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Interpreting the subterranean building (the crypt) in the northern courtyard of Hagia Sophia in Constantinople

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Abstract

This article discusses a subterranean building, situated north of Hagia Sophia in Constantinople, which was investigated during a recent interdisciplinary survey conducted by Çiğdem Özkan Aygün. Although it is generally accepted that the edifice had more than one phase of use, the date of its original construction and utilisation has been problematic since the building is not mentioned in any written sources and was either not included in other archaeological excavations and surveys or not studied intensively. The aim of this paper is to present the underground building in detail and to propose a date for its construction based on the new survey data and on ancient written sources about the church of Hagia Sophia. Archaeological data from previous surveys are also taken into account. The subterranean building's different phases of use are documented, and it is proposed that it was originally used as a reliquary, then later, after a number of alterations, became a cistern.

Özet

Bu makale, İstanbul'da Ayasofya'nın kuzeyinde yer alan ve yakın zamanda Çiğdem Özkan Aygün tarafından gerçekleştirilen disiplinler arası yüzey araştırmasına dahil olan bir yeraltı yapısını ele almaktadır.Yapının birden fazla kullanım evresine sahip olduğu genel olarak kabul edilmekle birlikte, yapıdan herhangi bir yazılı kaynakta bahsedilmemesi ve diğer arkeolojik kazı ve yüzey araştırmalarına dahil edilmemesi ya da derinlemesine çalışılmaması sebebiyle ilk yapım tarihi ve kullanım evreleriyle ilgili bilgiler sorunludur. Bu bildirinin amacı, söz konusu yüzey araştırmasından elde edilen yeni veriler ve Ayasofya kilisesi ile ilgili eski yazılı kaynaklardan hareketle yer altı yapısını detaylı bir şekilde ortaya koymak ve yapım tarihi hakkında bir öneri getirmektir. Bu amaçla, önceki araştırmalardan elde edilen arkeolojik veriler de dikkate alınmıştır. Bu makaleyle, söz konusu yeraltı yapısının farklı kullanım evreleri belgelenmekte ve başlangıçta rölik odası olarak kullanıldığı görüşü öne sürülerek sonradan geçirdiği değişimler ve sarnıca dönüştürülüşü ile ilgili veriler ortaya çıkarılmakta ve sunulmaktadır.

In 2005, an interdisciplinary survey on the subterranean remains in the area of Hagia Sophia began under the direction of Çiğdem Özkan Aygün. The work was supported by the Scientific Research Projects Department of Istanbul Technical University (project nos 37268 and 43072). Archaeologists, architects, civil engineers and art historians from Istanbul Technical University – as well as a group of photographers and divers, including members of the Anatolian Speleology Group (ASPEG) – contributed to the survey. Some of the subterranean remnants of Hagia Sophia are intact structures and others are partially surviving substructures. Almost all of them were integrated into the water supply system of the city and Hagia Sophia at a certain point in their history (Özkan Aygün 2010b). Because of the building's architectural vulnerability, non-destructive methods were employed in the exploration of conduits. Wells or cisterns, which were still full of water, had to be investigated using diving techniques; in fact, the Hookah Diving System (a surface-supplied air system where divers do not have to wear high-pressure air tanks

on their back) had to be used for the wells, as they were too narrow to enter with scuba equipment. Underwater and terrestrial ROV (Remote Operating Vehicles) were utilised for inaccessible areas and for detection in some parts of the research area. The outcomes of this research were also evaluated by comparing them with the results of the parallel Ground Penetrating Radar survey conducted by Öz Yılmaz (2013).

A section of the water channel system longer than 1km, which was connected to the subterranean structures, was detected and measured, along with the wells inside and under the courtyards of Hagia Sophia (fig. 1). The measurements and the drawings of the findings were made by the architect and speleologist Emine Azak. The water flow rate was calculated, as well as the different construction techniques of each era, based on the typology and the internal diameters of the Byzantine and Ottoman pipelines made from terracotta, lead and iron. Chemical analysis of the water from the wells led to an understanding of their use in collecting both rainwater and springwater (Özkan Aygün 2010b).

In 2009, new research directed by Dr Özkan Aygün began. Three-dimensional (3D) reconstructions and architectural animations of the subterranean structures were made possible using data from architectural measurements and photogrammetry techniques. A series of documentaries in the area of interest, including the crypt, was made using 3D architectural animation; the last of these was shot by the production company Pernel Media for the television network RMC Decouverte, under the scientific directorship and authorship of Dr Özkan Aygün (2020) and funded by the Turkish Ministry of Tourism and Culture. Recently, 3D drawings, orthographic views and virtual reality videos were designed using Rendering and

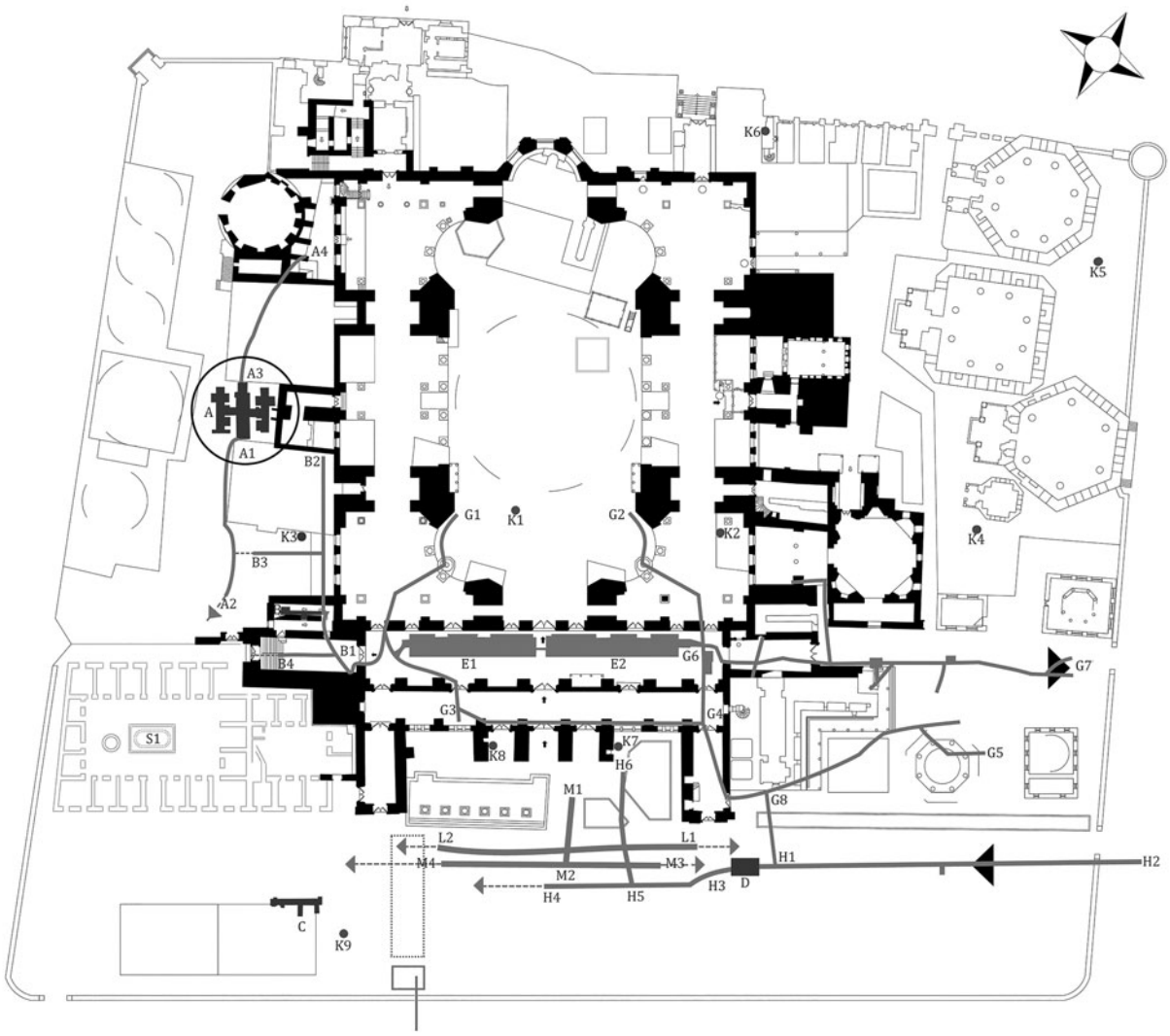

Fig. 1. The subterranean channels, wells and structures beneath the Hagia Sophia church. The letter 'A' denotes the crypt (© Ç. Özkan Aygün, adapted from Özkan Aygün 2010b, fig. 1).

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Blender software, and were presented at online scientific conferences for the BIAA (Özkan Aygün 2021) and the Research Center for Anatolian Civilizations (ANAMED) (Özkan Aygün 2022a; 2022b).

Most of the findings regarding the history and the construction techniques of the structures were unexpectedly rich and informative, opening a door to an unexplored aspect of the monument concerning its relation to water. In this survey, it was shown that the site of Hagia Sophia occupied a strategic position, which was at the very end of the ancient water supply line, in the distribution of the water supply. The nine wells studied during the survey showed the structure's ground water capacity (Ozkan Aygun 2010b). In addition to the impressive scientific findings, this research also brought to light the blockage and damage to this huge underground water supply, ventilation and drainage network beneath Hagia Sophia. This blockage prevents both the drainage of excess water and proper ventilation, which creates humidity in the structure. The humidity leads to structural defects, such as cracking and shedding (Özkan Aygün 2010b: 72, 77). This research was carried out through annual permits from the Turkish Ministry of Culture and Tourism and the General Directorate of Cultural Heritage and Museums, and it is the only archaeological research so far that has been conducted in a systematic and comprehensive manner. The results of the underground surveys were used for studies carried out up to the reconversion of the monument to a mosque, in 2020, and will hopefully help future conservation efforts.

The study was extended with surveys beneath the Hippodrome, Topkapı Palace and the Istanbul Archaeological Museum area, which were built on the site of the ancient acropolis (Magdalino 2022: 228–29; Özkan Aygün 2010b: 57–60). These surveys were integrated into the Scientific Research Project of Istanbul Technical University concerning the Roman and Ottoman water supply system of Constantinople – including cisterns, supply channels and related technologies – under the direction of Çiğdem Özkan Aygün. Most significantly, this was the first time all the subterranean buildings were investigated in a single contextual manner, which made it difficult to obtain the agreement of the managerial authorities. At the same time, the findings of this research were disseminated through 3D model productions, TV documentaries, public presentations and scientific articles. Thus, new information about Hagia Sophia was communicated to the public and to tour guides, and helped to establish a new field of research.

The surveys beneath the Hippodrome, Topkapı Palace and the Istanbul Archaeological Museum area were included in a new interdisciplinary project titled 'Water in Istanbul: Rising to the Challenge?' based on Geographical Information System (GIS) technology. This 24-month project began in 2021, led by the Director of the British Institute at Ankara (BIAA), Lutgarde Vandeput, and funded by the British Academy's Knowledge Frontiers 2021: International Interdisciplinary Research Scheme, the Scientific Research Projects Department of Istanbul Technical University (no. 43072), a BIAA research grant, and the SFC GCRF Fund of the University of Edinburgh. The project 'brings together archaeologists, engineers, social scientists and historians to investigate water management infrastructure in Istanbul' (Crapper et al. 2021). Dr Özkan Aygün is a co-investigator and responsible for the project's field work, which aims 'to increase understanding of how past authorities have attempted to respond to the significant water management challenges facing Istanbul' (https://biaa.ac.uk/research/water-istanbul/).

The site

The church of Hagia Sophia in Constantinople, the cathedral of the Byzantine capital, is situated on the first hill of the city (Janin 1964: 4–5). This area (fig. 2) was in the urban tissue of the ancient city of Byzantion, south of the acropolis where the sanctuaries were situated (Bauer 1996: 146–47, 149; Magdalino 2022: 227–28; Müller-Wiener 1977: 19–22) and at the centre of the Constantinian city (Basset 2006: 22–25; Chatzilazarou 2018: 38–39; Magdalino 2022: 238–39). According to the *Notitia Urbis Constantinopolitanae* (Seeck 1962: 231), the area belonged to the second of the 14 *Regiones* into which Constantinople was divided in the fifth century AD (Berger 1997: 358–60; Drakoulis 2021: 161; Janin 1964: 49–50).

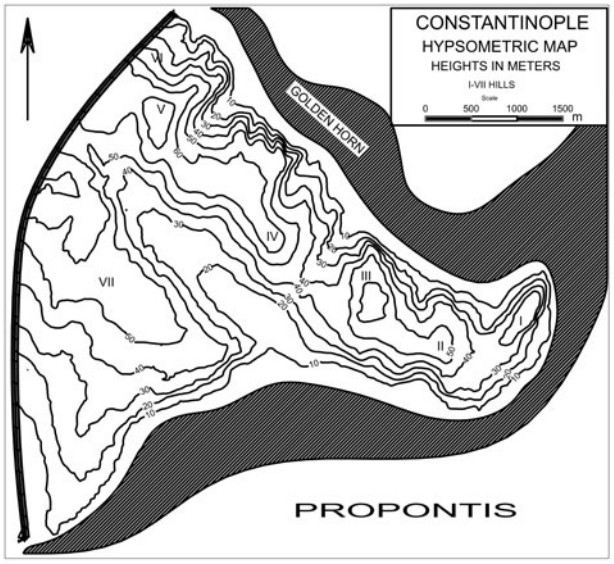

Fig. 2. Hypsometric map of Constantinople produced from the actual digital elevation data taken from İstanbul Metropolitan Municipality (© Ç. Özkan Aygün, produced by Ömer Saruhan).

