement*, passim.

24. Ibn Battuta, writing in 1332, says the inhabitants lived in thirteen separate villages; see van der Vin, 1, 254.

25. Cecil L. Striker, *The Myrelaion (Bodrum Camii) in Istanbul* (Princeton: Princeton University Press, 1981), 13-16.

26. Cyril Mango, *Byzantine Architecture* (New York: Braziller, 1976), 24, suggests that they were abandoned because of the decline in the labor force; see also Nuşin Asgari, "Roman and Early Byzantine Marble Quarries of Proconnesus," *Proceedings of the Tenth International Congress of Classical Archaeology (1973)*, 1 (Ankara, 1978), 467-80; and Anthony Cutler, "Quarries," *Oxford Dictionary of Byzantium*, 3, 1766.

27. A.H.S. Megaw, "Notes on Recent Work of the Byzantine Institute in Istanbul," *Dumbarton Oaks Papers* 17 (1963), 345-346; figs. E, 7-8.

28. As I have discussed elsewhere: Robert G. Ousterhout, *The Architecture of the Kariye Camii in Istanbul* (Washington, D.C.: Dumbarton Oaks, 1987), 39-45.

29. Magdalino, "Byzantine Aristocratic *Oikos*," passim.

30. Anna Comnena, *The Alexiad*, trans. E.R.A. Sewter (Harmondsworth: Penguin, 1969), 492, on the Orphanage of St. Paul; Ioannes Zonaras, *Epitome historiarum* (Bonn, 1841-97), 3, 767, on the palaces of the Comnenian nobility; see Magdalino, "Byzantine Aristocratic *Oikos*," 92-95.

31. Michael Angold, "Inventory of the so-called Palace of Botaniates," in *The Byzantine Aristocracy*, 254-266.

32. See Ousterhout, *Architecture of the Kariye Camii*, 91-96, 110-114, 142-144.

33. Cyril Mango, "Byzantine Writers on the Fabric of Hagia Sophia," in *Hagia Sophia from the Age of Justinian to the Present*, eds. Robert Mark and Ahmet Çakmak (Cambridge: Cambridge University Press, 1992), esp. 45-50.

34. Cyril Mango, "Ancient Statuary and the Byzantine Beholder, *Dumbarton Oaks Papers* 17 (1963), 55-75; and Gilbert Dagron, *Constantinople imaginaire* (Paris: Institut Français d'Études Byzantines, 1984). These views may be tempered by Helen Sarandi-Mendelovici, "Christian Attitudes toward Pagan Monuments in Late Antiquity and Their Legacy in Later Byzantine Centuries," *Dumbarton Oaks Papers* 44 (1990), 47-61.

35. Mango, "Antique Statuary," passim, for these and other amusing anecdotes. For an attempt to reconstruct the original meanings, see Sarah Guberti Bassett, "The Antiquities in the Hippodrome of Constantinople," *Dumbarton Oaks Papers* 45 (1991), 87-96.

36. See van der Vin, *Travellers*, 1, 269; and Thomas F. Madden, "The Serpent Column of Delphi in Constantinople: Placement, Purposes, and Mutilations," *Byzantine and Modern Greek Studies* 16 (1992), 111-145.

37. Cyril Mango, *The Brazen House: A Study of the Vestibule of the Imperial Palace of Constantinople*, Arkæologisk-kunsthistoriske Meddelelser udgivet af Det Kongelige Danske Videnskabernes Selskab, 4, no. 4 (Copenhagen, 1959), 100-101, citing information from the *Patria* and from the 12th-century visit of al-Harawy.

38. Dagron, *Constantinople imaginaire*, 107-115.

39. Mango, "Antique Statuary," 62-63, quoting Niketas Choniates.

40. Much of what follows comes from a book-length study in progress, *Byzantine Masons at Work*. For many of the hagiographical references, I am indebted to Dr. Alice-Mary Talbot.

41. E.H. Freshfield, trans., *Roman Law in the Later Roman Empire* (Cambridge, 1938); E. Dujčev, *To Eparchikon Biblion* (London, 1970).

42. Freshfield, 48-50.

43. Denis Sullivan, trans., *The Life of Saint Nikon of Sparta* (Brookline, Mass.: Hellenic College Press, 1985), 114-119.

44. Sullivan, 124-131.

45. Such as the appearance of the guardian angel to the apprentice at H. Sophia, already mentioned; Dagron, passim. Foundation "miracles" are also noted in the *typikon* of the Kosmosoteira monastery, founded ca. 1152; see L. Petit, "Typikon du monastère de las Kosmosotira près d'Aenos," *Izvestiia Russkago Arkeologicheskago Instituta v Konstantinopole*, 13 (1908), ch. 75.

46. George Dennis, *Three Byzantine Military Treatises* (Washington, D.C.: Dumbarton Oaks, 1985), 246-261; 329-335.

47. Carolyn Carty, "The Role of Gunzo's Dream in the Building of Cluny III," *Gesta* 27 (1988), 113-123; Kenneth J. Contant, "Mediaeval Academy Excavations at Cluny. IX: Systematic Dimensions of the Buildings," *Speculum* 38 (1963), 8-11; and ibid., *Cluny. Les Églises et et la Maison du Chef d'ordre* (Mâcon, 1968), 76, saw the illustrations of Gunzo's dream as evidence that the architects employed the Vitruvian system of geometry—square and half-square set pointwise, although this is reading too much into some rather simple depictions. It is noteworthy, however, that in the illustration in which Gunzo relates his dream to Abbot Hugh, he shows the plan with gestures rather than with a drawing.

