Egypt's Origins

An Icon Reborn

Restoring Istanbul's Hagia Sophia

Ruins on the Rapids

White-knuckle ride to save Peru's past

China's Great Wall

Three-month trek from desert to sea
From the top of the scaffolding in the immense dome, rising 185 feet above the marble floor, one sees the golden mosaics up close, and the beautiful nineteenth-century calligraphy spelling out a passage from the Koran, beginning: "The inherent light illuminates earth and sky." This Hagia Sophia, for over nine centuries the principal church of the Byzantine Empire, and for nearly five centuries the principal Ottoman mosque. Gazing down to the floor and then up, the eye catches walls veneered with colored marble, massive monolithic columns of green and purple stone, and then the mosaics: angels, the Archangel Gabriel, and the infant Jesus on the lap of the Virgin Mary in the apse. Above all is the golden dome, which a sixteenth-century poet described as "formed of gilded tesserae set together, from which pour golden rays in an abundance striking men's eyes with irresistible force."

Hagia Sophia's mosaics were also admired by Sultan Abdülmejid in the nineteenth century. He gazed for a long time at the mosaics of Jesus and Mary, then commented, "They are all very beautiful, but for the time it is not appropriate to leave them visible. Clean them and cover them over again carefully, so that they may survive until they are revealed to view in the future." Gaspare and Giuseppe Fossati, the sultan's Swiss architects, completed the necessary structural repairs to the building, and by 1849 Hagia Sophia's exquisite mosaics were covered by fresh plaster painted with Gaspare's hybrid Ottoman-Byzantine motifs.

The sultan's order was in keeping with the sensibilities of his times, but times change. In 1934, Mustafa Kemal Atatürk, founder of the modern Turkish republic, signed an order making a museum of Hagia Sophia, which had served as a mosque for nearly five centuries. It was Atatürk's belief that the mosaics should be revealed, and the work was entrusted to Thomas Whittemore and the Byzantine Institute of America which he directed. In a letter to his former teacher, Henri Matisse, Whittemore wrote, "My Dear Master, the fourth year of my work uncovering and cleaning the mosaics of Hagia Sophia in Istanbul is now over. Peerless examples of Byzantine art have been preserved in this great church for a thousand years."

Today, conservators on the scaffolding are busily examining the tesserae, the small cubes making up the mosaic, each one cut from a layer of glass on which leaves of gold or silver were placed, covered by a thin piece of clear glass, then fused together in a kiln. They are checking each of the millions of tesserae, cleaning and consolidating them. This, the most recent of many efforts to restore and preserve Hagia Soph
The dome of Hagia Sophia, the sixth-century church built by the Byzantine emperor Justinian, rises above the modern metropolis of Istanbul.
began in 1992. According to Seracettin Sahin, director of the Hagia Sophia Museum, the scaffolding will be moved to the dome’s southeast quarter next year, and by the end of 2004, work there will be completed.

Honoring not a Saint Sophia, but Christ as the Holy Wisdom (Hagia Sophia) of God, this is the third church to be built here. The first was completed by Constantius, son of Constantine the Great, in 360. Burned down in 404, it was replaced by a church opened by Theodosius II in 415. There’s no evidence to suggest the first two churches were anything more than conventional Roman basilicas: long rectangular naves with side aisles and pitched roofs built on wooden trusses.

The opportunity for something exceptional to be built at the site came in 532, when the Blues and the Greens, rival chariot-racing factions, united in a general rebellion against the emperor Justinian. Once enough loyal troops had been assembled, Justinian sent them against the mob. Trapped in the hippodrome, some 30,000 of the rebels were slaughtered, but Theodosius’ church had been destroyed by fire on the first day of the uprising.