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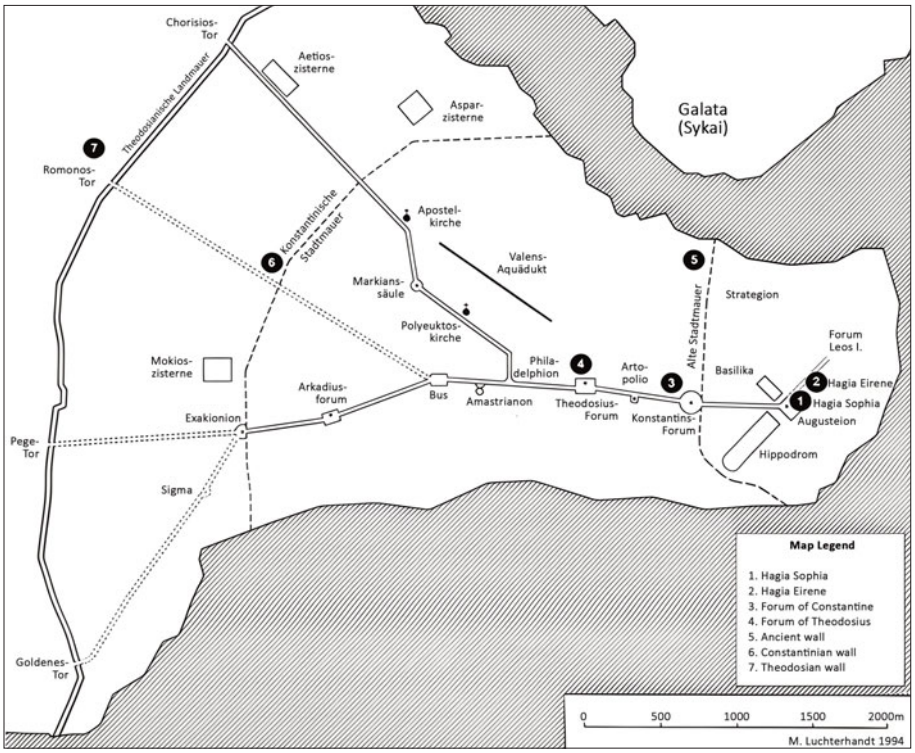

Fig. 3. Constantinople (redrawn from Bauer 1996: 47).

The first church on the site of Hagia Sophia is dated to the fourth century AD. It was probably founded by Constantine, constructed by Constantius II and consecrated in AD 360 (Chatzilazarou 2018: 53–54; *Chron. Pasch.* 360; Magdalino 2022: 238; Mainstone 1988: 131–32; Whitby, Whitby 1989: 35). Written sources refer to this building as the *Megale Ecclesia*, namely 'Great Church', a term which implies that this church was larger, at least, than the city's other churches (Dark, Kostenec 2019: 11). The *Megale Ecclesia* was first damaged by an earthquake in AD 361 and then destroyed during the Council of 381 in a fire set by the Arians (Müller-Wiener 1977: 84).

The church was situated south of Hagia Eirene (fig. 3) and a precinct enclosed both churches (Socrates Scholasticus, *Hist. eccl.* 2.16.16). Hagia Eirene, the so-called *Palaia Ecclesia* (*Ecclesia antiqua*), that is, the 'Old Church', was a pre-existing church that Constantine enlarged (Müller-Wiener 1977: 112; Taddei 2017: 25). Until the erection of the *Megale Ecclesia*, it was the most important church in the city and was used as the Episcopal Church. It was destroyed by fire during the Nika Riot in AD 532 and rebuilt by the emperor Justinian.

After the destruction of the *Megale Ecclesia* in 381, a second church was erected in the fifth century AD under Theodosius II. It was also destroyed during the Nika Riot, and a third church – which survives, with alterations, today – was constructed by Justinian under the direction and plans of the architects Anthemius of Tralles and Isidorus of Miletus (Mainstone 1988: 157; Müller-Wiener 1977: 85).

All three churches, Hagia Sophia and the two pre-existing buildings, were complexes comprising many annexes connected to the church (Mainstone 1988: 135–39). Excavations conducted in the past revealed parts of the fourth- and fifth-century buildings. Some subterranean remains of these previous complexes were used as water facilities during the sixth century and later (Özkan Aygün 2010b).

The aim of the present study is to investigate and shed light on the subterranean structure on the north side of Hagia Sophia (fig. 1; Özkan Aygün 2006; 2010a: 56–70; 2010b: 57–78, tabs. I–XXVIII; Özkan Aygün, Eğilmez 2015; Özkan Aygün, Kaçan 2013). All measurements in this article are based on the archaeological survey by Çiğdem Özkan Aygün unless otherwise stated (fig. 4).

Before the archaeological survey began in 2005, there had been few surveys of the building under study. The *skeuophylakion* (sacristy, treasury chamber) situated on the same side of the church, east of the subterranean building, has been studied better. This edifice is mentioned in Byzantine and Ottoman written sources, whereas there is no mention of the underground structure. The north courtyard of Hagia Sophia is a less-researched and less-known area of the Hagia Sophia complex, despite its importance because of its relation to Hagia Eirene. Recalling Socrates Scholasticus' statement that Hagia Sophia and Hagia Eirene were enclosed by a single wall (*Hist. eccl.* 2.16.16) and a similar statement in Justinian's third Novel that they were enclosed by a single wall and run by the

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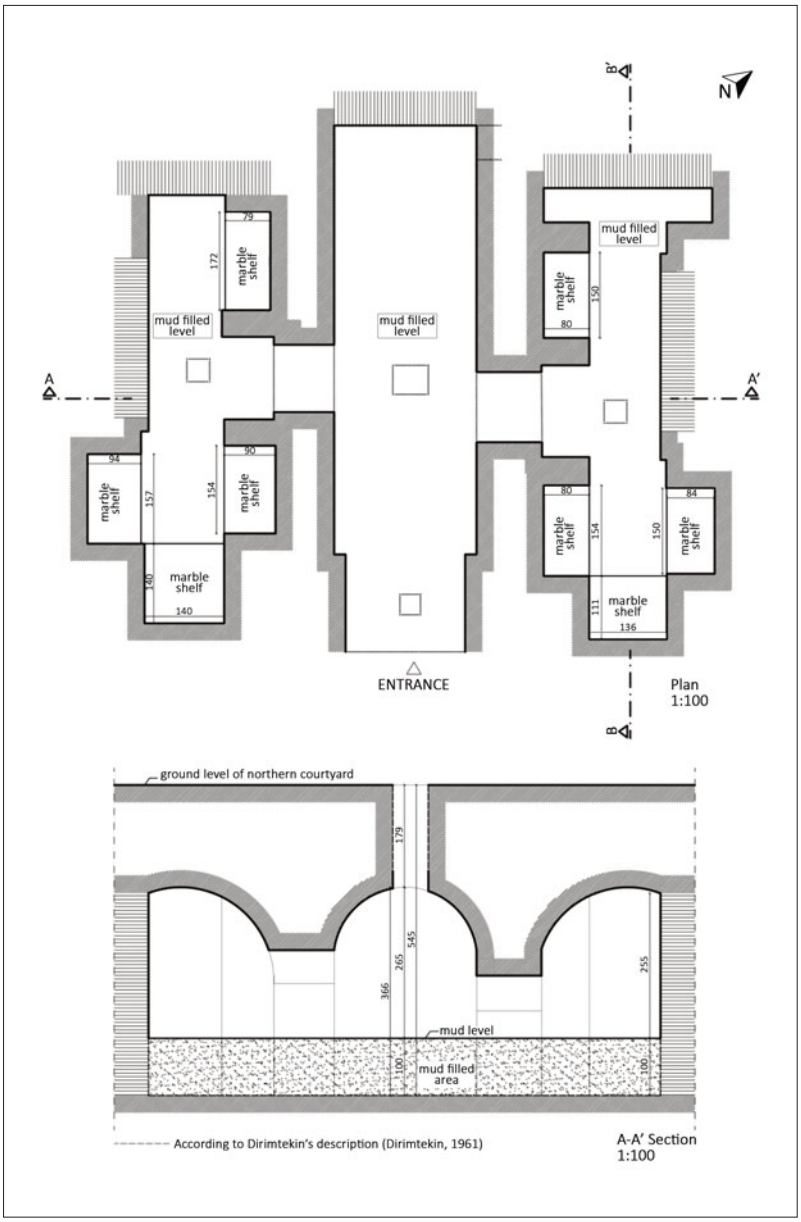

Fig. 4. Plan of the crypt of Hagia Sophia and the later changes (© Ç. Özkan Aygün, drawing by Ece Uysal Engüdar).

same clergy (*Corpus Juris Civilis III* cap. 1; Miller, Sarris 2019: 77–78), the two churches were connected to each other from the beginning, spatially and liturgically, and the north courtyard was the common space between them.

The subterranean edifice is mentioned by Ramazanoğlu (1953: 224–35) and Van Nice (1965: plans 1, 14), who provide plans for the building but do not describe it in detail. Ramazanoğlu published a plan for the structure without dimensions, identified it as a *columbarium* (a subterranean sepulchral building containing niches for cinerary urns) and dated it to the fourth century AD. The only detailed scientific research on the building came from Dirimtekin (1961b: 30–36, 109–15, tab. III). In a 1961 article, he wrote that he was unable to enter all niches because of the high-water level due to the rainy season, but he mentioned that it was possible to reveal the original floor level. He dated the edifice to the fourth or fifth century AD and the two conduits east and northwest of it to the period of Selim II, at the time of restorations of the buttresses by the architect Sinan (Müller-Wiener 1977: 91–92, 112).

In 1985, Koyunlu (1990) excavated the area above the subterranean building and uncovered two layers of marble pavement and a hole/well leading to its middle chamber, but he did not find a well-head. He dated the lower pavement to the fourth century AD and the upper one to the fifth century AD, arguing that they belonged to the first and the second church before the Justinianic Hagia Sophia.

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Koyunlu could not relate the pavements to the underground building, as he could not expand the excavation north and south of them, where they would overlap the ventilation shafts of the subterranean structure.

The subterranean building

The subterranean building is situated in a part of the northern court of Hagia Sophia that during the Ottoman period was called Vezir Bahçesi (Vizier's Garden), which indicates that this was an open space in that period. More evidence of the absence of buildings is the contemporary engravings that show no Ottoman structures over that area.

The structure is located between the northwest and the northeast outer buttresses of Justinian's church. Its orientation is northwest–southeast, but it is not exactly aligned with Hagia Sophia. According to the survey reports of Özkan Aygün (2009–2010), the direction of the Justinianic Hagia Sophia is about 33º southeast calculated from the north wall, whereas the direction of the underground building is 30º southeast (fig. 1). Antōniadēs, on the other hand, calculated the exact direction of the church as 33º 40' to magnetic north (see Antōniadēs 1907: 74 for details about the directions of Hagia Sophia's walls).

The building consists of three parallel barrel-vaulted chambers (figs 4, 5, 6). The entrance to the edifice was at the east end of the central chamber, where a door closed the opening. The door was reached from outside via a descending staircase that no longer exists (Dirimtekin 1961b: 109). The former directors of the Hagia Sophia Museum, Erdem Yücel (1995) and Feridun Dirimtekin (1961b: 109; Özkan Aygün 2010b: 73), mention that they saw the remains of the stairs. At the beginning of that staircase another monumental entrance door would have existed (fig. 5).

The door of the subterranean structure is 2.20m wide and has a white marble frame and moulded jambs (fig. 8). Above the straight, unadorned lintel there is a blind brick arch, as we can conclude from the remaining parts on the broken sides. Perhaps the arch was decorated but no decoration is preserved.

The chamber to which the door leads is almost rectangular, with a maximum width of 2.45m. Its two long walls are not equal in length, as the south is 8.28m and the north 9.24m long (Dirimtekin 1961b: 109; Özkan Aygün 2010b: 73). Dirimtekin (1961b: 110) records that the original pavement was formed of square-shaped bricks, of which only the traces remain.

Arched openings on both sides of the main chamber, south and north, give access to the two rectangular lateral flanks. The north opening is ca 1m long (the structure is not regular; 1.06m in the west and 1.00m in the east) and 1.15m wide. The south opening is ca 1m long and 1.13m wide. The northern chamber has a 7.82m length and 2.96m maximum width, while the southern chamber is 7.25m long and a maximum of 3.19m wide.