48. W. Eugene Kleinbauer, "Pre-Carolingian Concepts of Architectural Planning," *The Medieval Mediterranean: Cross-Cultural Contacts*, Medieval Studies at Minnesota, 3, ed. Marilyn J. Chiat and Katherine L. Reyerson (St. Cloud, Minn.: North Star Press, 1988), 67-79, nicely summarizes what we know of early medieval architectural procedures; see also Glanville Downey, "Byzantine Architects: Their Training and Methods," *Byzantion* 18 (1946-48), 99-118.

49. *AASS*, 64 (Nov. 3), 109.

50. Denis Sullivan is making a study of the *Poliorcetica* manuscript, and I am grateful to him for fruitful discussions on the subject; see for now Denis Sullivan, "Originality in the *Poliorcetica* of 'Heron' of Byzantium," *Byzantine Studies Conference, Abstracts of Papers*, 18 (Champaign, IL, 1992), 32-33; for text, A. Dain, ed., *Texte de Heron de Byzance* (Paris, 1933).

51. Krăstju Mijatev, *Die Mittelalterliche Baukunst in Bulgarien* (Sofia, 1974), passim; also Robert Ousterhout, "Beyond Hagia Sophia: Originality in Byzantine Architecture," in *Originality and Innovation in Byzantine Literature, Art, and Music*, ed. Anthony Littlewood (Oxford: Oxbow Books, 1994, in press).

52. Erich Schilbach, *Byzantinische Metrologie* (Munich: C.H. Beck'sche Verlag, 1970), 13-36.

53. Hans Buchwald, "The Geometry of Middle Byzantine Churches and Some Possible Implications," *Jahrbuch der Österreichischen Byzantinistik* 42 (1992), 293-321.

54. Hülya Tezcan, *Topkapı Sarayı ve Çevresinin Bizans Devri Arkeolojisi* (Istanbul: Türkiye Türing ve Otomobil Kurumu, 1989), 187-250.

55. Ousterhout, *Architecture of the Kariye Camii*, 61 and figs. 92-93.

56. Talbot, "Posthumous Miracles," 99.

57. Nicola Coldstream, *Masons and Sculptors* (Toronto: University of Toronto Press, 1991), provides a useful, well-illustrated introduction.

58. Jacques Noret, ed., *Vitae duae antiquae S. Athanasii Athonitae*, *CC*, Series Graeca, 9 (Turnhout-Leuven, 1982), *vita A*, ch. 234; *vita B*, ch. 66.

59. Talbot, "Posthumous Miracles," 96-97.

60. René Ginouvès and Roland Martin, *Dictionnaire méthodique de l'architecture grecque et romaine*, Collection de l'École Française de Rome, 84 (Rome-Paris, 1985), 1, 113-114; pls. 27-29.

61. A.H.S. Megaw, "The Original Form of the Theotokos Church of Constantine Lips," *Dumbarton Oaks Papers* 18 (1964), 296, and fig. 9.

62. Lawrence Butler, "Hagia Sophia's Nave Cornices as Elements of Its Design and Structure," in Mark and Çakmak, eds., *Hagia Sophia*, 57-77, discusses the structural role of cornices in sixth-century architecture.

63. Auguste Choisy, *L'art de bâtir ches les Byzantines* (Paris, 1883), 31-57.

64. Megaw, "Notes on Recent Work," 347, figs. 13-14.

65. Robert Demangel and Ernest Mamboury, *Le quartier de Manganes et le première région de Constantinople* (Paris, 1939), fig. 28.

