



# NEWSLETTER

The Institute of  
**ARCHAEOLOGY**  
 Siegfried H. Horn Museum



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**INSTITUTE OF ARCHAEOLOGY  
 HORN ARCHAEOLOGICAL  
 MUSEUM  
 NEWSLETTER**

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## 3D Printing Artifacts

The Institute of Archaeology has started using a new technique for studying and preserving artifacts found during their archaeological excavations. Robert D. Bates, assistant director of archaeological publications, is collaborating with the Engineering and Innovation Departments at Andrews University to scan ancient artifacts and then reprint them in an epoxy resin or plastic filament. Archaeologists and museums use this method to create replicas of important artifacts, allowing further study without exposing them to conditions that might cause unintended damage or be mishandled in transit. Although this 3D scanning and printing is widely used by engineers to design small objects, reverse engineer parts, and prototype items for manufacturing, it has previously not been used by the Institute of Archaeology. Artifacts provide valuable information about the cultures they represent and are an important part of the cultural heritage of their country of origin. In some cases, a host country will give researchers a special permit to take artifacts discovered during an excavation back to their university research labs for detailed study and analysis. This permit usually lasts for one year before the object must be returned. However, not all countries allow artifacts to be taken out of their country, even for research purposes. These artifacts can only be studied on-site or in a local research facility, limiting what types of analysis can be done or the research that can be conducted.

During the 2022 excavation season, an Egyptian statue was found by seminary student Jongdae Kim in Field C at Khirbat Safra. Trisha Broy, Field Supervisor for Field C, believes this artifact may be one of the most important discoveries an Andrews University team has made in recent years. It opens “the possibility that individuals or families of Egyptian origin settled” at this site. The artifact was brought to Andrews University on a one-year loan from the Department of

(cont'd on p. 2)



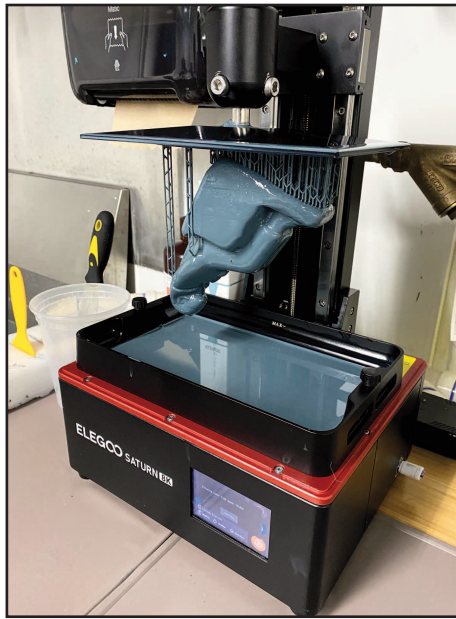
Martin Ramirez scanning Egyptian Statue.



Antiquities of Jordan, for research purposes. Although it was photographed, measured in detail, and carefully drawn, there wasn't enough time to conduct a full analysis of the statue while it was at the University. It was discovered later that some areas of the artifact may have been damaged in antiquity and that the artifact may be much older than the soil layers where it was found. Further study is needed to compare the object with similar statues from Egypt and assess the damage it may have experienced in antiquity. In order to further study the object, the Institute of Archaeology joined with the School of Engineering and the Office of Innovation and Entrepreneurship to create a 3D scan and resin print of the object before it was taken back to Jordan.

Handheld three-dimensional scanners like the ones used in the School of Engineering at Andrews University have been an important tool for reproducing mechanical parts that can be 3D printed for testing. This type of scanner projects a patterned series of lasers across the surface of an object and records its shape on a computer as a dense point cloud. Two cameras on the device at different angles record the position of the lasers reflecting off the object, measuring it in fine detail and capturing its exact shape and size. The point cloud and photographs are combined to create a 3D model of the object. Martin Ramirez, Jr., a senior engineering student, carefully passed the handheld scanner over the Egyptian artifact to record its shape and size. The lasers in the scanner did not harm the object, making this technique a safe, efficient, and non-destructive way of preserving ancient artifacts for later study.