The building is constructed in brickwork, which is visible in only a few places, as the surface was completely covered in a later phase by a thick layer of hydraulic mortar. The original masonry is visible above the marble lintel of the entrance door, on the remains of the blind arch and just behind the broken panel of the arch where a part of the barrel-vaulted roof has been uncovered. In the northern chamber, parts of the original masonry were revealed in the pilaster in front of the later wall constructed with greenstone, as well as at the point where this wall cracked the original wall. Additionally, the bricks were revealed on the wall above the eastern marble slab of the

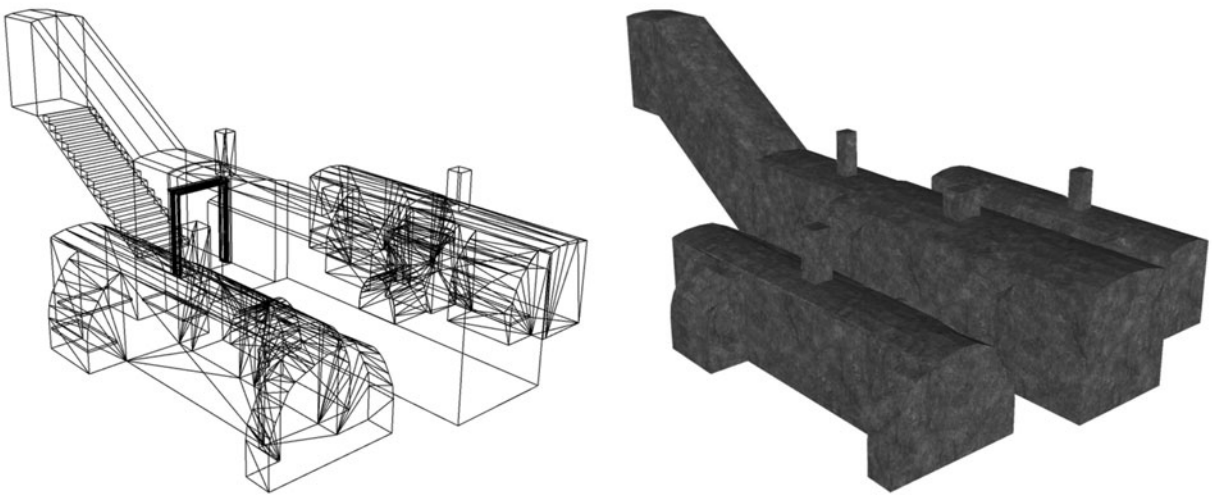

Fig. 5. 3D model of the crypt with a prediction for the original stairs of the descent (© Ç. Özkan Aygün, model by Ceyda Yücesoy).

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north chamber, just beneath the same slab, and on the north and south pilasters which form the recess. The masonry is most visible at the arches formed in the communication opening between the central and northern chambers. In fact, on the east side of that opening a double brick arch is visible (fig. 9); most likely, there would have been similar ones on the other three corresponding surfaces. Finally, the brickwork of the building is evident at the rectangular opening in the barrel vault of the central chamber.

Along the west side of the building, three later walls – one in each chamber – block off this end, thus making impossible any research behind them (Özkan Aygün 2010b: fig. 34, plan A shows the actual state). These constructions belong to the substructure of the northwest outer buttress of Hagia Sophia and the debris created by the weight compressing and distorting the terrain. The masonry of the later wall in the central chamber is made of big white marble blocks – some of them, without doubt, spolia – along with rubble stones to fill in the gaps (fig. 10; Özkan Aygün 2010b: 73). Dirimtekin wrote that he managed to drill the blockage at the western extremity of the north chamber and arrived at the original wall of the subterranean building, 1.60m west of the substructure of the buttress (Dirimtekin 1961b: 111). This blockage is more like an agglomeration and belongs to the substructures of the northwest buttress (fig. 11). Although this buttress is known to be Ottoman, made by the architect Sinan in the 16th century AD, it is an enlarged revetment of the original buttress dating to Justinian's Hagia Sophia. It is also possible that the wall which Dirimtekin claims was the original western wall of the underground building was in fact just the Justinianic inner buttress (Dirimtekin 1961b: 111).

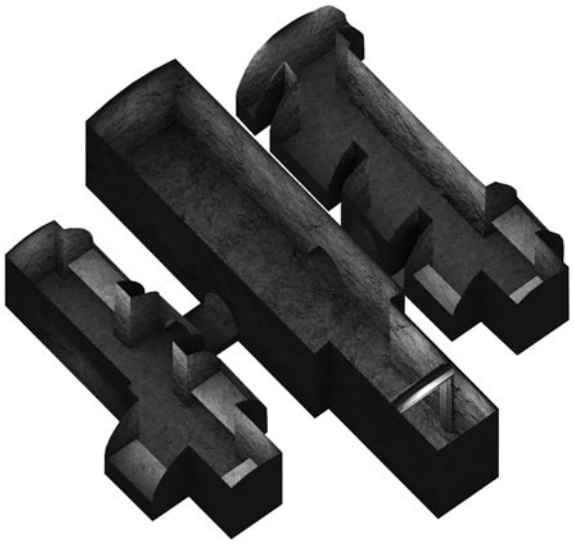

Fig. 6. 3D model depicting an orthographic view of the crypt (© Ç. Özkan Aygün, model by Ceyda Yücesoy).

Two later piers in the two lateral chambers, built with blocks of greenstone, are visible, one at the south wall of the south chamber and one at the north wall of the north one. These are 3.62m wide on the north wall and 3.25m wide on the south wall (Özkan Aygün 2010b: 73; survey notes of Çiğdem Özkan Aygün) and the dimensions of the blocks on the pier visible in the north chamber are 1.05 x 0.65m. They break through the vault of the structure, and there is a visible crack in between (fig. 12). As they are both made up of greenstone blocks, and because of the similar construction techniques, Dirimtekin concluded that the piers belonged to the construction period of the Justinianic church (figs 12–13; Dirimtekin 1961b: 112; Özkan Aygün 2010b: 73). The question of whether the underground building was in use when the construction of the piers destroyed its lateral walls or whether it was already out of use remains unanswered.

At the eastern part of the two flanking chambers, there are three rectangular niches – two on the long sides and one on the narrow one (fig. 14). Two more niches are preserved, one on the northern wall of the south flank and one on the southern wall of the north flank. Similar recesses also existed at the western ends of the two side chambers; however, the later constructions caused

Fig. 7. 3D simulation of the view towards the east from inside the crypt. Monumental door and descending stairs (© Ç. Özkan Aygün, model by Ceyda Yücesoy).

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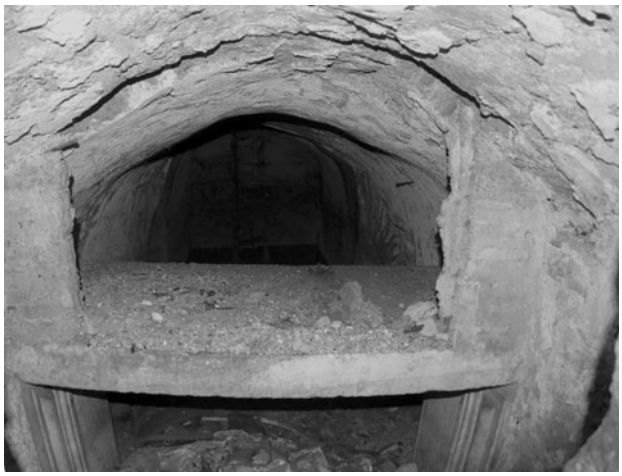

Fig. 8. Entrance of the crypt (© Ç. Özkan Aygün).

Fig. 9. Crypt. Right: double brick arches (© Ç. Özkan Aygün).

Fig. 10. Central corridor of the crypt: the masonry of the wall made of white marble blocks and, upper right, the mouth of the northwest conduit (© Ç. Özkan Aygün).

Fig. 11. The west end of the north chamber. Right: the substructure of the northwest outer buttress of Hagia Sophia blocks the chamber (© Ç. Özkan Aygün).

significant alterations to the original plan of the building. Thus, only small parts of the niches on the north and south long walls at the west end of the northern chamber are visible today. Consequently, originally there would have been 12 or 14 niches (fig. 4).

Dirimtekin is the only one who managed to reach the original floor of the building, and he reports that the floor level of the main chamber was at a depth of 5.45m from the mouth of the ventilation shaft on the vault of the chamber through which they had entered. He also noted that the original height of the structure was 3.50m (Dirimtekin 1961b: 109). However, the calculation is not consistent with the individual measurements he reported. Dirimtekin mentioned the existence of an absidiole, with dimensions of 0.86m length and 0.38m height. We assume that similar small arched niches exist on all sides of the three-sided chambers. Above this small niche, he noticed a massif wall 0.32m high, and over that he mentioned a horizontal surface covered with square bricks (0.60 x 0.60m). At 0.94m above the brick surface, the marble surface, visible today, was found. According to Dirimtekin, the same kind of surface would have existed in all niches, although this could not be established because of the layer of mud (Dirimtekin 1961b: 31, 110).

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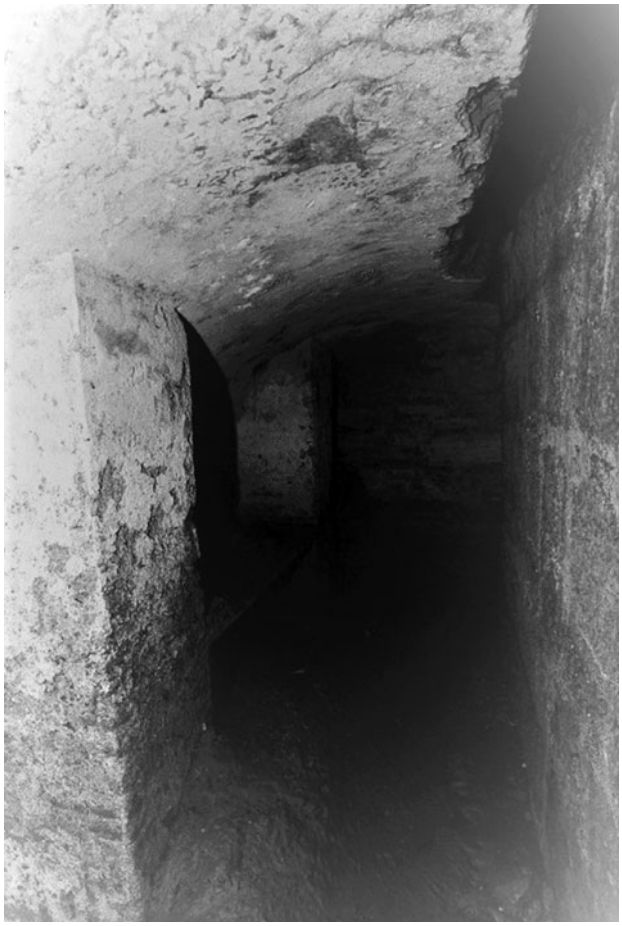

Fig. 12. The greenstone pier of the crypt breaking the north wall of the northern chamber (© Ç. Özkan Aygün).

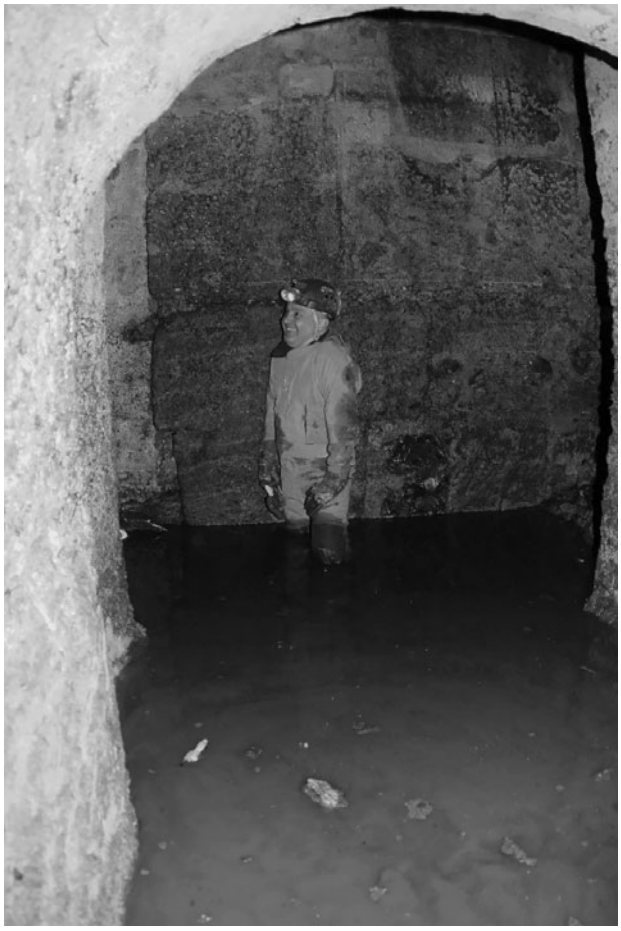

Fig. 13. The greenstone pier visible in the crypt's south chamber (© Ç. Özkan Aygün).

During our own surveys, marble slabs 0.05m thick were visible in all niches; however, it was not possible to identify the brick surfaces.

Combining all the data, an absidiole is formed in the thickness of the wall at a height of about 0.40m from the original floor. Above its keystone there is a 0.32m massif wall, above which is a brick surface 1.50m long. After the interposition of a 0.94m massive wall there is a marble slab that is still visible today. Therefore, the brick shelf stands at a height of 1.15m and the marble shelf at a height of 2.14m (figs 15, 16). Each marble slab is precisely adjusted to the width and length of the corresponding recess. The slabs were placed by carving a recess in the respective wall, in order for the slab to nest inside. Their dimensions vary; the length of the marble slabs varies from 1.36m to 1.72m, and the width from 0.79m to 1.40m. Bearing in mind that the structure is not regular and the mud layer varies in different places, it can be concluded that the original height of the edifice is 3.65m, and there was approximately 1.35m of mud and silt in the northern chamber when Özkan Aygün's team entered the building (fig. 16).

The vaults of the edifice are pierced by three openings, in the middle of each of the three vaults. There are two square holes (south and north: 0.40 x 0.40m) and a rectangular one (central: 0.62 x 0.51m), almost aligned with each other. These openings were air ducts that provided ventilation to the interior.