66. Ousterhout, *Architecture of the Kariye Camii*, 126-133.

67. Choisy, *L'art de bâtir*, 66-68.

68. Otto Demus, *Byzantine Mosaic Decoration* (London: Routledge & Kegan, 1948), presents the now classic formulation.

Figure 1.   Constantinople, plan of city (redrawn after Mango with author's modifications).
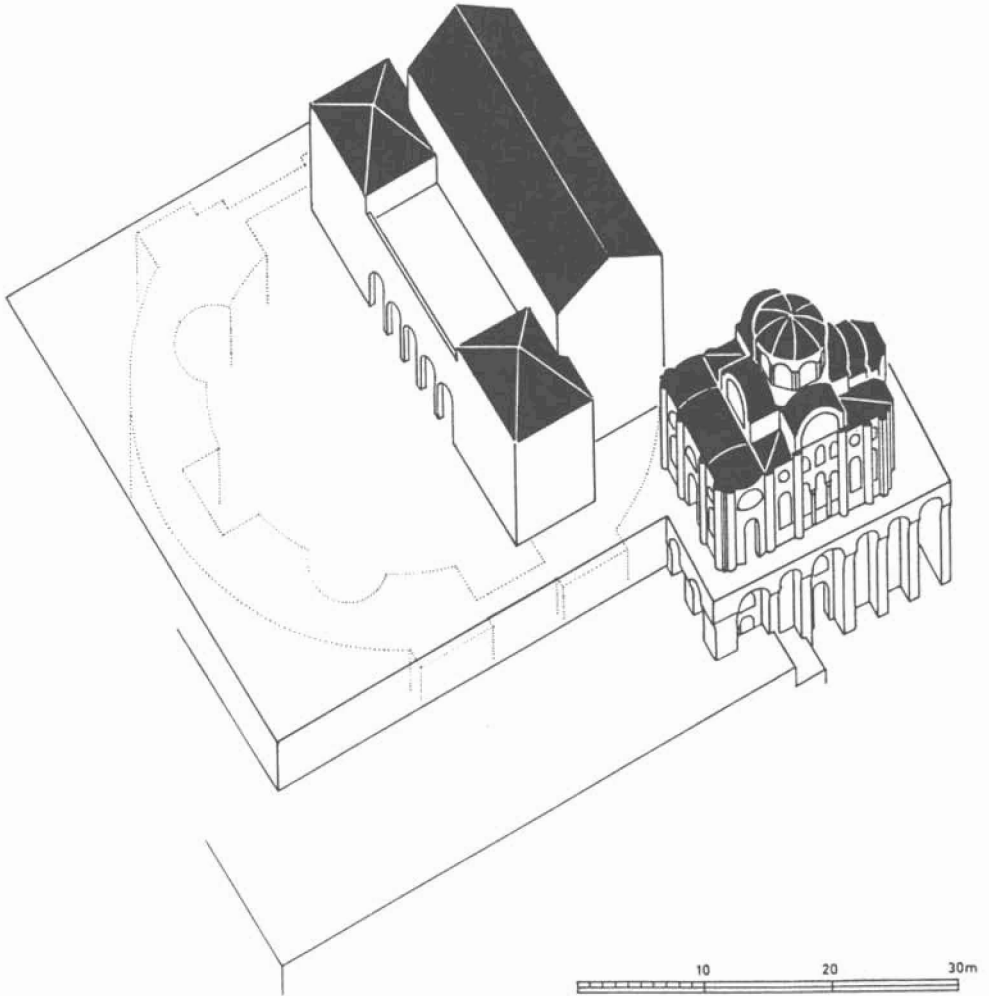
Figure 2. Constantinople, Romanos Lecapenos' palace at the Myrelaion on the foundations of a Late Antique rotunda (reconstruction, after Striker).

Figure 3. Constantinople, Chora (Kariye Camii), naos interior, looking north; marble revetments (Photo: author).