Justinian had to reassess his authority, not just as emperor—the slaughter had done that—but as a ruler with the stamp of divine authority. On February 23, 532, scarcely a month after the end of the revolt, Justinian began work on the third church, Hagia Sophia. The heavenly inspiration and approval of the emperor and his work is clear in the words of the historian Procopius, who witnessed its construction firsthand:

The emperor, thinking not of cost of any kind, pressed on the

work, and collected together workmen
from every land. Anthemius of Tralles, the
most skilled in the builder’s art, not only at
his own but of all former times, carried for
ward the king’s zealous intentions, organ-
ized the labors of the workmen, and pre-
pared models of the future construction. Asso-
ciated with him was another architect
named Isidorus, a Milevisan by birth, a
man of intelligence, and worthy to car-
ry out the plans of the emperor Justinian. It
indeed a proof of the esteem with which
God regarded the emperor, that he fur

nished him with men who would be so useful in effecting his
designs, and we are compelled to admire the wisdom of the
emperor, in being able to choose the most suitable of mankind
to execute the noblest of his works....

Anthemius and Isidorus’ design for the new church was revolutional. It would be roofed with a great central dome supported by arches springing from four massy
pillars. Additional pillars would carry half or semidome on the east and west, forming a vast open area 245 feet by 230 feet. The building’s scale would be unprecedented and its interior decoration lavish and costly. In an incredibly short time, less than six years, the building was fin

ished. Procopius described it in term of astonishment:

[The Church] is distinguished by indescribable beauty, excelling both in its size and in the harmony of its measures, having no part excessive and none deficient; being more magnificent than ordinary building and much more elegant than those which are not of so just a proportion. The church is singularly full of light and sunshine; so would declare that the place is not lighted by the sun from

without, but that the rays are produced within itself....

spherical-shaped dome... makes it exceedingly beautiful, for
the lightness of the building, it does not appear to rest upon solid foundation, but to cover the place beneath as though
were suspended from heaven by the mabed golden chain. A
these parts surprisingly joined to one another in the air, sus

pended one from another, and resting only on that which
next to them, form the work into one admirably harmonious
whole, which spectators do not dwell upon for long in it
mass, as each individual part attracts the eye to itself.
Justinian’s pride in Hagia Sophia and his central role in its building were canonized in legend. One later account claims that on December 27, 537, the day Hagia Sophia was consecrated, Justinian exclaimed, “Glory to God who as thought me worthy to finish this work. Solomon I have undone you.” The divine inspiration of the church was suggested in another story. During construction, the emperor was said to have dreamed that he saw an old man in green robes holding a silver plaque with the plan of a temple engraved on it, and “the old man turned to Justinian and said, ‘The time has come and I have brought it. This is Hagia Sophia, whose plan has been waiting so long on the laque of Destiny. What is Hagia Sophia, old man?’ Justinian asked. ‘Hagia Sophia is the house of God whose name has been etched since the beginning of time.’”

Divinely orchestrated or not, for the next thousand years, Hagia Sophia would be the world’s largest church. As late as 1950, its dome had been surpassed by only three others. It is “one of the greatest architectural achievements of all time,” says historian Rowland Mainstone, “and no other has been so influential.”

Fourteen centuries after Hagia Sophia was built, Mainstone headed a UNESCO mission inspecting the condition of the church and its mosaics. In the 1993 report he authored, Mainstone noted that the Fossati’s nineteenth-century painted plaster decoration was badly discolored by moisture in most of the vaults and in places had fallen altogether. Water came in through the poorly maintained lead roofing and windows, water condensed from the air on the cooler walls in early summer, and there was rising damp from the foundation level. The mosaics were once much more extensive, said Mainstone, noting that depictions of the Baptism and Pentecost in side galleries recorded in early descriptions were now gone. “But the loss of so much of the figural mosaic cannot be blamed on Muslim religious zeal,” he concluded, “but must be attributed chiefly to loosening of the plaster setting beds as a result of water seepage, earthquakes, and long-term structural movements.” Too long neglected, Hagia Sophia was overdue for an overhaul. Mainstone’s report called for repair of the roof and windows, conservation of the mosaics, and cleaning of the marble facings on the walls.