In a second phase, the underground building was converted into a cistern. Two water conduits were added and the interior was covered with hydraulic mortar in a similar way to the substructure of the *esonarthex* (inner narthex) of Hagia Sophia (Özkan Aygün 2010b: 61). The complete covering of cisterns' interior by hydraulic mortar was a common practice and ensured that the building was waterproof, as in the case of the cistern under the Catholicon of Christ Pantepoptes monastery (Eski İmaret Mosque). In the building under study, the inlet of the first conduit is located on the northwest corner of the main chamber; it extends from the vault spring almost to the far wall. It is a large horseshoe-shaped barrel-vault conduit (or stilted barrel-vault), about 1.50m high and 1.00m wide. It is formed in the natural subsoil, constructed in brick and sealed with hydraulic mortar to ensure waterproofing.

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Fig. 14. The niches and the marble slabs in the eastern end of the north chamber of the crypt (© Ç. Özkan Aygün).

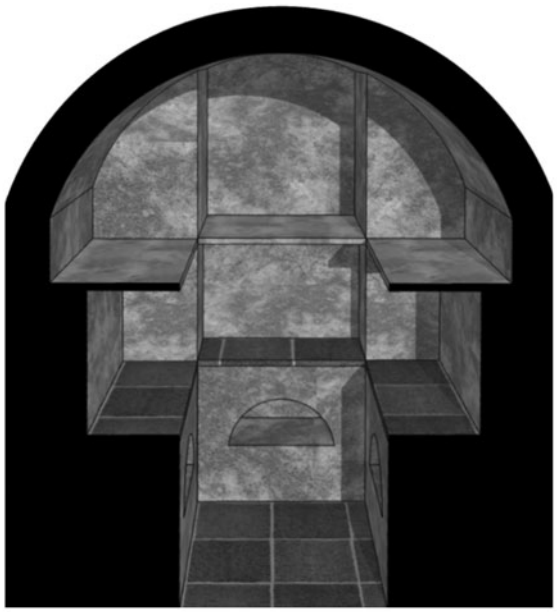

Fig. 15. Restitution of the niches and the shelves according to Dirimtekin's descriptions (drawing by Eleni Michailidou, 3D model-perspective view by Ece Uysal Engüdar).

This conduit bypassed the Justinianic northwest buttress and continued westward. Until recently this conduit carried sewage into the subterranean facility which was used as a cesspit. This pipeline was also connected with several conduits coming from the west and east of the northwest ramp and forming a water network. Thus, the conduit in the northwest corner of the building was connected to the conduit along the northwest side of the nave, which drained the water overflowing from the urn placed there by Sultan Murad III (1574–1595) for religious purification rituals. It was also connected to the rainwater drainage conduits, the pipeline under the *exonarthex* located at a higher altitude and the vaulted structure under the *exonarthex*. Stalactite formations are visible in the vault of the conduit, as well as 'calthemites', which are 'various secondary deposits of concrete (mortar or lime) consisting primarily of calcium carbonate ($CaCO_3$) that grow from manmade alkaline structures outside the cave environment' (Smith 2016: 4). Those straw stalactites/calthemites were formed through water leakage. The lime (CaO) of the mortar is dissolved by the leaking water, forming $Ca(OH)_2$; reacting with air, it forms calcium carbonate ($CaCO_3$) and creates stalactites. These configurations point to the existence of cracks on the conduit vault, from which water leaked and formed calcium carbonate (fig. 17).

The second conduit was at the east end, just outside the underground building. It is a rectangular conduit covered by a flattened vault, constructed in bricks and covered with hydraulic mortar. Its floor consists of a mixture of gravel, stone rubble, and broken ceramics, knitted with hydraulic mortar. This 25m-long channel came from the *skeuophylakion* and ran beneath the foundation of the northeast buttress that is dated to the Byzantine period (Dark, Kostenec 2019: 108), then entered the cistern right above the marble door and filled it with water. Until recently, fresh water ran through that conduit (Özkan Aygün 2010b: 73). The absence of stalactites/calthemites in this vaulted conduit leads to the conclusion that the construction of the vault did not allow water to enter (fig. 18).

Additionally, an earthenware pipe (0.18m in diameter) was added to the crack formed in the vault of the northern chamber by the greenstone wall and was used to convey the surface water into the building. Readily accessible material and spolia were used to support the pipe. Moreover, in the northern chamber, beneath one of the marble slabs at the eastern end, a vertical semicircular recess is formed in the thickness of the wall; its shape suggests the presence of a pipe. It continues vertically above the slab inside the wall (fig. 19).

Finally, another square opening (0.36 x 0.36m) connected with the surface was created just outside the entrance of the building, to assist in the ventilation and cleaning of the later cistern.

Regarding the draining of the cistern, there was most likely an outlet pipe relatively close to the bottom of the facility which was not accessible during the on-site investigations due to a deep deposit of soil. Similar pipes were found in several other cisterns, such as in the Unkapanı cistern, in Constantinople (Forchheimer, Stryzgowski 1893: 71), as well as in cisterns in other Byzantine cities including Thessaloniki (see Avgoloupēs, Katsifarakis 2016: 26; Loverdou-Tsigarida et al. 1995: 242, for the cistern near the church of Hagioi Apostoloi).

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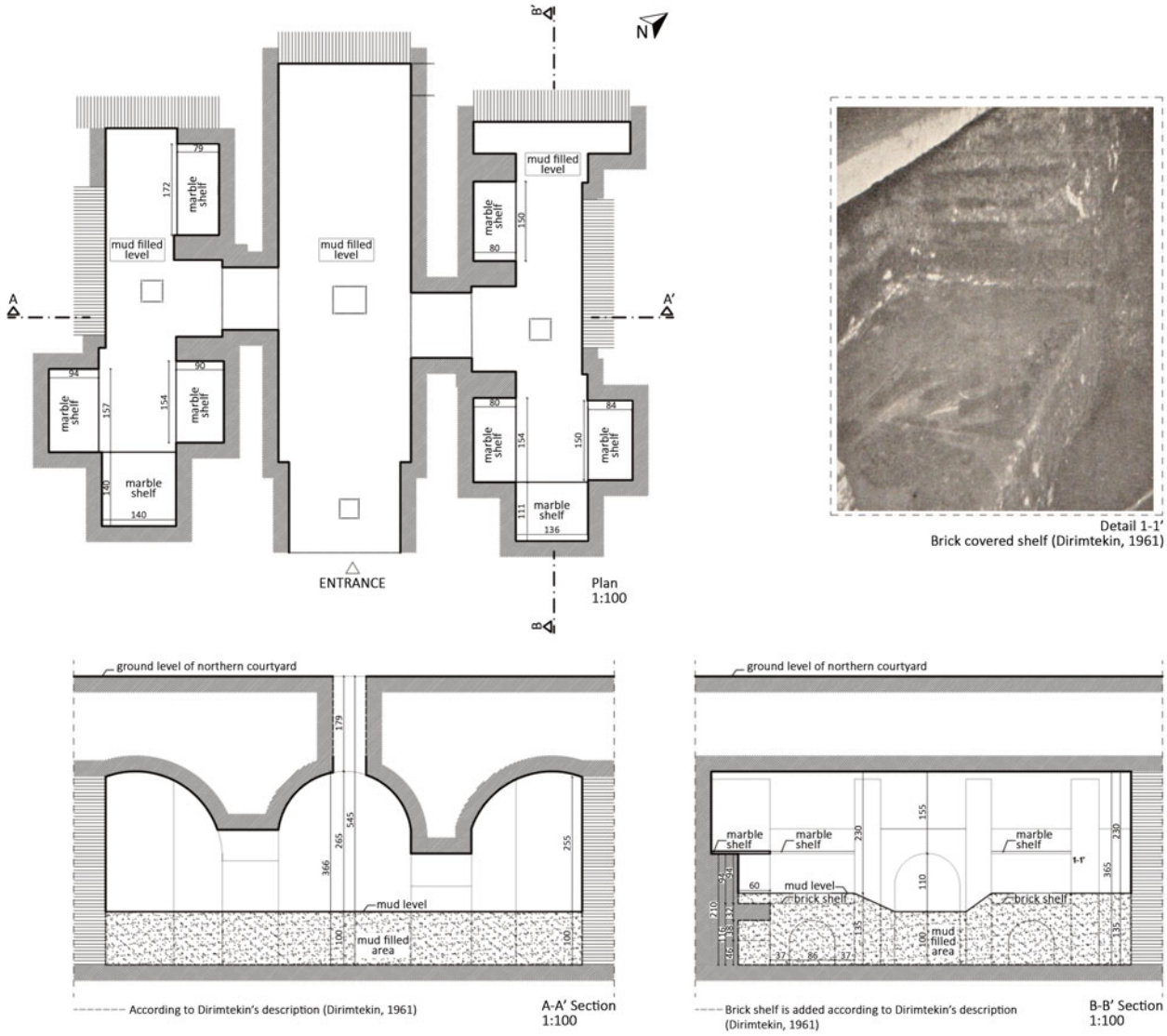

Fig. 16. Crypt plan. Upper right: northern chamber detail; lower right: northern chamber section (© Ç. Özkan Aygün, drawing by Ece Uysal Engüdar).

According to the data presented, the underground structure north of Hagia Sophia in Constantinople had at least two phases of use. The second-phase use is clear: the building was transformed into a cistern after various interventions and additions. However, the original use of the facility is debatable, as is whether it was an independent structure during both phases or part of a larger complex.

The overlying building

The findings on the ground above the subterranean building indicate the existence of more than one edifice dating to different periods. The two marble pavements excavated by Koyunlu above the underground structure belong to two different phases, but the excavator was unable to prove a connection between those pavements and any of the buildings they might belong to (Koyunlu 1990: 151–54). The earlier pavement is probably dated to the fourth century AD (Dark, Kostenec 2019: 62; Koyunlu 1990: 145) and could belong to an edifice dated before the church of Justinian and linked to the original phase of the subterranean structure (Taddei 2017: 244, fig. 157).

The second, upper, pavement is also dated before the sixth century AD, as the northwest buttress of the sixth-century church was founded above it (Koyunlu 1990: 142). Moreover, Koyunlu records that he found pieces of wood and fire markings on that pavement, apparently from the destruction during the Nika Riot in AD 532, which led him to ascribe the upper pavement to the second Hagia Sophia (Koyunlu 1990: 144). He also states that during his excavation he revealed on the foundation of the buttress an 'ENT' (fig. 20) mason mark (Koyunlu 1990: 142). This mason mark has parallels found in the

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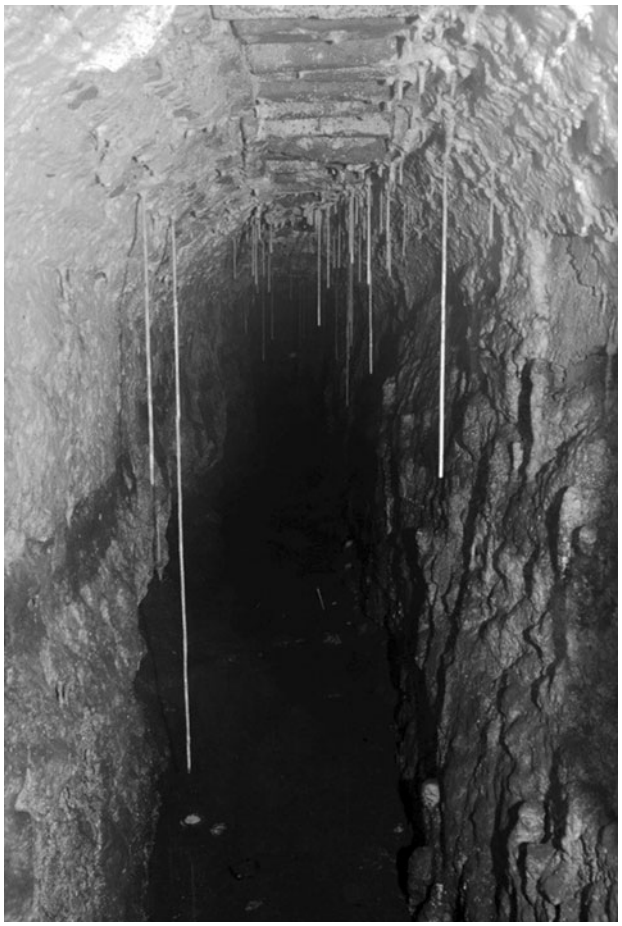

Fig. 17. Calthemites on the vault of the crypt's northwest conduit, heading west (© Ç. Özkan Aygün).

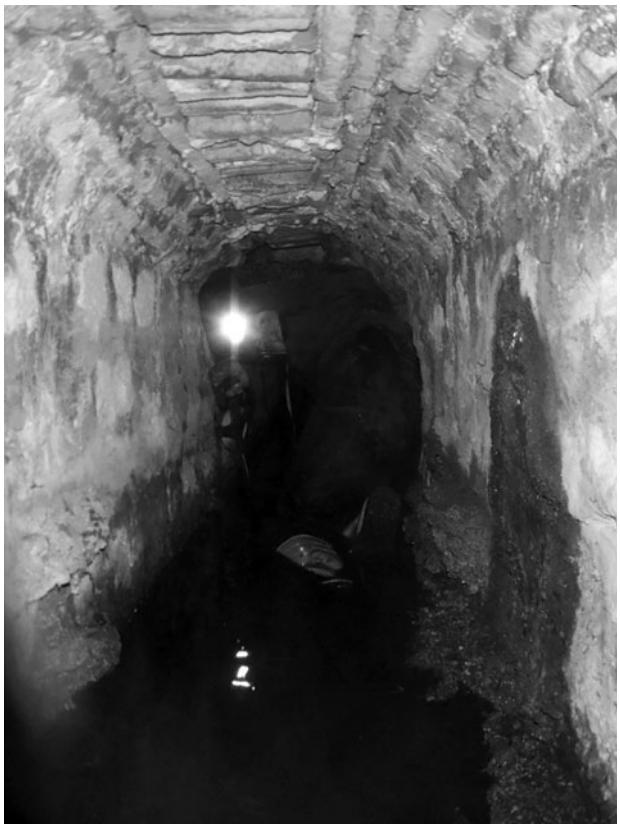

Fig. 18. East conduit of the crypt (© Ç. Özkan Aygün).