Figure 4. Constantinople, Pantocrator (Zeyrek Camii), general view of the monastic complex from the east (Photo: T. Mathews, courtesy of Dumbarton Oaks).
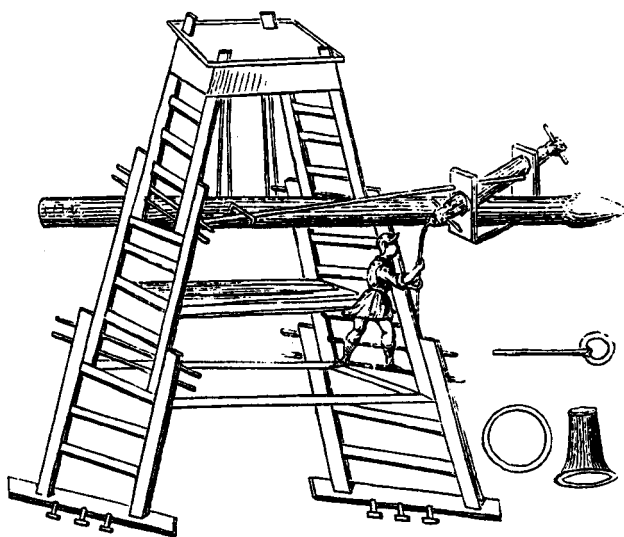
Figure 5. Codex Bononiensis Sancti Salvatoris 587, fol 182ʳ, drawing of a siege engine (as redrawn by Wescher).
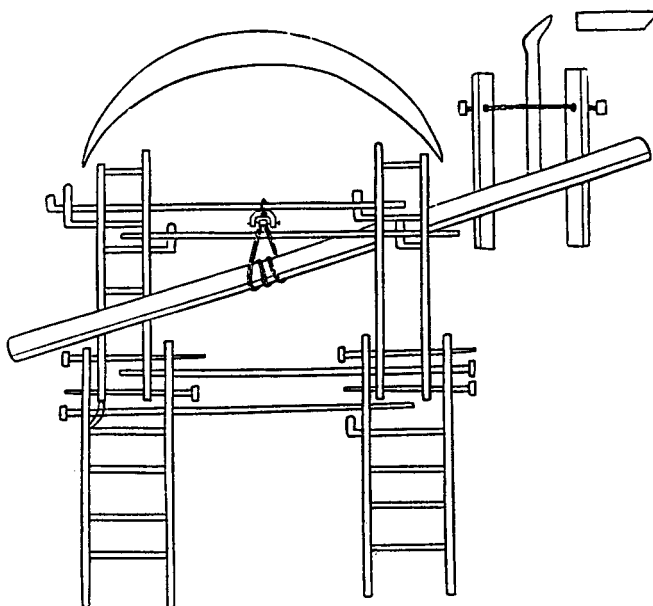
Figure 6. Codex Parisinus vetustissimus suppl. Gr. 607, fol. 43 ᵛ, drawing of a siege engine (as redrawn by Wescher).