Because of Hagia Sophia’s long and complex history, no conservation or restoration project is simple. There were difficulties during its construction from the start. Procopius records the main eastern arch nearly collapsing in one instance, and columns in the clerestories so overloaded with weight that they began shedding flakes of
stone. Then, on May 7, 558, the central part of the eastern main arch collapsed, taking with it part of the dome and semidome on that side. Hagia Sophia was simply built too quickly. The slow-drying lime mortar used in the massive pillars did not have time to fully set before the immense weight of the dome was placed on them. The dome's low curvature sent pressure not straight down the pillars but outward, deforming the pillars and tilting back four massive buttresses on the sides of the church. A series of earthquakes hit Hagia Sophia from 542 to 557, opening cracks that masons were repairing when the arch gave way. Justinian entrusted the repair of the church to Isidorus the Younger (nephew of the deceased elder), who erected a loftier dome with a higher curve that reduced the lateral stresses caused by the shallower original dome. The repairs took two-thirds of the time of original construction, but finally, on December 24, 563, Hagia Sophia was reconsecrated.

Despite the improvements made by Isidorus the Younger, earthquakes in the ninth and tenth centuries brought down the western arch and one-third of the dome in 989. The emperor Basil III's Armenian architect, Tredat, made major repairs, and Hagia Sophia was reopened in 996. Following major earthquakes in 1343 and 1346, Hagia Sophia was once again in danger. Reconstruction was completed nine years later, but then the Byzantine Empire was in terminal decline.

The last Christian liturgy was performed in the church on May 28, 1453. The city fell the next morning to the army of the Ottoman ruler Mehmet II, who ordered the immediate conversion of Hagia Sophia into a mosque. A mihrab (a niche indicating the direction toward Mecca) and mihrab (pulpit) were installed and a wooden minaret was added to the southwest corner of the structure (later rebuilt brick by Mehmet's successor). In the late sixteenth century, Sinan, the great Ottoman architect, made repairs to the fabric of the building and added three stone minarets. The last renovations before the Fossati's were in the first decades of the nineteenth century. And the mosaics? They remain recovered for some time following the conquest of Constantinople, deep the conversion of the church into a mosque. Only gradually, in 1603, during the reign of Ahmed III, and in the reign of Mahmud I (1730–1754), were they plastered over.

The Fossati brothers' restoration of the interior of Hagia Sophia in 1847 through 1849 was a marvel in terms of speed. Their method—covering the mosaics with plaster and concealing painted designs—would never be cloned today, their efforts did preserve the mosaics. Their extensive use of reinforcements and pins to consolidate areas of mosaic that had pulled away from the dome was successful, and hand-forged iron being resistant to rust was less successful. The work from 1894 about 1909, when Hagia Sophia was administered by the General Directorate of Pious Foundations, which oversaw mosques. More successful was the work uncovering and restoring the mosaics begun by the Byzantine Institute.
Many have left their mark on Hagia Sophia through the centuries. A Viking named Halfdan carved his name on a marble railing during the tenth century (below). Dandolo, the Venetian leader of the Fourth Crusade, was buried there in 1205 (above). And Ottoman sultans, including Selim II (1566–1574), built their tombs within its precincts (left).

in 1931, just eight years after the establishment of the Turkish republic.

In 1985, Hagia Sophia was added to UNESCO's World Heritage list as part of the Historic Areas of Istanbul (the part of the city within the Byzantine fortification walls built by the emperor Theodosius). The international effort to restore dome mosaics began in 1992. Funding has come primarily from the Turkish government, with outside contributions from UNESCO and the World Monuments Fund amounting to about $700,000. The northeast quarter of the dome was treated first, followed by the northwest quarter, which was completed in December 2002. Now the scaffolding is in the southwest quarter.

Reza Ozil of Turkey's Central Laboratory for Restoration and Conservation in Istanbul was a key figure through much of the conservation work on the dome. Ozil estimates that about 55 percent of the original mosaics (from the sixth century or the rebuildings of the tenth and fourteenth centuries) are still present. Some 15 percent of the surface covered by the mid-nineteenth-century Fossati restoration and another 29 percent from the restoration work of the Pious Foundation at the beginning of the twentieth century.