Fig. 19. Vertical semicircular recess under the marble slab in the north chamber of the crypt (© Ç. Özkan Aygün).

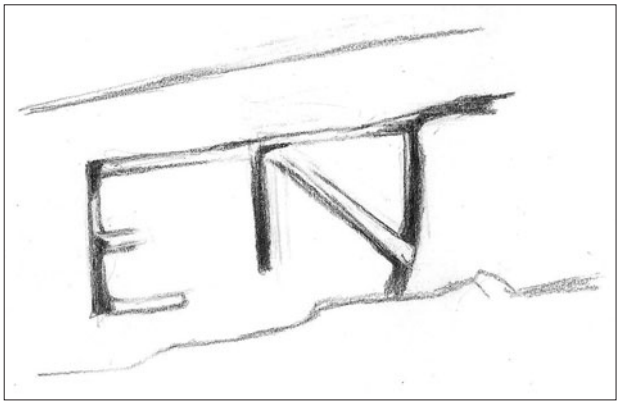

Fig. 20. Mason's mark ENT on the northwest buttress of Hagia Sophia, sixth century AD (© Ç. Özkan Aygün, drawing by Marcelo Xavier Azevedo).

sixth-century church, especially on the architectural elements of the windows (Guidobaldi, Barsanti 2004: 720; information provided by Prof. Andrea Paribeni). This is an indication of the original construction phase of the sixth-century buttress.

Beside the pavements, immediately east of the underground building, a north-south–oriented wall was observed (Dark, Kostenec 2019: 40, fig. 29). It is made of banded masonry with alternating courses of rubble stones and bricks 0.30–0.31m long and 0.045–0.05m thick, and is covered with marble revetment, traces of which are still in situ (Dark, Kostenec 2019: 12–13; Koyunlu 1990: 141). This wall could belong to a building of the late fourth century AD, as bricks of

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comparable size have been found in the fourth-century phase of the Hippodrome (Bardill 2004: 105, 118–19, 128). This is further evidence of the existence in the area of annexes belonging to the churches before the sixth-century Hagia Sophia.

The next phase in this area, according to Dark and Kostenec, is related to the existence of a rectilinear edifice with dimensions of 13.50 x 24.50m (they proposed that the piers found by Koyunlu were part of a single structure). According to their theory, the piers seen in the underground structure belong to that upper building, and based on this, they correlate that building with the subterranean edifice's second phase of use (Dark, Kostenec 2019: 42, fig. 31, 60–61). Although this overlying building does not exactly follow the orientation of the subterranean one, the assumption is that the design of the new upper building considered the existence of the underground structure (fig. 21; Dark, Kostenec 2019: 62; Taddei 2017: 244).

Dark and Kostenec, in their latest work, argue that this now-lost rectilinear building was part of the sixth-century AD Great Baptistery (Dark, Kostenec 2019: 61–62). Although Early Christian baptisteries are usually centrally planned, there are many rectilinear baptisteries in the Early and Middle Byzantine periods as well (Brandt 2011: 1592–93; 2016). Therefore, we could accept that the rectilinear edifice north of Hagia Sophia could be a baptistery (Dark, Kostenec 2019: 62). According to Dark and Kostenec, the repurposing of the underground building as a cistern strengthens that theory, assuming that the two buildings are functionally connected.

The written sources mention that Hagia Sophia had two baptisteries, the Great Baptistery and the Small Baptistery, that were used on different occasions (Constantine Porphyrogenitus, *De Cerimoniis* 2.22). One of them was situated on the northern side of the church – its exact location remains unknown – at least from the fourth century AD onward (*Chron. Pasch.* 478; Berger 2013: 563–79; Taddei 2017: 240–41; Whitby, Whitby 1989: 92–93). This was sometimes referred to in association with the *skeuophylakion*. Of the two baptisteries, only one survives, an octagon-in-square building situated southwest of the church. The extant baptistery has been identified by some scholars as the Great Baptistery, while others identify it as the Small Baptistery (Dark, Kostenec 2019: 90–92; Taddei 2017: 240 [with previous bibliography]).

In the sixth century AD, Paul the Silentiary, in his work *Ekphrasis*, described a door on the northern part of the church, which led to the 'clean waters of baptism which purify the human soul'; the baptistery was described as being on the north side of the Justinianic church (Paulus Silentiarius, vv. 564–66; Fobelli 2005: 68).

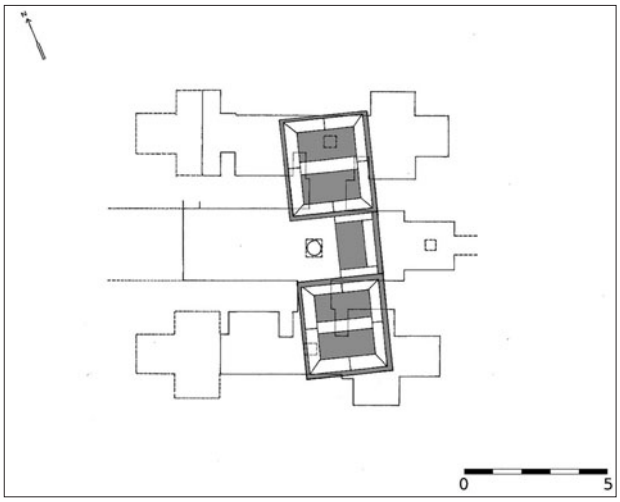

Fig. 21. The crypt's orientation in relation to the upper marble pavement (© Ç. Özkan Aygün, drawing by Marcelo Xavier Azevedo).

Palladius, whose work *De Vita S. Joannis Chrysostomi* was also from the sixth century, mentions that the Patriarch 'entered the baptistery and exited from the east side of the building. He could not exit from the west side because of the pillar of the church' (*PG* 47, 35–36).

In a Middle Byzantine source (12th century AD), Patriarch Euchologion describes how the Patriarch descended from the *synthronon* of Hagia Sophia and went to the Great Baptistery through the *skeuophylakion* (Euchologion 291; Taft 1998). The description can apply to the pre-Justinianic *skeuophylakion* and to another possible building right next to it.

Therefore, based on the sources, the Great Baptistery was on the north side of the church. According to the excavation report of Türkoglu, there is a large, filled-in opening probably on the west side of the existing *skeuophylakion* – 'The "outside door" at which stood the cross showing the height of the incarnate Christ' (Türkoglu 1983: 25–35). The aforementioned door would have been the door leading to the now lost Great Baptistery, where the Patriarch went 'through the *skeuophylakion*'; consequently, the Great Baptistery would have been west of the *skeuophylakion*. According to Dirimtekin (1961a: 396–97), the location of the second doorway of the *skeuophylakion* – the one through which the Patriarch entered the building – is less clear, but it was probably on the south side, almost 5m from the door of the church.

Consequently, there were at least two annexes north of the Great Church: the *skeuophylakion* and a baptistery (Dark, Kostenec 2019: 55–56 [with previous bibliography]; Taddei 2017: 240–45 [with previous bibliography]; Taft 1998: 7–8). The *skeuophylakion* is dated by Dirimtekin (1961a: 399–400) to the fifth century AD,

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perhaps before the Hagia Sophia of Theodosius. Bardill (2004: 56 n. 39) concludes that the lower part is dated to the late fourth or early fifth century AD and the upper part to the sixth century AD, while Peschlow (2008: 393) dates the original building to the second half of the fifth century. In any case, the edifice identified as the *skeuophylakion* was constructed before the Justinianic Hagia Sophia, but it was still in use, with alterations, in the sixth century AD and beyond (Dark, Kostenec 2019: 73–74; Mathews 1971: 16–17; Taft 1998: 12–13, 35). The assumption that the edifice above the subterranean one could be the Great Baptistery mentioned in the written sources is not without grounds; however, this cannot be confirmed by the archaeological remains (Dark, Kostenec 2019: 62; Taddei 2017: 244; Taft 1998: 7–10).

The function of the subterranean building

The underground edifice was interpreted as a *hypogeum*, a subterranean sepulchral building (Dark, Kostenec 2019: 12; Dirimtekin 1961b: 30, 112–14; Koyunlu 1990: 141; Ramazanoğlu 1946: 12, 15, pl. 2), based solely on its form. The general layout of the building resembles at a first glance the layout of burial edifices, but Dirimtekin also states that 'it does not resemble any other subterranean burial edifice found in Constantinople and its surrounding area' (Dirimtekin 1961b: 113). The proposed use of the monument as a burial site is problematic, and several questions arise. The fact that neither any burials nor any objects have been found that could justify this interpretation – as is the case in the region's burial buildings (Deckers, Serdaroğlu 1993; Dirimtekin 1960) – is to be expected, given the conversion of the monument into a cistern. What is not expected is the discovery of a funerary monument *intra muros*.

The area where Hagia Sophia and the subterranean edifice are situated belonged to the old Constantinian city and has been within the city walls since the city of Byzantion was founded (Müller-Wiener 1977: 17–28, fig. 3). According to Roman and early Byzantine laws, burial *intra urbem* was allowed only in urgent cases, such as during the plague epidemic in AD 746 (Dagron 1977: 16; Emmanouēlidēs 1989: 183–84), or for a few prominent people who could claim burial within city walls (Dagron 1977: 12–13). Could this case fall within that category?

During excavations in the 20th century, ancient burials were excavated in the centre of modern Istanbul. Southwest of Hagia Sophia, in the northwest part of the third hill of Constantinople, 96 grave steles and 14 sarcophagi were found. Thirty of the steles were dated to the fourth century BC and the later ones to the third century AD. The most interesting result was that these findings, spanning seven centuries, were almost all on the same topographical layer (Fıratlı 1956: 198). However, the *Forum Constantini* and the *Forum Tauri*, where these fourth-century BC burials were found, are situated outside the Roman wall (Bauer 1996: 147, Abb. 48–49; Dagron 1977: 15; Fıratlı 1960: figs 1, 17; Mamboury 1951: 433–34). Ancient burials were also excavated in the area northwest of the Hippodrome, between the Hippodrome and Divanyolu-Mese (on the excavation of Adalet Sarayı in the 1950s, see Duyuran 1953; Fıratlı 1956: 196), and on the opposite side of the Mese, which was outside the wall of ancient Byzantium, and between the former and the Roman wall (fig. 3). Consequently, the ancient Greek and Roman burials found were outside the assumed line of the pre-Constantinian walls. Moreover, so far there is no archaeological data nor written sources to support Fıratlı's theory that traces of early Christian burials in the ancient necropolis were destroyed or not found because of continuous and dense construction in the area throughout its history (Fıratlı 1956: 194). If this had been the case, ancient burials would have been destroyed too.

Early Christian (fourth-century AD) cemeteries were situated outside the Constantinian wall (Mango 2004: 47–48; Müller-Wiener 1977: 219–20), and burial chambers and mausolea of that era were found beyond it, as for example the *hypogeum* found in Macri-Keuy, the Byzantine Hebdomon (Macridy-Bey, Ebersolt 1922: 363–93). According to Schneider, the Balaban Agha Mescidi (Müfid 1933; Müller-Wiener 1977: 98–99; Bardill 2004: 71), which is situated within the Constantinian walls and is dated to the fifth or sixth century AD, was originally a burial chapel (Schneider 1936: 53–55). Although the burial chamber found under the building is dated to the 13th century AD, Schneider presumes that it was a mausoleum since the fifth century AD (Schneider 1936: 54). Bardill, who dates the building to the second half of the fifth century AD, interprets it as a mausoleum connected with the church of Theotokos of the Kourator (Bardill 2004: 71; for the church, see Janin 1969: 191–92), whereas according to Orlandos it was not a mausoleum but the library of a monastery (Orlandos 1958: 109–10). As there are many alterations to the edifice and there is no evidence of the early phase, we cannot be sure of its original use in the fifth or sixth century AD.

We should note that, as the city expanded rapidly, the suburban areas of the fourth century AD were included in the urban area. Thus, fourth-century burials were found during the fifth century inside the new wall of Theodosius II (Dagron 1977: 15–16; Mango 2004: 47–49). These old cemeteries, situated between the Constantinian and Theodosian walls, continued to be in use along with the new ones outside the new wall. Thus, according to Theophanes (I, 423), there were cemeteries inside and outside the walls. The quality of burials inside the wall, though, is poor or mediocre, perhaps because most of them belong to poor

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people, to whom burial was offered gratis by the church (*Corpus Juris Civilis III*, 1.2.18; N.59. 5; Mango 2004: 48). Other Byzantine burials found within the walls are dated mostly after the law of Leo VI the Wise that allowed burials in the city (Dagron 1977: 14), or even later, as, for example, the burials on the third hill, which belong to the 12th–15th century AD, when this area was uninhabited (Mamboury 1951: 445).