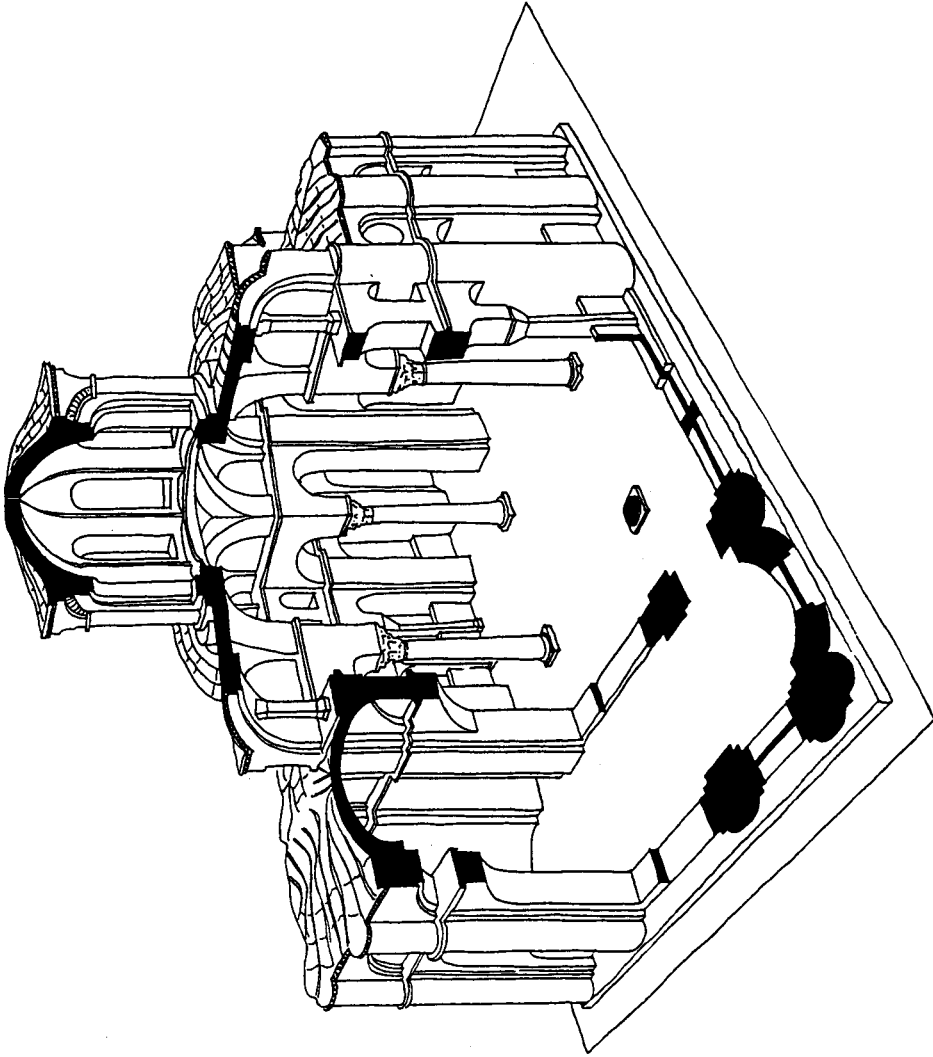
Figure 7. Constantinople, Myrelaion church, cutaway perspecive (redrawn after Striker with author's modifications).
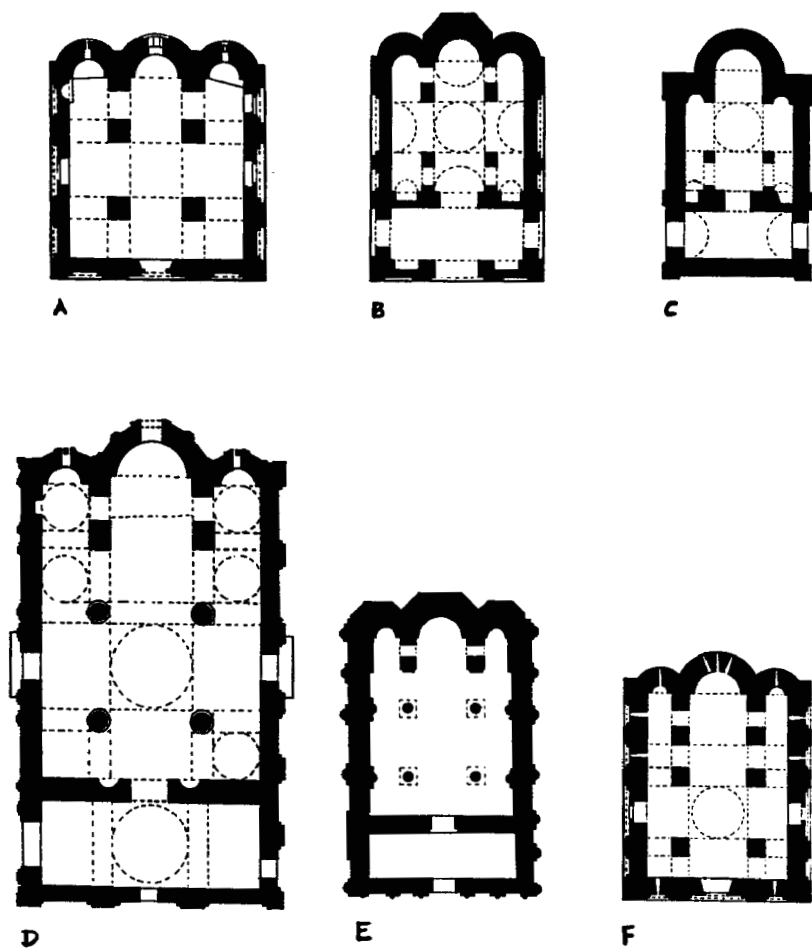
Figure 8. Cross-in-square churches from Bulgaria, showing range of variations (redrawn after Mijatev with author's modifications).
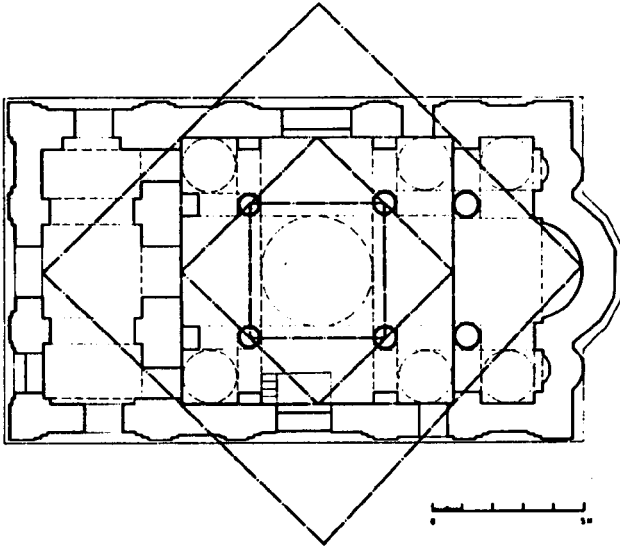
Figure 9. Sardis, Church E, plan; possible application of *quadratura* in laying out the plan (after Buchwald).