**Phantom Menace?**

Earthquakes would appear to be the gravest threat to Hagia Sophia, given its early history, but how serious a threat is a matter of some debate. The 560-mile-long North Anatolian Fault, which is similar to California's San Andreas Fault, periodically ruptures in a series of earthquakes. The latest was the deadly 1999 quake near Izmit, 55 miles southeast of Istanbul. According to Mehmet Çelebi of the U.S. Geological Survey, there is a 65 percent probability in the next thirty years for a large earthquake farther west on the fault, closer to Istanbul. But this is by no means a doomsday scenario for the city or Hagia Sophia. The parts of the fault that might rupture, says Çelebi, are at least seventeen miles from Istanbul. The shockwaves would attenuate considerably over that distance, he notes, adding that most of the city, including Hagia Sophia, is built on bedrock.

Princeton University engineer Ahmet Çakmak has assessed the threat to Hagia Sophia using computer modeling. He proposed addressing the danger of collapse by tying together some of the building's principle pillars and arches with steel reinforcements to strengthen it. But architectural historian Rowland Mainstone notes that despite strong earthquakes, no collapse affecting Hagia Sophia's main structure has occurred for more than six centuries. The modeling, he says, did not take into account important factors like buttresses added to Hagia Sophia after its construction. Istanbul University's Metin Ahunbay, who has more hands-on experience with Hagia Sophia than anyone else, is another skeptic. He believes its Byzantine and Ottoman mortar, bricks, and buttresses offer the flexibility and strength needed to resist an earthquake.

Çakmak's aggressive approach has been rejected. For now the consensus is that Hagia Sophia is stable and could withstand a major earthquake, says Robert Ousterhout, a University of Illinois Byzantine architecture specialist. Dramatic changes would affect the structural performance of the building in an earthquake, so any intervention has to be consistent or at least sympathetic with the original technology and materials.
In both of these cases the repaired areas are a plaster surface painted to resemble the Byzantine mosaics.

Problems in the dome range from individual pieces of mosaic being loose or missing to whole areas where the mortar bearing the mosaic has separated from its masonry support. The various rebuildings and earlier restorations have left a legacy of problems, such as numerous metal nails and clamps at the juncture of sixth- and fourteenth-century mosaics, and extensive painting over original mosaic. "The area by the windows near the base of the dome is worst," says Ozil. "The glass was broken sometimes, so wind and rain got in. Humidity and salts have affected arches, so the area to around ten feet above the windows is all very deteriorated."

Much of the restoration work is small scale, the patient cleaning of old varnish applied by the Fossatis or the reattachment of outer glass layers on the gold and silver compound tesserae. In places, mortar is injected behind the mosaic where it has separated from its brick support or is cracking or beginning to disintegrate. While priority is given to the Byzantine mosaics, the Fossati restoration is also treated, and is removed only if there is a compelling reason to do so. After 150 years, it has become part of the building's history, explains Ozil.

The Ottoman calligraphy in the center of the dome, executed in the mid-nineteenth century by Mustafa Izzet Efendi, was also in need of treatment. Powdery areas of the gilding had to be consolidated and badly flaking paint needed to be reassixed to the surface. And what is beneath the calligraphy? The original sixth-century cross mosaic was later replaced by one of Christ Pantokrator (the ruler of all), as often appears in Byzantine churches. But Ozil is doubtful that any mosaic remains here. "In the center of the dome, in the calligraphy area, in the northeast quarter there were a lot of problems, many iron nails in the mortar," she recalls. "They were rusted and had affected the mortar around them, so we took away maybe 200 nails, and we looked inside and we found sixth-century mortar, but no tesserae."