Funerary structures within the inhabited area did exist in cities of Roman Asia Minor because of the influence of the ancient Greek practice of erecting *heroa*, or honorific funerary structures, in the residential area (Cormack 1997: 139). However, the structure under study is not Roman, as will be demonstrated below; in addition, as it was built underground, it was not visible and consequently cannot be interpreted as an honorific funerary monument.

Apart from that, we should mention that there are many reasons to interpret the edifice as a Christian building. First of all, this area was the centre of the Christian religion since the beginning of the fourth century AD, when Hagia Eirene was erected. Furthermore, according to the historian Socrates Scholasticus, before the construction of Hagia Eirene there was already a small church on the site, which was enlarged when the city of Byzantion became capital of the Eastern Roman Empire (*Hist. eccl.* 2.16). We should also note that Hagia Eirene was the seat of the Patriarchate and hosted the Second Ecumenical Council of AD 381 (Banduri 1711: 52; Van Millingen 1912: 85). Therefore, Christians were already using the area before the construction of Hagia Eirene. Even after the foundation of Hagia Sophia, the two churches were within the same precinct and considered as one sanctuary. Under these circumstances it does not seem possible that any non-Christian buildings would have been constructed within the area.

Moreover, the east–west orientation of the building, with a small, negligible deviation (fig. 1), is clear, as are the monument's semiotics. The sacred number of the Christian faith, number three, is used symbolically through the three parallel chambers of the monument. The two main axes of the building form the shape of the cross, the vertical axis coinciding with the central chamber and the horizontal axis coinciding with the imaginary line formed by the communication openings of the three chambers. In addition, the two preserved chambers are laid out in the form of a cross with almost equal arms.

Assuming that the building was a burial site, the problem of the size of the niches and marble slabs arises. The length of the marble slabs cannot support the deposition of a human body in the required Christian burial position, since of the eight preserved slabs, six are too short to fit a human body in a supine position and at full extension – and in many cases with bound hands and feet (Chrysostomus, XXVII. 4, col. 349–50; Poulou-Papadimitriou et al. 2012: 379). These six slabs are between 1.40m and 1.59m long, and 0.80m and 1.00m wide. Even the longest marble slab, located in the northwest part of the building, is shorter than the places where the dead are positioned in burial monuments. Arcosolia–niches, for example, in Roman catacombs, are more than 2m x 1m in size (Baruffa 2000: 105; Reekmans 1988: 128–29). The same applies to sepulchral buildings with arcosolia–niches in other parts of the Roman Empire, as in the few examples in the Greek peninsula (Laskaris 2000: 206 no. 378a; Markē 2006: 100–2, figs 36–39).

Regarding the orientation of the purported burial beds, which was very important in the Early Byzantine period (Poulou-Papadimitriou et al. 2012: 379), the marble slabs of the long sides follow an east–west axis, while those of the narrow sides are oriented on a north–south axis. This orientation was not usual in the Early Byzantine era.

Moreover, having in mind burial monuments of the same period, the internal configuration of the structure precludes its use for burial. In Early Byzantine funerary complexes most of the available free space was used; in this case, by assuming that the deceased were placed in the niches, the largest part of the building remains unused.

But even if we disregard all of the above and consider the edifice as a burial one, we cannot explain why the tomb was destroyed in order to be converted into a cistern or how this was accepted by the people.

The fourth part of *Patria of Constantinople* (*Πάτρια της Κωνσταντινουπόλεως*) includes '*Διήγησις περί της οικοδομής του ναού της μεγάλης του θεού εκκλησίας της επονομαζόμενης αγίας Σοφίας*', likely composed in the middle of the ninth century AD (Berger 2013: 234–79). According to that text, Justinian, in order to secure the necessary space for the Great Church, began to expropriate the area around the church of Theodosius, buying lands from various owners. One of them was a widow called Anna, owner of the land north of the church. Anna, after negotiations, agreed to give up her property for the church construction, but rejected the price offered to her by the emperor, asking instead to be buried near her house and to be commemorated forever. So according to the source, Justinian promised to bury her there, and when Anna died she was buried under the *skeuophylakion*.

> When she saw the emperor, she fell down at his feet, beseeched the emperor, and said, 'I do not need to receive compensation for the houses. Build the church you want, I beg of you, so that I may "have my share in it", and have my reward on the day of the Judgement, and be buried near the houses.' The emperor promised that she would be buried there after

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the church was completed, as she had given away her own property, and that she would be remembered forever. The site of the houses comprises the whole area of the treasury (Berger 2013: 234–35).

Another source, the 12th-century Russian *Kniga Palomnik*, delivers the same story. In this version, Antonios, Archbishop of Novgorod, saw Anna's grave during his journey in Constantinople.

Ту же есть во олтари вода и приведена по трубам ис колодязей; и вне дверий олтаря малаго стоит крест мерный, колико был Христос возвышен плотию на земли. И за тем крестом лежит Аньна, иже давала двор свой святей Софеи, на немже и поставлен малый олтарь; и того ради положена бысть ту (Loparev 1899; Jouravel 2021: 116–41 [with previous bibliography]).

and there is water inside the altar, which comes from a well through pipelines, and outside of the altar's doors there is a cross … Behind this cross lies Anna, who gave her courtyard to Hagia Sophia and they have placed an altar there and that's why she has the right to be there.

The two texts present important evidence for continuous knowledge of a structure associated with both the *skeuophylakion* and water channels. However, according to scientific research, the absolute accuracy of the *Διήγησις* text is debatable since the text is much later and 'not strictly historical' (Avramea 1989; Efthymiades 2015: 16–22; Mergiali-Sahas 2006: 41); Anthony of Novgorod, who purportedly saw the tomb, is a much later source. The historical time of Anna is prior to the construction of Justinianic Hagia Sophia and the execution of Justianian's building programme. According to Dagron, the Basilica prior to Hagia Sophia occupied almost the same surface as Justinian's church, therefore no expropriation was required. In addition, the *skeuophylakion* that was supposedly built at the place of Anna's house belongs to one of the previous complexes (Dagron 1984: 278). The story therefore is not real, but is a 'patriographique theme' from popular literature that shows, among other things, the emperor's humility (Dagron 1984: 218).

Since the early Christian centuries, relics of saints and martyrs had begun to arrive in Constantinople (Klein 2006: 81–84; Mergiali-Sahas 2001: 41–45). According to George Cedrenos, relics were being brought to the Great Church as early as the middle of the fourth century AD; among the relics that arrived in AD 360 were those of the martyrs Pampilos, Theodoulos, Porphyry and Paul (Georgii Cedreni, 121: 569A). Another important relic stored temporarily at Hagia Sophia was the Virgin's robe, which, according to Theodore Syncellus, was translated to Blachernae Church in AD 623/624 (Wortley 1977: 113). These kinds of relics were imported to the church to be venerated, or to be kept until they were transported to their destination (Wortley 2007: 633). However, sometimes the relics were kept in the Great Church for a considerable amount of time. This is the case, for example, with the relic of the Prophet Samuel that remained there for five years, from AD 406–411 (*Chron. Pasch.* 569; Whitby, Whitby 1989: 60; for the first-known translation of relics to the Great Church upon their arrival in Constantinople, see Taddei 2017: 105). The most interesting thing about this story is that the church was destroyed by fire in AD 404, and therefore the relic could not have been inside it. Taddei suggested that the relic could have been transported to a safe place in the church complex (Taddei 2017: 108). Indeed, a Middle Byzantine source, the so-called *Anonymous Mercati* (1936; Ciggaar 1976: 246–63), reported that in Hagia Sophia, relics were kept in a subsidiary building or in a *skeuophylakion* (Wortley 2007: 638–39). The subterranean building could not have been the building mentioned by *Anonymous Mercati*, since it was already transformed into a cistern in the sixth century, but it could have been the fifth-century building where Samuel's relics were kept. Certainly, the exact use of the edifice is debatable but the theory of the tomb in the sense of body deposition should be reconsidered. It is difficult to accept the edifice's burial use due to lack of evidence, its place in the city and its constructional features. Moreover, had it been a burial place, when it was transformed to a cistern the tombs would have been destroyed and the remains transported elsewhere; this would have been against Roman custom and law, which showed great respect for the dead (Wortley 2005: 210). In addition, the tomb would have belonged to a prominent person or family, or to a martyr; therefore, it would have been mentioned in the sources and would not have been destroyed.

The deposition of Christian martyrs' relics in subterranean buildings was common in the Early Byzantine era (Skontzos 1988: 51). Crypts like the subterranean building of Hagia Sophia have been found in various places; however, most of them are beneath the church (Orlandos 1994: 460–66). Christians began to collect relics of saints in safe places for security reasons in the middle of the fourth century AD. As a result, whole bodies or parts of them were removed from their original place of deposition and carried in majestic processions to churches, where they were placed either immediately under the altar or in a crypt beneath or beside the church. The descent to the crypt was by means of a staircase, and the compartments were covered with cross vaults or barrel-vaults (Orlandos 1994: 455–57, 459).

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The subterranean building of Hagia Sophia shares many affinities with the Martyrion of Hagios Leonidēs in Athens. The latter is an underground brickwork building constructed to the north of the Early Byzantine Basilica of Ilissos. The building is cross-shaped, consisting of a square core with three arched niches. The entrance is located to the south through a staircase; directly opposite the entrance is the largest recess with a length of about 2.60m and a width of 2.13m. The other two niches are about 2.50m long and 1.40m wide. The total height of the crypt is 2.02m, and the storage shelves are 0.93m from the floor (Sotēriou 1919: 8–14). The crypt was built in the middle of the fourth century AD in order to house the relics of Hagios Leonidēs and his escort, which were translated there from Corinth during the reign of Constantine the Great. The crypt gradually became a place of pilgrimage (Skontzos 1988: 50).

The proposed interpretation of the subterranean edifice in Hagia Sophia as a crypt or repository for skeletal remains and relics is supported by the construction characteristics of the building, as presented in the description of the monument. Combining the data of the two researchers who entered the monument, apart from the absidiole, each niche had at least two shelves, the lowest being 1.15m and the highest being 2.14m above the original floor (fig. 15). According to Dirimtekin, the distance between the shelves is 0.94m, but the existence of a wooden shelf fixed to the wall between them cannot be ruled out; traces of this shelf would have been lost when the building was covered with hydraulic mortar. The shelves are of various sizes and widths. They could have been used to store relics, the worship of which from the fourth century AD onwards became increasingly intense (Orlandos 1994: 454); as for the Great Church, according to the sources mentioned above, holy relics were arriving there in droves.

Even though the Great Church had a *skeuophylakion*, part of which is extant, the storage of valuable sacred objects in the subterranean building cannot be ruled out. If we accept Taft's theory that the Great Entrance proceeded from the *skeuophylakion* until the late 12th century AD (Taft 1975: 115), then it would not be prudent to keep objects of great value in this rotunda; even if we accept Moran's contrary view about the starting point of processions (Moran 1986), keeping objects of value in such an accessible building would not have been wise.

According to Matthews (1971: 161), Hagia Sophia and Hagia Eirene could have had a common *skeuophylakion* since they were considered one sanctuary and common clergy served both churches. The rotunda excavated by Dirimtekin (1962: 162–65) at the northeast corner of Hagia Eirene is a later sixth-century AD construction; therefore, the underground building or crypt in the north courtyard of Hagia Sophia could also have served as a repository for valuable objects, as well as relics, for the church of Hagia Eirene.

We should also add that in the central chamber of the edifice there is absolutely no configuration with niches and shelves, without being able to exclude the existence of wooden shelves on the walls. However, it is a fact that the central chamber of the building is structurally unformed, and a possible explanation may be linked to the performance of sacraments.

Thus, the crypt of Hagia Sophia could have served before the sixth century as a repository of sacred relics, and sacred and valuable objects. In addition, if the ground structure above it had an ecclesiastical character, which is most probable, as it is constructed in the immediate vicinity of the church, then the building under study was likely constructed in direct relation to it. But, even if the ground-floor facility was destroyed when the underground edifice was built, its erection could belong to a wider construction programme in relation to the adjacent churches.

The second phase of the subterranean building is related to the use of water, and therefore water conduits were added to the edifice, as well as air ducts and a ventilation shaft. The rectangular opening found in the roof of the main chamber, which is larger than the others, could have served both to circulate air inside the cistern and to pull water. The almost square opening, just outside the entrance of the building to the east, allowed for ventilation and for cleaning the ducts.

The conversion of the crypt to a cistern raises questions about the need for another cistern near the Great Church. However, if we accept Dark and Kostenec's theory about the baptistery above the underground building, then the conversion of the structure – after the removal of all the sacred objects – makes sense and does not contradict the previous sacred use of the space. The water collected in the cistern could have been used for ritual purposes, and this is a common denominator that facilitates the transition from one use to another. Several other examples are known of early Christian baptisteries that are related to a source of water. For example, the baptistery of the Oktagon in Philippi is adjacent to a bath building that provides the baptismal font with water, as the conduit found during the excavation proves (Gounarēs 1990: 42). In another early Christian Basilica in Aigosthena, an ancient town in the Megaris region, an excavation showed that east of the baptistery there was a reservoir for the water required for baptism (Orlandos 1954: 136; Volanakēs 1976: 71–72).