Once the Egyptian statue had been scanned and the data processed, it was printed in the Maker Lab at the Office of Innovation & Entrepreneurship. Matias Soto, director of Innovation and Entrepreneurship, encourages collaborative projects like this one because it brings together partners from multiple disciplines, "...generating new ways of working together." He believes that "this allows students to participate in experien-



3D Printed Egyptian Statue.

tial learning as well as interacting with professionals from the partnering organizations." Ramirez printed two full-scale prototypes of the statue, one in bright yellow plastic and the other in a gray-colored resin. The plastic statue was printed using a Creality Ender-3 FDM 3D printer. This printer uses a software program called a "slicer" to divide the scanned image into a stack of flat layers and digital instructions on how to print the object. The printer used these instructions to extrude thin layers of heated plastic through a filament nozzle in the shape of the statue. Once the object was completed, it was sent to an artist to create a finished drawing of the statue for publication. The second statue was printed with an Elegoo Saturn 8K resin printer. Unlike the FDM printer that extrudes heated plastic through a nozzle in fine layers, resin printers expose layers of photosensitive liquid resin to a UV-laser beam, which solidifies in the shape of a desired pattern. As each layer of the statue was exposed to the UV shape on the LED light below, it hardened the resin, slowly adding layers to create the statue's shape. This makes the resin print heavier than the plastic print and more like the original, with finer details and fewer blemishes. After the statue was removed from the resin, it was

cleaned with alcohol and cured with a UV light to harden its shape completely. Unfortunately, prototyping artifacts can be cost-prohibitive, making it too expensive to produce multiple copies in the resin format so only one object was made. The final printed statue was sent to the archaeologists at the Institute of Archaeology, who, with their colleagues, are preparing a detailed report of the statue and its context for a future publication.

Three-dimensional scanning and printing have become useful techniques for prototyping objects for manufacturing and design, and the collaborative experiments described above indicate the utility of their use to study and preserve artifacts from museums and archaeological excavations. The Institute of Archaeology plans to continue collaborating with the Engineering Department and the Office of Innovation & Entrepreneurship to test the limits of this technology under field conditions such as archaeological excavation and museum conservation. (Robert D. Bates)

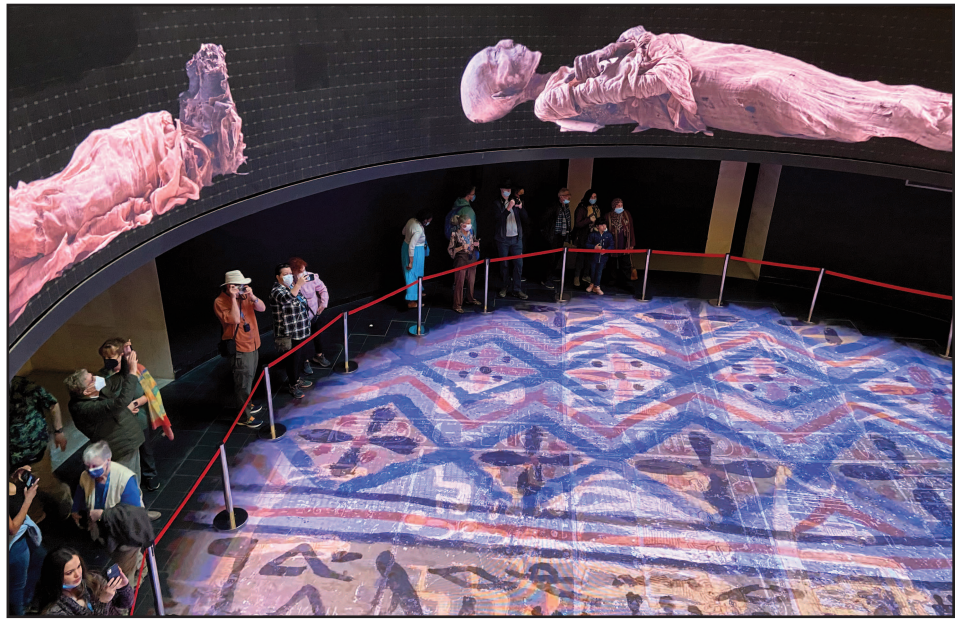


## Egypt Tour

Following the Khirbet Safra excavation season, many of the Safra participants toured Egypt for five days. Leaving Madaba early on the morning of June 30, we arrived at a resort complex in Aqaba, on the Red Sea coast, and after going through customs, we enjoyed a short voyage across the Gulf of Aqaba to Taba, Egypt, aboard a large yacht commissioned for this purpose. From our vantage point, we could see the southern end of the Arabah in the distance, straddled by Elat, Israel and Aqaba, Jordan, as well as the Saudi Arabian coastline, visible to the southeast. After docking at Taba and meeting Max, our Coptic Egyptian guide, we traveled several hours by bus to southern Sinai, where we lodged at Saint Catherine's guest house, adjacent to the monastery, located at the foot of Jebel Musa, the traditional site of Mount Sinai.