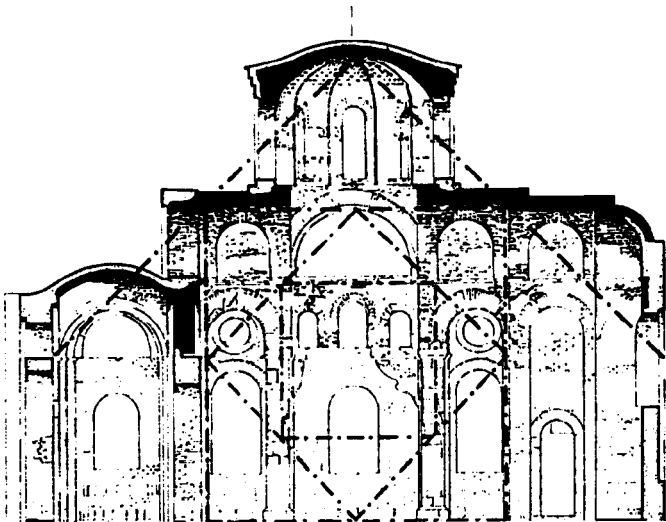
Figure 10. Constantinople, Myrelaion church, elevation; possible application of *quadratura* in determining the elevation(after Buchwald).
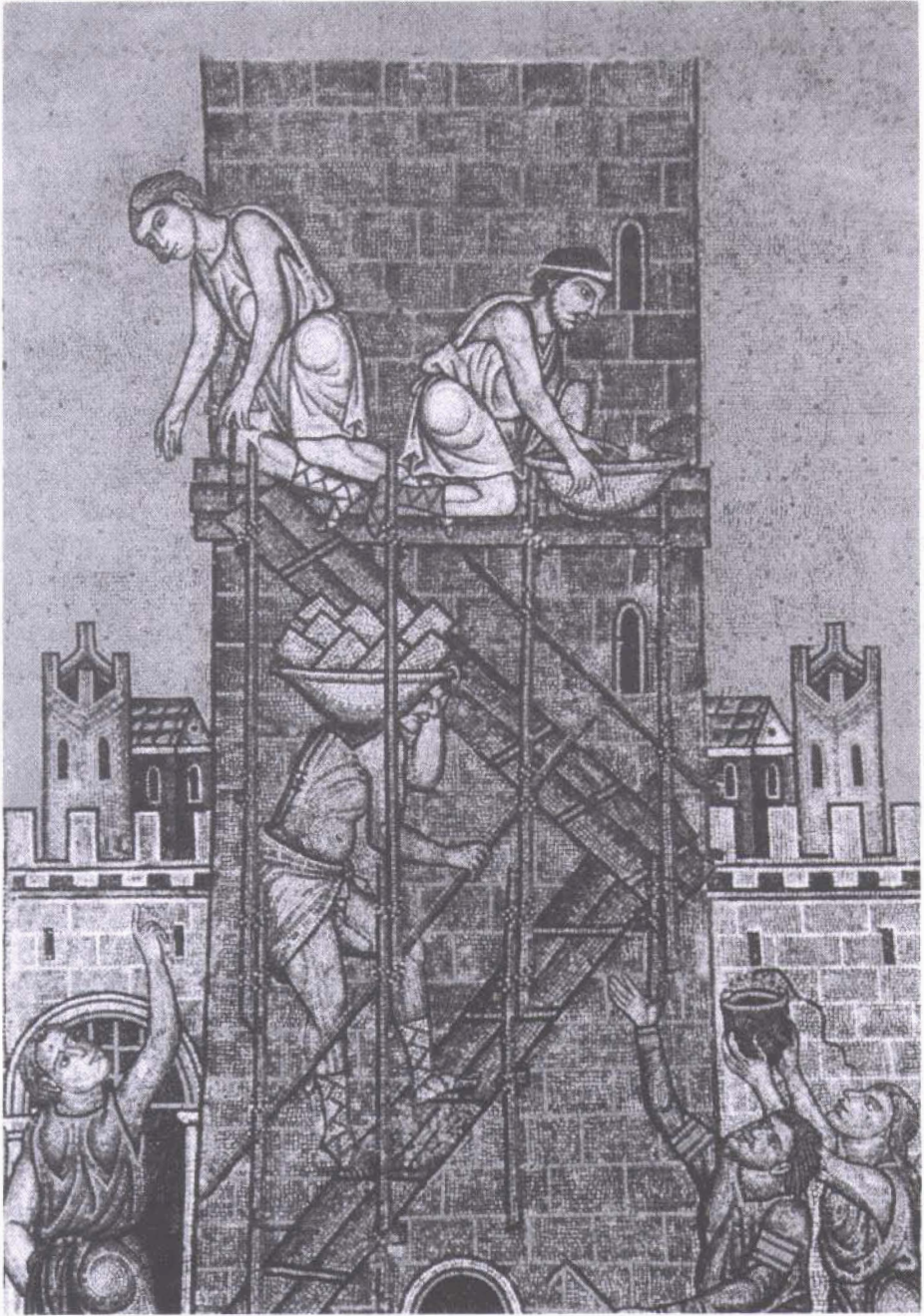
Figure 11. Venice, S. Marco, mosaic *Construction of the Tower of Babel*, showing masons working on a scaffolding supported on putlogs.
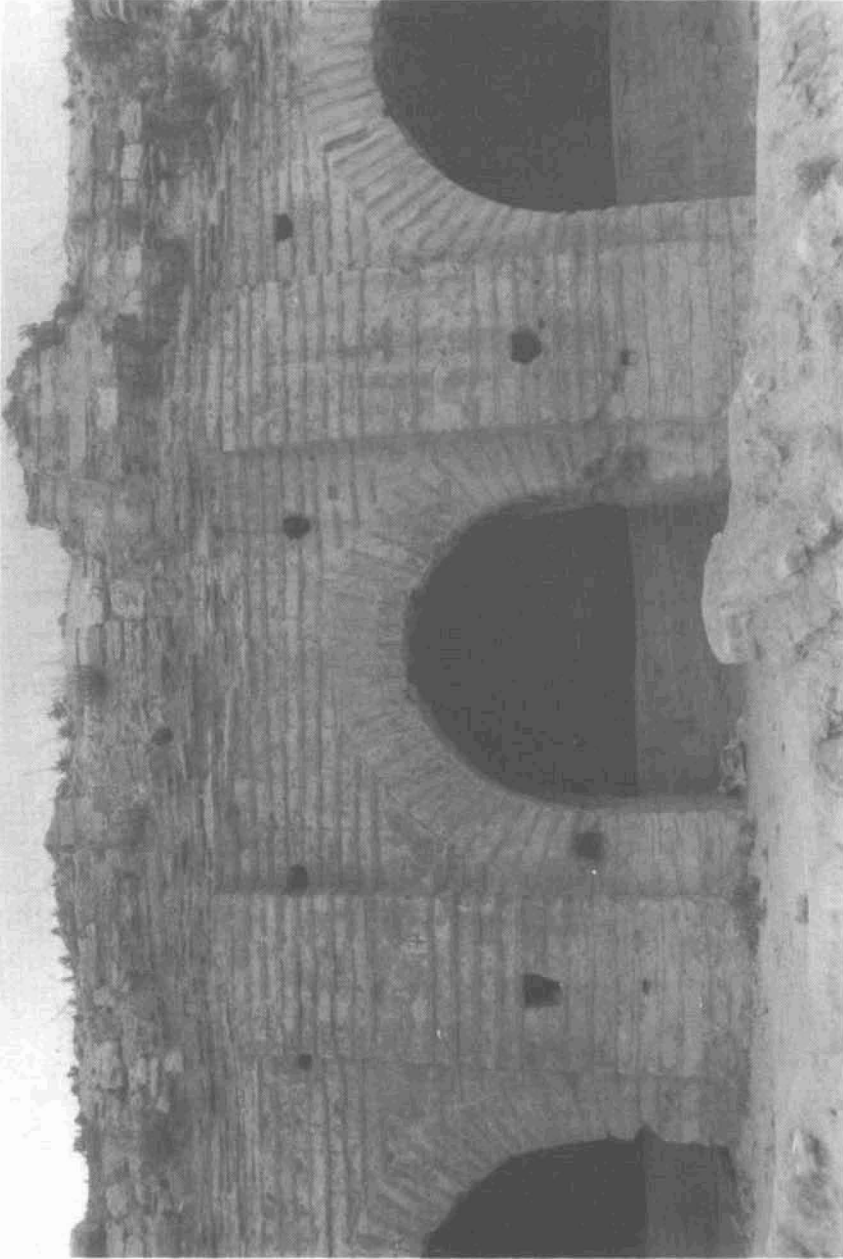
Figure 12. Constantinople, Mangana complex, substructures, east facade, showing a pattern of putlong holes left by the scaffolding (Photo: author).