The structural evidence suggests that the crypt was converted into a cistern after being reduced in size, and with the addition of two water conduits and a rainwater collection pipe. The two conduits were used to bring water from opposite sides: west and east. The eastern conduit would be the continuation of the one found in the niche of the *skeuophylakion*, as they follow the same direction (fig. 22; Özkan Aygün 2010b: 73). Koyunlu assumed this conduit crossed

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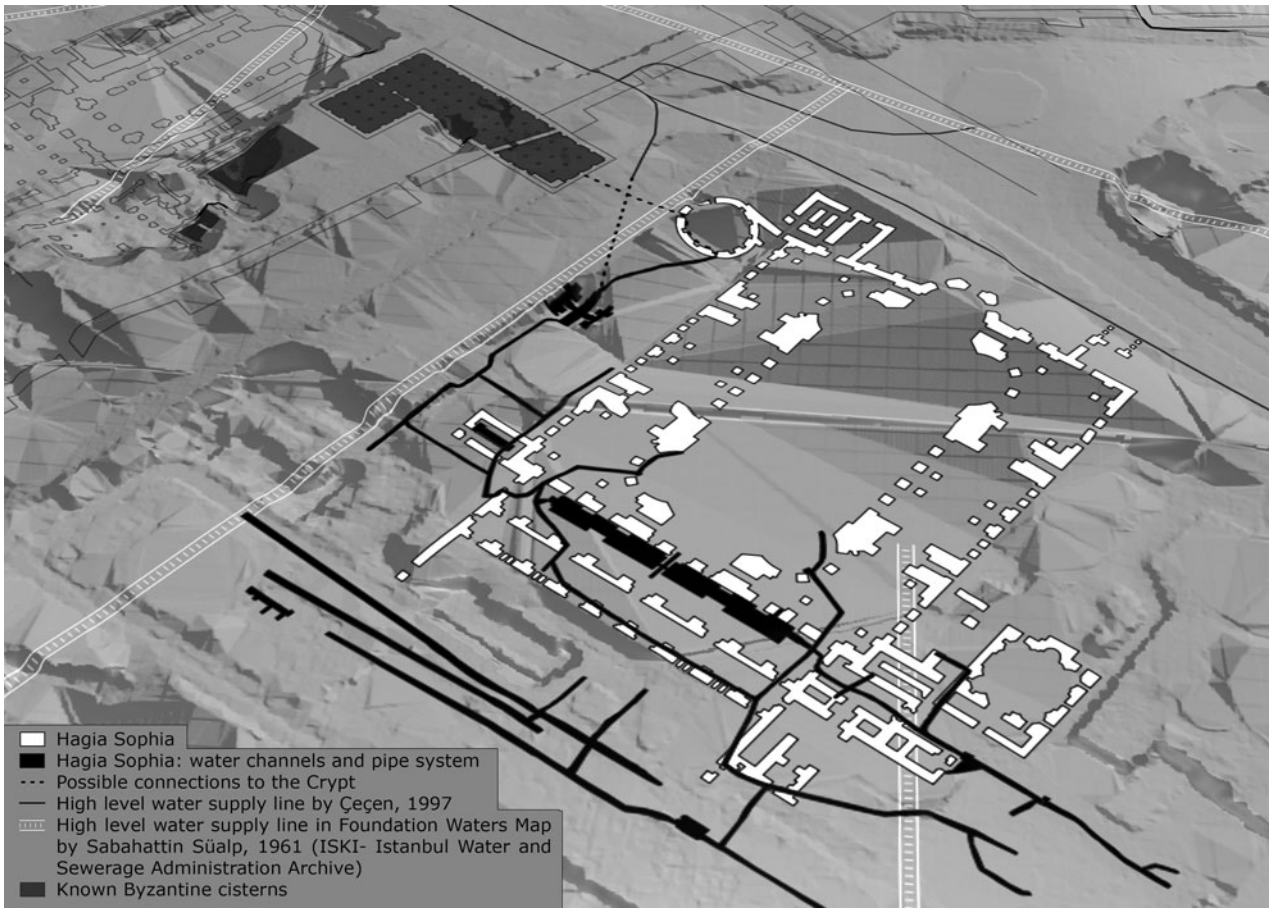

Fig. 22. Elevation map depicting the correlation between the crypt and the water supply and drainage system (© Ç. Özkan Aygün, GIS map by Stefano Bordoni).

the subterranean building along its northwest wall and went out at its end; however, there is no recorded evidence to verify this hypothesis (Koyunlu 1990: 141, 150–51). Moreover, the earthenware cylindrical pipe, which was vertically placed in the thickness of the vault, brought rainwater from the surface, as previously mentioned.

Judging from the marks left on the cistern walls, the water level in the cistern usually reached the barrel vault spring, about 3.14m high (fig. 10). Therefore, the usable water capacity of the newly established cistern was approximately 185m^3 and according to a recent classification, it is considered a small-scale cistern (Ward et al. 2017). Therefore, the Hagia Sophia cistern would have been aimed at serving specific facilities in the surrounding area. If the overlying building was the Great Baptistery, it would certainly have used the water from this cistern, as would other buildings in the complex.

The question that arises here is: how was it possible to access water from the cistern? Even though no wellhead was found on the grounds or during the excavations, the obvious way to draw water up was through the large openings in the vaults of the chambers (Crow et al. 2008: 137). Specifically, the dimensions of the central opening are large enough that a bucket could easily be used to pull the water, a method common in many Byzantine cisterns (Crow et al. 2008: 140–41). In this way the cistern could directly serve the needs of the overlying and adjacent buildings. The same opening could be used to enter the cistern to clean it. In all likelihood the ground-floor building had running water from a different source, although 'living water' (*The Doctrine of the Twelve Apostles* 3, 2) stopped being necessary in the sacrament of baptism in relatively early times (Brandt 2011).

Observing the topographical position of Hagia Sophia, it is obvious that it is located over the flanks of the first hill (Janin 1964: carte IV), and the north courtyard is significantly higher than the church's other courtyards (Eldem, Akozan 1982: L5: topographical maps for Topkapı Palace; Müller-Wiener 1977: topographical map of Historical Peninsula and Galata; elevation maps were created for the ongoing project 'Water in Istanbul'). Bearing in mind that water technology until the 18th century worked on the principle of gravity, it is easy to understand that a higher source is needed to supply the northern courtyard (fig. 22). This higher source could be the L-shaped cistern situated in the court south of Hagia Eirene (Özkan Aygün 2010b: 73; Taddei 2017: 243; see Crow et al. 2008: 124, 154 on

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the L-cistern). The cistern is situated 42m above sea level, whereas the subterranean edifice is 36m above sea level. During the surveys led by Özkan Aygün a channel coming from the direction of the L-cistern was found above ground; as it is situated northeast, it could be associated with the upper edifice. Thus, the L-shaped cistern could be a source of water for the underground cistern under study and the upper structure as well. Also, the eastern conduit, which could have been the continuation of the one found in the niche of the *skeuophylakion*, could be connected to the L-shaped cistern or could have been supplied with water from Halkalı and Thrace (figs 22–23).

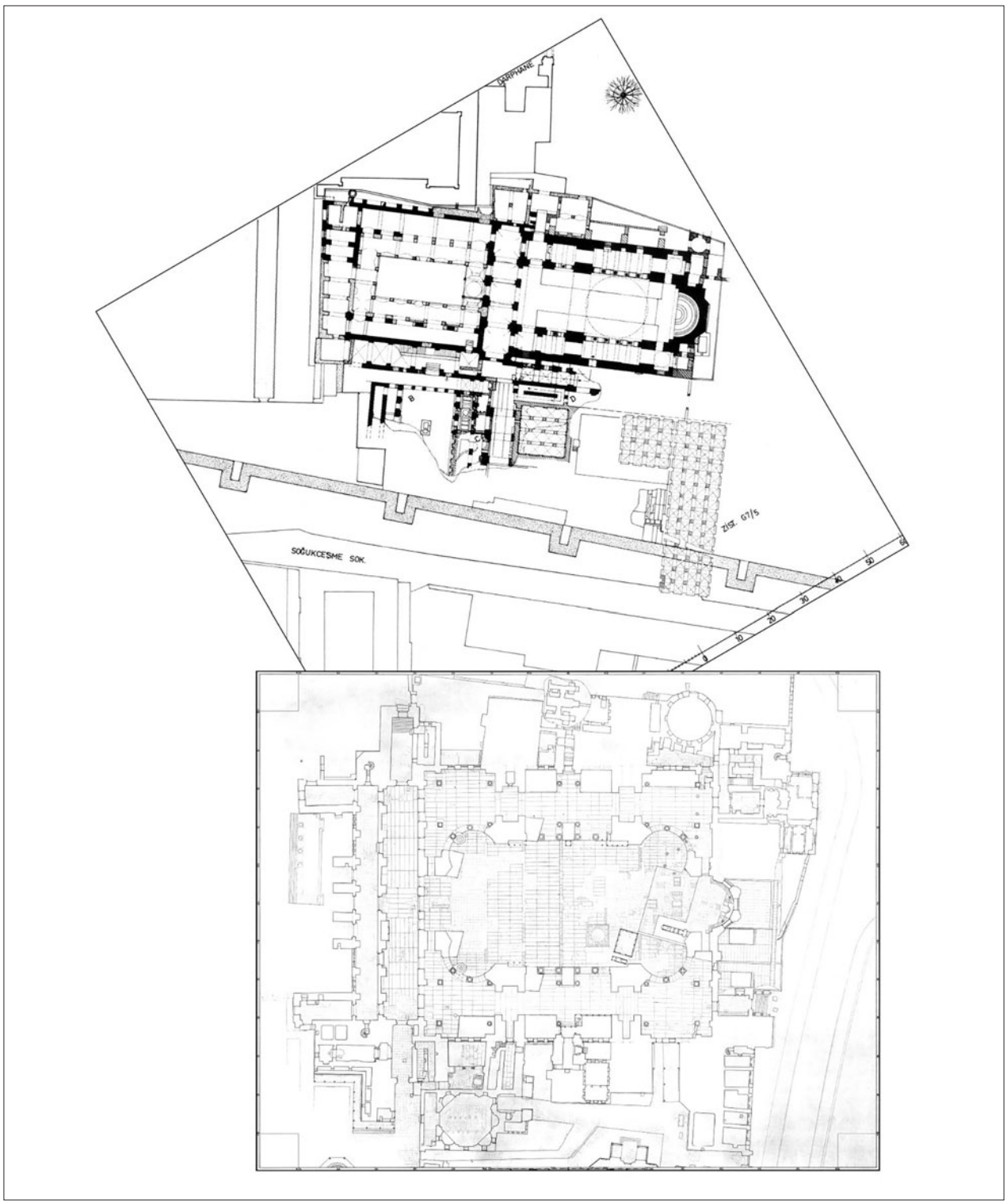

Fig. 23. L-shaped cistern in relation to the crypt and the skeuophylakion *of Hagia Sophia (© Ç. Özkan Aygün, drawing by Nikos Theokharis adapted from Hakkı Eldem and Robert L. Van Nice).*

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Dating the crypt

The crypt in the north courtyard of Hagia Sophia has two functional phases. In its original use the building served as a repository for relics and valuable ecclesiastic objects, then at some point, with the appropriate modifications and additions, it was converted into a water storage area, a cistern.

The dating of the building's original construction is difficult, given that any portable finds that could help with dating would have been lost due to its subsequent conversion and to the site's usage over several centuries (continuing into the later Ottoman years). Moreover, the successive alterations to the interior of the edifice, and in particular the covering of all surfaces with hydraulic mortar, conceal possible configurations or decorations that could limit the construction date range. Thus, the dating should be based on the information available from the building's construction data.

Starting from the construction level of the building, this seems to coincide with the lower level of the existing pre-Justinian *skeuophylakion*, which has been dated to the late fourth or early fifth century AD (Bardill 2004: 56 n. 39; Dark, Kostenec 2011: 56–57; 2019: 17; Dirimtekin 1961a: 395; Mainstone 1988: 137). The floor of the crypt is slightly lower than that of the pre-Justinian *skeuophylakion*, while the upper part of the crypt seems to slightly overhang the floor of the *skeuophylakion* (fig. 25). Given that the crypt was a subterranean structure from the time of its construction, the upper part of it could have protruded slightly above the natural ground level, and it either formed an artificial crest or was incorporated into a ground-floor building (figs 24–26), maybe the aforementioned overlying building.

The building's original masonry can be evaluated based on two factors: the pure brickwork of the construction and the thickness of the bricks (fig. 9). During the conversion, and to ensure the waterproofing necessary for a cistern, the entire inner surface of the subterranean depository was covered with hydraulic mortar. The original brickwork walls are visible in particular, indicative parts of the monument; this pure brick masonry was used in the Roman as well as in the Early Byzantine period. In the Early Byzantine period, the use of this type of masonry is quite common, as in the Crypt of the Martyrdom of Hagios Leonidēs in Athens, which is made of pure brickwork and dates to the mid-fourth century AD (Sotēriou 1919: 8–14).

The thickness of the bricks in the subterranean edifice suggests a dating after the Roman period. The bricks in the crypt measure 0.35 x 0.35 x 0.04m (Özkan Aygün 2010b: 74) and can be compared to the bricks in the lower part of the *skeuophylakion*, which have a side length of 0.345–0.37m and are 0.045m thick; these belong to its earlier phase, in the late fourth or early fifth century AD (Bardill 2004: 56 n. 39; Dark, Kostenec 2011: 56–57; 2019: 17; Dirimtekin 1961a: 395; Mainstone 1988: 137). They can also be compared to bricks from the Hippodrome, dated also to the late fourth or early fifth century AD (Bardill 2004: 118–19, 279 [nos 757, 342, 1181]). Consequently, we should date the original phase of the underground building to the late fourth or early fifth century AD.