*Restoration of the Dome Mosaics is only one step in preserving Hagia Sophia. The northern and southern walls below the dome need to be conserved. Mosaics of saints on the bottom of the eastern arch that the Fossatis covered are now partially exposed, not through any restoration effort but simply because humidity and penetration by salts is causing the Fossati plaster to flake off. New plaster in the upper galleries is flaking off. "All these things should be cleaned and consolidated," says Ozil. "These recent plasters should be taken down, and if no mosaic exists beneath them, proper plastering should be done." And, she notes, all of the mosaics exposed and cleaned by the Byzantine Institute in the 1930s through the 1950s need to be reexamined, from the Virgin Mary in the apse to the mosaic at the entrance showing Justinian presenting a model of Hagia Sophia to the infant Jesus.

On the north side of Hagia Sophia, Metin Ahunbay of Istanbul Technical University's Faculty of Architecture is supervising work on the exterior, where cement plastering is being stripped away, revealing the brickwork and greenstone from the original structure and later additions. Half a dozen architecture students are kept busy recording the walls, while workmen make needed repairs and repoint the masonry with a lime-based mortar that matches the original. The work is time consuming, says Ahunbay. It took one year to record the area currently being treated, and it will be three years in all to finish the project. And beyond Hagia Sophia itself, there are Byzantine structures that were part of the church, such as its baptistry and adjacent tombs of Ottoman sultans that require attention.

And the work at Hagia Sophia must be placed in the larger context of restoration in Istanbul. Zeynep Ahunbay, an architecture professor at Istanbul University and long involved in efforts at Hagia Sophia, directs the work at Zeyrek Mosque with Robert Ousterhout of the University of Illinois. The converted twelfth-century Church of the Pantokrator, Zeyrek is much smaller than Hagia Sophia but shares many of
the same difficulties. Funding is problematic. Simply put, there are too many worthy projects and too little money. Zeyrek has been fortunate, receiving support from the city of Istanbul, UNESCO, the World Monuments Fund, the University of Illinois, and private donors. Even so, the funds have amounted to only a fraction of the $3 million that Ahunbay estimates it would take to complete the job. How funds are administered can create problems. If they are granted for projects before the necessary background studies are completed, it may mean determining what conservation treatments are required as you go along rather than studying the situation first. Regulations may mandate selection of a contractor who bids the lowest but may lack the necessary expertise or simply doesn’t care about the work. Ahunbay also points out that restoration in Istanbul is not limited to its Byzantine and early Ottoman structures. Near the Süleymaniye Mosque and in the area around Zeyrek, for example, are neighborhoods of traditional nineteenth-century wooden houses, most of which have been demolished or burned down elsewhere in the city. There’s much historic preservation work in Istanbul that ought to be done, as in any major city, but there are few full-time positions for restorers.

What are the prospects for Hagia Sophia as it approaches its first century as a museum open to all? The current work is encouraging, but it is far from comprehensive. Future restoration, no less essential than that of the dome, will have to face competing claims for funding, and priorities may shift with political and bureaucratic changes. In 1993, Mainstone and UNESCO supported a Turkish suggestion that a single entity responsible for Hagia Sophia be established, noting that the head of such an organization “should be able to command considerable authority.” But that has not happened. “There should be a special team only for the conservation of Hagia Sophia,” says Ozil. “It needs continuous maintenance from a team, a small nucleus of two or three people, dealing with the maintenance of the building, the mosaics, the marble slabs that I know are read to fall. The lead sheeting on the roof should be examined regularly, every week or fifteen days.” Such steps would help ensure that Hagia Sophia continues to receive the attention it deserves.

William Emerson, dean of MIT’s School of Architecture, and Robert Van Nice, who spent many years studying and documenting Hagia Sophia, wrote in the conclusion of their 1993 articles about it in *Archaeology* that “the unique architectural achievement of the sixteenth century may well, with careful and continuous maintenance, stand for another fourteen hundred years.” Half a century later, those words still apply, both as a caution that the preservation of this monument must be an ongoing effort and as an optimistic prediction that, if it is cared for, it will not fall.

**SENGÜL AYDINGÜN**, an art historian and archaeologist based in Istanbul, is a former curator of the Hagia Sophia Museum. **MARK ROSE** is executive editor of *Archaeology*. The authors wish to thank Serencetin Selim, director of the Hagia Sophia Museum, for his generous assistance.