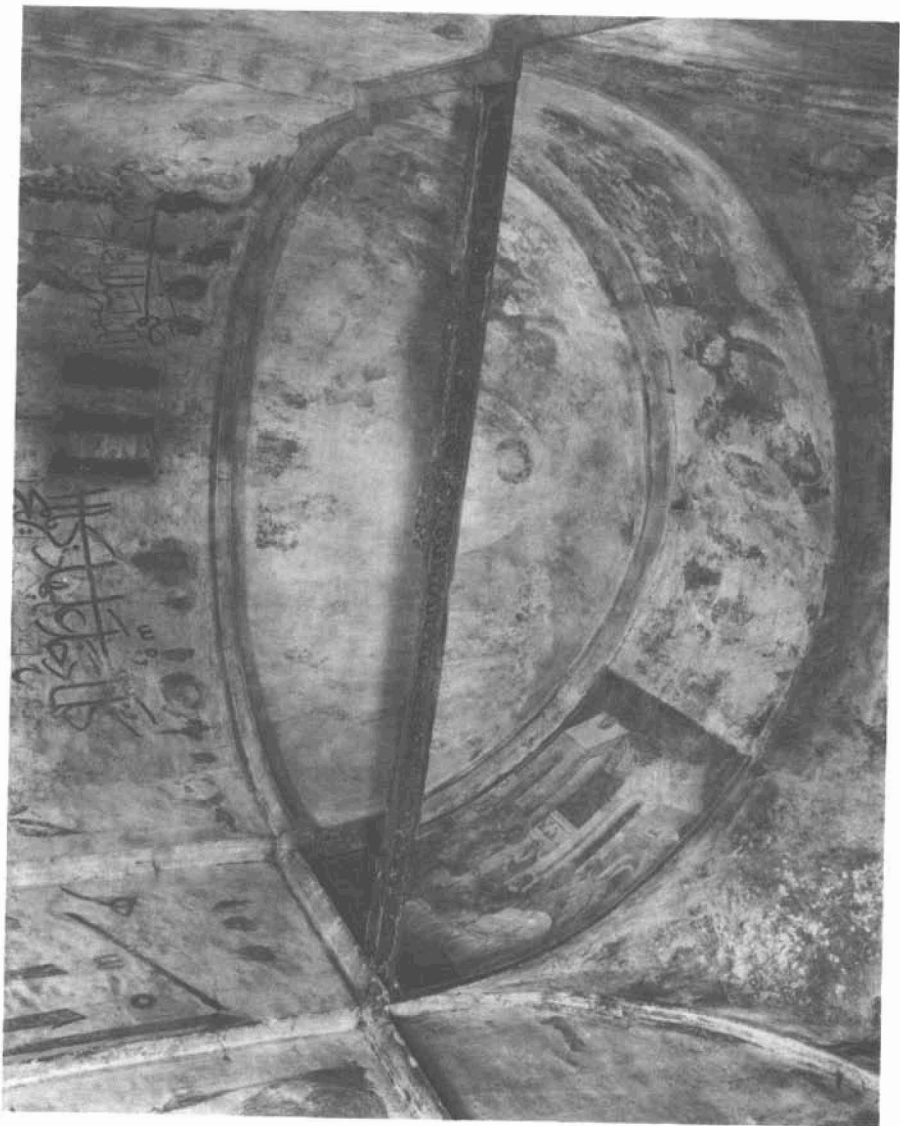
Figure 13. Constantinople, Chora, parekklesion, decorated tie beam, before its removal in restoration (Photo: courtesy of Dumbarton Oaks).
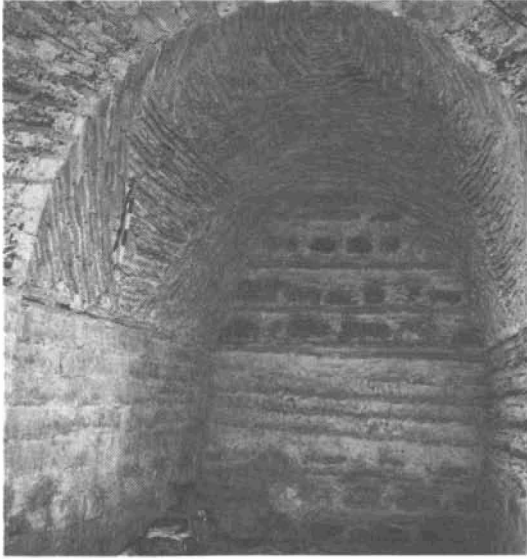
Figure 14. Constantinople, Pantocrator (Zeyrek Camii), south church, cistern; vault constructed without formwork (Photo: courtesy of Dumbarton Oaks).
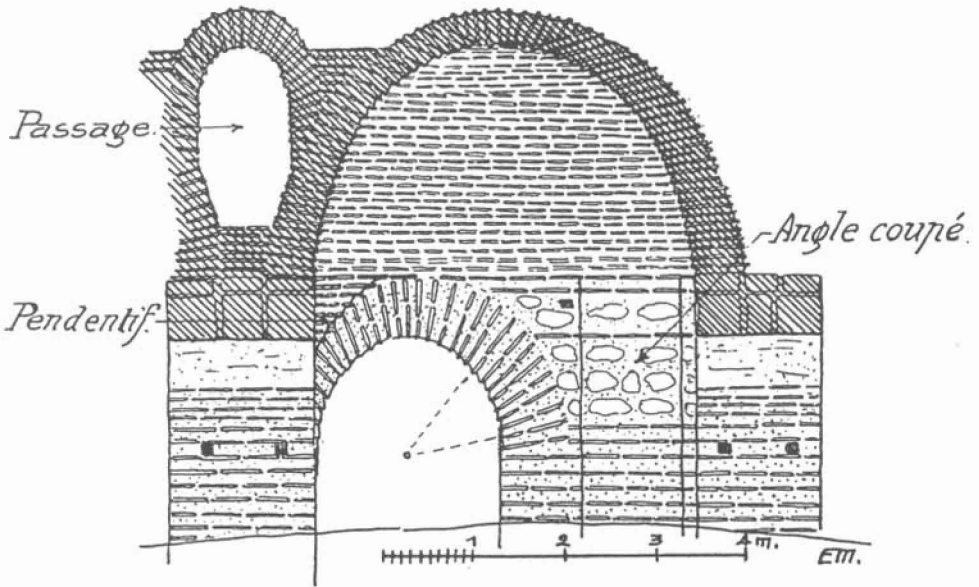