Apart from the structural configuration, the only surviving element of the original building that can be used for dating, based on stylistic elements, is the moulding of the door jamb. The moulding of the marble door frame can be compared with those of the green Thessalian marble pilasters in the third courtyard of Topkapı Palace (fig. 27), dated to the fifth (Guiglia et al. 2009: figs 3–4) or fifth–sixth century AD (Peschlow 1991: 1463–66).

In the second phase of use, the substructure of the newly built buttresses for the Justinianic church blocked off the west side of the building, while a thick layer of hydraulic mortar completely covered the internal surface of the walls to make the edifice suitable for water use. In addition, piers constructed with greenstone blocks, which belonged to a no-longer-preserved overlying building, are visible in the lateral chambers (figs 12–13). This is strong evidence regarding the date of the modification, as the piers can be dated to the sixth century AD based on construction features (Dark, Kostenec 2019: 60–61, fig. 51).

The greenstone (*od taşı- seng-i ateş*, which in Ottoman Turkish means 'the stone of fire') comes from Karamürsel, the ancient Greek Praenetus or Prainetos (Πραίνετος), Prinetos or Prinetus (Hierocles, *Synekdemos* 691.2: Πρίνετος), Pronectus or Pronektos (Stephanos Byzantius: *Πρόνεκτος*), in the northwest of Nicaea, in Bithynia, and it was preferred in buildings, as it could be quarried in large blocks. As it is durable against fire, it was used in the substructures and in the main structural walls along with alternating courses of bricks. According to Ahunbay (2020: 1797), it was not used in Byzantine structures after the sixth century AD. This observation provides a *terminus ante quem* for the construction of the greenstone piers substructure, which was built over and disturbed the outer walls of the crypt.

Beside the crypt, the substructure under the *esonarthex* of Hagia Sophia – which dates prior to the sixth-century AD church, as it does not fit the length of the *esonarthex* – was also converted into a cistern (Özkan Aygün 2010a: 61). Judging from the level of the channels and the spolia belonging to the prior Hagia Sophia that were found during the survey in the channels, the underground cistern of the *esonarthex* was connected to the water channels as part of the sixth-century AD construction campaign. Therefore, it can be argued that the substructure beneath the *esonarthex* was converted to a water facility and added

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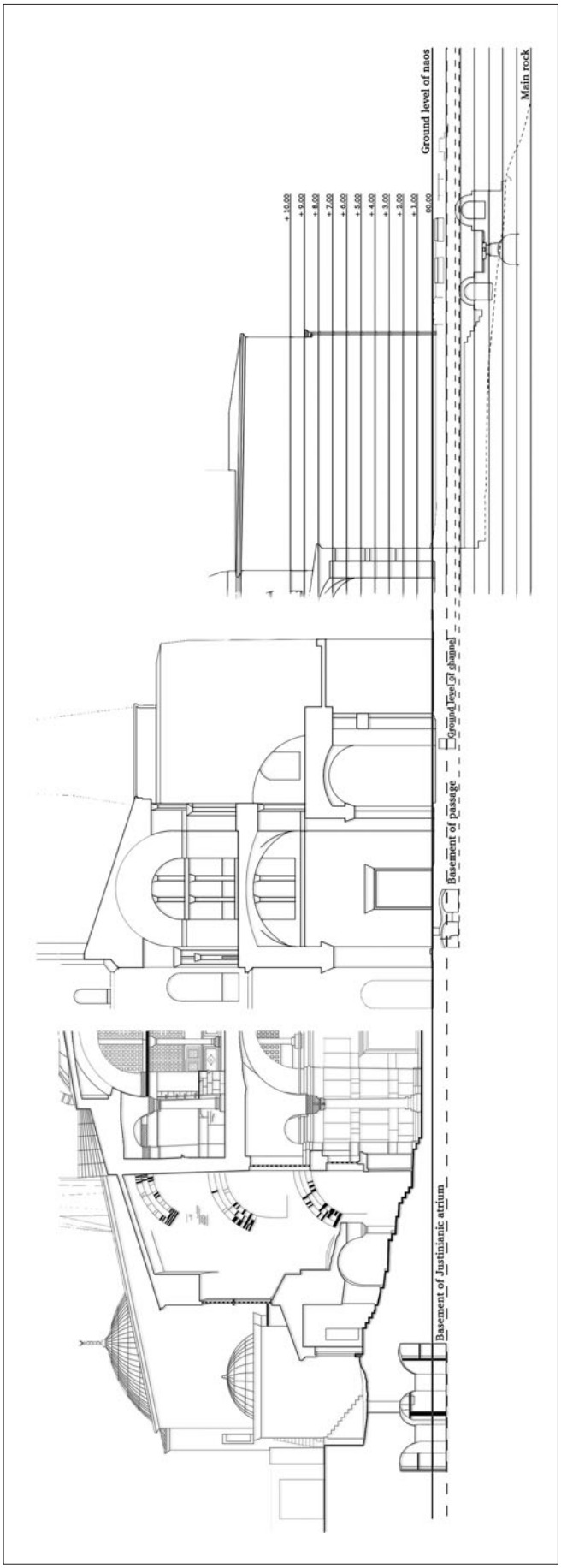

Fig. 24. Comparison of the crypt's construction levels and other subterranean structures (© Ç. Özkan Aygün, drawing by Hande Saraç).

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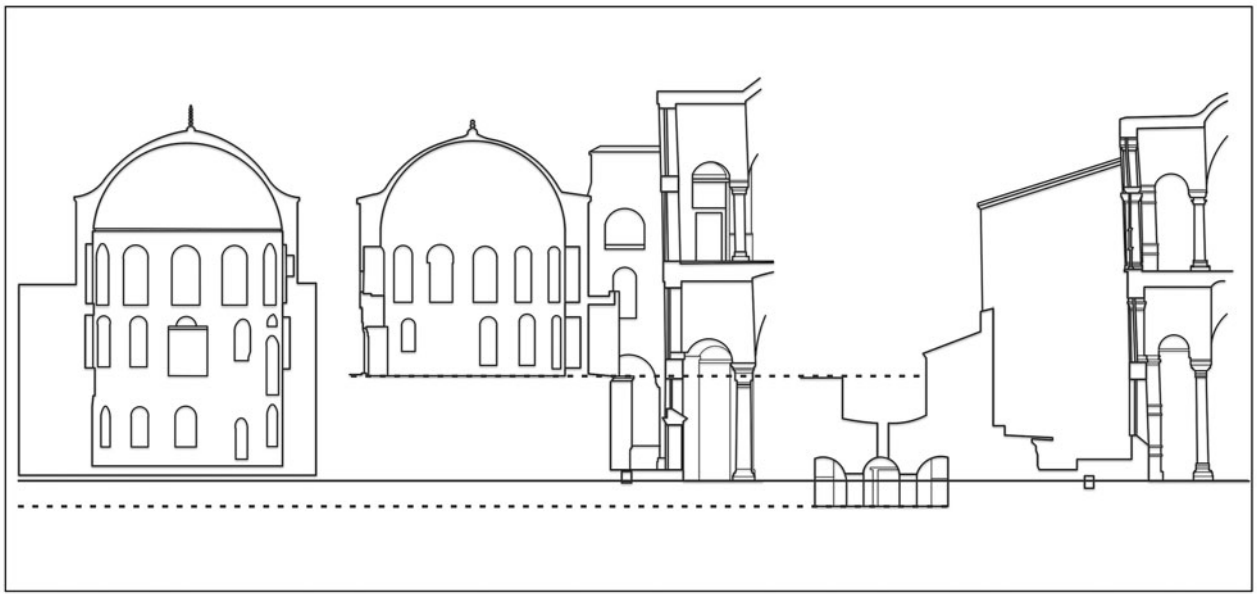

Fig. 25. Comparison of construction levels of the skeuophylakion *and the crypt (© Ç. Özkan Aygün, drawing by Hande Saraç).*

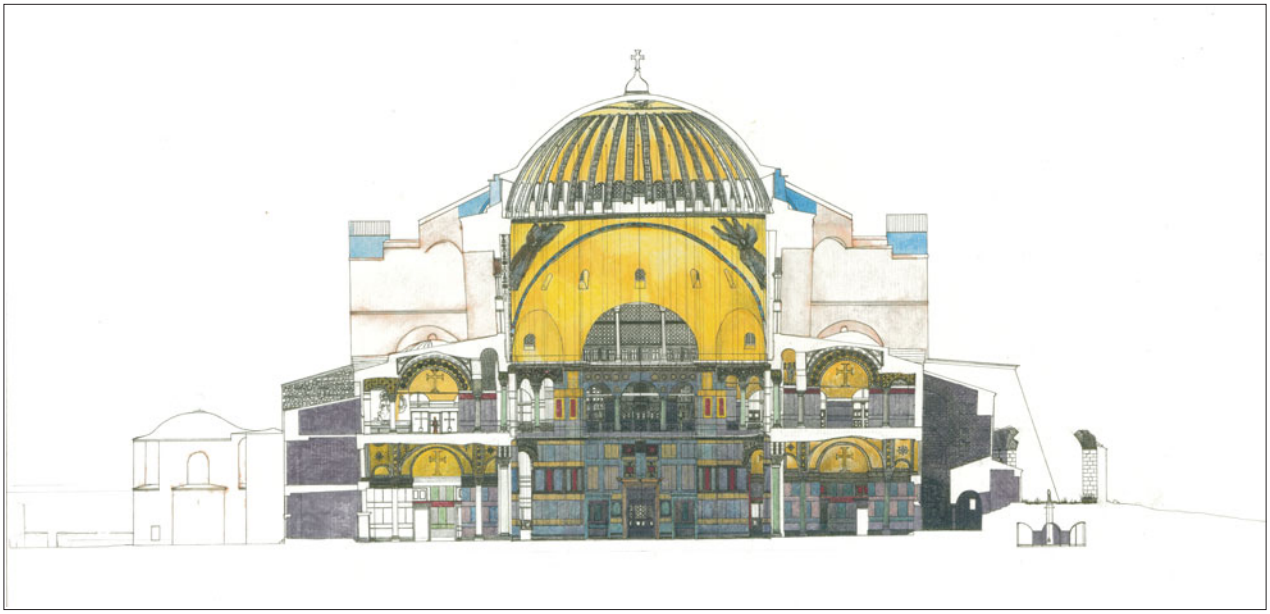

Fig. 26. North-south section of Hagia Sophia and the crypt viewed from the east (drawing by Marcelo Xavier Azevedo).

to the water supply system during the construction of the Justinianic Hagia Sophia, and the conversion of the crypt in the north courtyard could be attributed to the same sixth-century AD programme.

According to all of the above chronological data, the crypt in the north courtyard of Hagia Sophia was constructed in the late fourth or early fifth century AD, and in the sixth century it was converted into a cistern with the addition of water conduits.

Conclusion

Analysis of the available data on the subterranean building north of the Cathedral of Hagia Sophia in Constantinople leads us to the following conclusions. First, the building is situated in one of the most central parts of the city and is dated to a period when laws prohibited burials *intra urbem*. Its constructional features show that it was built in the late fourth or early fifth century AD, either as an autonomous building or as part

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Fig. 27. The fifth-century AD green Thessalian marble pilaster in the third courtyard of Topkapı Palace (photograph by A.G. Guidobaldi).

of a larger construction plan on this side of the church. Originally, it would likely have functioned as a repository for valuable ecclesiastical objects and reliquaries with martyrs' or saints' relics after their translation to Constantinople and for as long as they remained in the Great Church before being transferred to other establishments to be deposited there. The same space would probably have served as a repository for the adjacent Hagia Eirene, as the two churches are counted as one sanctuary. Therefore, we have argued for the interpretation of this building as a crypt in its first phase of use.

In the two lateral chambers of the crypt niches with shelves were created for the placement of reliquaries. Assuming that there was symmetry in the building, there would have been a total of 12 or 14 recesses with at least two shelves each. Depending on the size of the items stored, there would have been space for a wooden temporary shelf between the two permanent ones. The central chamber was left deliberately unformed, perhaps for the performance of ceremonies related to the relics hosted in the edifice.

The time of emptying and converting the crypt cannot be accurately determined. However, it is a fact that the building was included in Justinian's renovation programme to assist the new Hagia Sophia, and it was remodelled to function as a cistern. According to archaeological data, the new cistern could be related to the new overlying building, whatever its use. The baptistery theory is very tempting and would not entail any issue of Christian morality, as the place of deposition of holy relics would be transformed into a place of gathering water for the performance of one of the church's most important sacraments, baptism. In any case, in the Early Byzantine era the demand for drinkable or non-drinkable water increased as the population increased, as did the threat of barbarian attacks. Therefore, pioneering projects for water storage were developed (Crow, Ricci 1997: 235–61). In this context, the conversion of the crypt, and also of the building under the *esonarthex*, into a cistern could have been an effort to provide the necessary amount of water for the new church and its auxiliary buildings.

The presence of water in the area of Hagia Sophia was known to the people until late in the Byzantine era, as the written sources show. A Russian traveller in Constantinople, Stephen of Novgorod, wrote in AD 1349: 'St. Sophia has many fountains with sweet water in addition to those in the walls of the church and between the walls. You will not know it, but they are at the level of the church floor' (Majeska 1984: 232).

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