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We rose the following morning and began a four-hour trek up the mountain. Some of our group utilized camel for part of the trip, while others walked the entire way. Arriving at the summit, we examined the Byzantine chapel and enjoyed a glorious sunrise with sweeping views of southern Sinai's rugged mountain range. After descending the mountain, Max gave us a tour of Saint Catherine's monastery, explaining its rich history, dating back to its founding in the fourth century. A six-hour bus trip through southern Sinai and following the western Sinai coastline included views of biblical locations such as Refidim (Exodus 17). Our bus traveled through the recently completed tunnel under the Suez Canal. While driving through Cairo, Max described the recent transformation of Egypt, including the construction of a "new Cairo" and capital, largely financed by China. The following day, after a short bus trip from our hotel, we arrived at the Giza plateau and the famous pyramids. Many in our group made the climb to the burial chamber in the great pyramid of Khufu, while others explored the outside of adjacent pyramids. Our next stop was the recently opened National Museum of Egyptian Civilization <https://nmec.gov.eg/>, which



National Museum of Egyptian Civilization.

brilliantly encapsulates all Egyptian history in one large hall of displays. However, the museum's main attraction must be sought on the lower level, where a seemingly labyrinth of darkened passages simulating subterranean tombs leads the visitor to a stunning array of royal mummies. Each mummy is encased in plexiglass, which allows close examination of their faces. Nearly all the Egyptian pharaohs

of note are on display, except Tutankhamen. Safra team member Scottie Baker rightly noted that he confidently gazed into the face of the pharaoh of the exodus, whether that pharaoh be Thutmoses III, Amenhotep II, Rameses II, or another. All the leading candidates are present. On the return trip to our hotel, we drove through old Cairo and saw the Ben Ezra Synagogue, where a huge cache of early Hebrew manuscripts and scrolls were unearthed in its genizah. The next morning our group flew to Luxor, where we spent the day touring the great Karnak temple complex, while dealing with extremely hot temperatures. The following day we crossed the Nile and visited the Valley of the Kings, the Colossi of Memnon and the famous Mortuary Temple of Hatshepsut. Recrossing the Nile was done in two tourist shuttle boats, after which we flew back to Cairo and consequently boarded flights back to the USA and other final destinations. The trip was extremely enjoyable, despite the very hot July weather, and left each of us was left with powerful impressions of the glory that was ancient Egypt. (Jeffrey Hudon)



Colossi of Memnon.



# RANDOM SURVEY

## *New Ruins Found:*

Archaeologists at Habua II (ancient Tjaru), Egypt, have found the ruins of a fort meant to protect Egypt's eastern frontier during the Second Intermediate period. Later known as the New Kingdom site of Sile on the Way of Horus, these excavations have revealed earlier ruins of buildings, with silos dating to the Hyksos period. In these structures, human skeletons with deep wounds were found. These finds appear to relate to the Rind papyrus, that mentions that Ahmose I seized Tjaru, before laying siege to the Hyksos capital of Avaris.

## *Crucifixion Burial Found:*

Archaeologists excavating graves in a second century AD Roman-period Britian cemetery, at a site near Fenstanton, have discovered the remains of a man in his late 20s who had been executed by crucifixion. The relatively small nail was driven into the heel bone of the skeleton, barely protruding out the other side. DNA analysis indicates the man was local to the region.

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## *Persian Temple Restored:*

Restoration has begun on the temple of Anahita, the water goddess, in the city of Kangavar, in Iran. Her cult was prominent during the reign of Artaxerxes II (r. 404-359 BC), when her monuments were set up throughout the Persian empire. This temple is constructed on a natural hill that rises to a height of 32 m. Its Arsacid architecture style, is like other palaces and temples erected during the Achaemenian era (550 BC to 330 BC), with large chunks of stone fashioned into blocks, and stacked on top of one another, and interlocked to form walls and platforms.

## *Early Fortified Settlement Found:*

The Neolithic and Chalcolithic period site of Kuruçay Höyük, is located ca. 15 km south of Burdur, Turkey. Excavations have yielded 13 settlement layers. Level 11 represents the earliest fortified site in Anatolia. Here, a 1.10-1.20 m thick E-W wall extends for 26 m, with semi-circular towers on the outside, on its southern face, and a gateway on its eastern end, forming a right angle to the north. Of interest is a 1.0 m gap in the towers and fortification wall on the same axis, both closed with a single line of stones.

## *Kushan Script Deciphered:*

Scholars have decoded about 60 % of the known characters of the ancient script of Kushan, carved into a rock face in the Almosi Gorge, Tajikistan. The language originated in a territory that includes modern Afghanistan, Tajikistan and Uzbekistan.

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