Figure 15. Constantinople, Mangana complex, substructures, section, showing radial arch construction and corbeled vault construction (after Demangel and Mamboury).
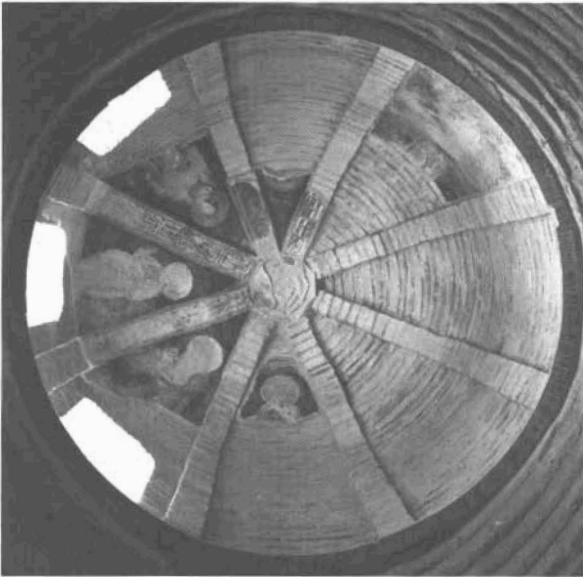
Figure 16. Constantinople, Chora, diakonikon dome; ribbed construction, probably executed with minimal formwork (Photo: courtesy of Dumbarton Oaks).
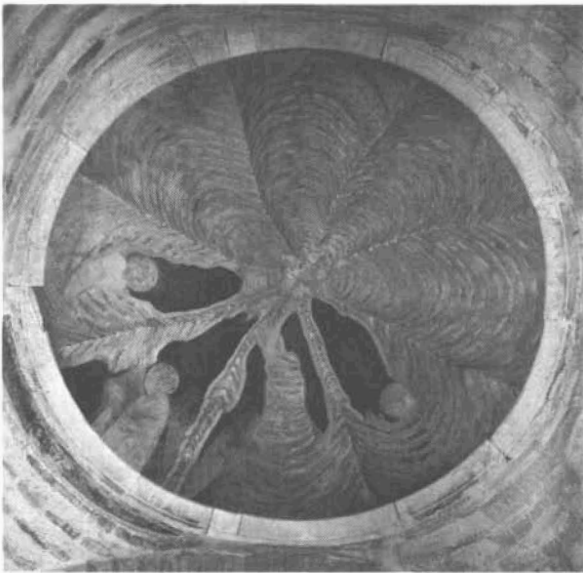

Figure 17. Constantinople, Chora, prothesis dome; a *pumpkin dome*, built without formwork (Photo: courtesy of Dumbarton Oaks).

Figure 18. Constantinople, Pammakaristos (Fethiye Camii), parekklesion; view to east showing the hierarchy of interior spaces (Photo: author).