

# CULTURAL HERITAGE PRESERVATION WORK IN AFGHANISTAN

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In 2020–21 we completed the ninth year of our cultural heritage preservation work in Afghanistan. Our three ongoing projects are funded by the U.S. State Department. Since 2012, we have worked in partnership with the National Museum of Afghanistan (NMA), directed by Fahim Rahimi, and the Afghan Institute of Archaeology (AIA), directed by Noor Agha Noori. Our State Department partners are Dr. Laura Tedesco, cultural heritage program manager in the Department of Central and South Asian Affairs, and grants manager Jacqueline Viselli. At the U.S. Embassy–Kabul, cultural affairs specialist Muzhgan Azizy provides valuable administrative assistance. The OI team includes principal investigator Gil Stein, grants administrator Matthew Perley, and Afghan Heritage Mapping Partnership (AHMP) project manager Andrew Wright, as well as Kabul field director Alejandro Gallego Lopez, head conservator Fabio Columbo, and assistant conservator Elisa Pannunzio.

Our current partnership projects with the NMA and the AIA have five key goals: (1) preserve and restore the hundreds of early Buddhist sculptures at the NMA that were smashed by the Taliban in 2001 (fig. 1); (2) train NMA conservators and curators; (3) conduct museum outreach programming to high school students across Afghanistan (the Mobile Museum Project [MMP] grant); (4) work with the AIA in the AHMP to

Figure 1. Fragments of the hundreds of rare early Buddhist Gandharan style sculptures in the National Museum of Afghanistan (from the monastic center Hadda near the Khyber Pass) that were smashed by the Taliban in 2001 are being conserved and reassembled by the Hadda Sculptural Project: a partially restored standing Buddha sculpture (left) compared with a photo from the 1960's showing its condition when originally accessioned (right).





develop a GIS database of archaeological heritage sites in Afghanistan using satellite imagery; and (5) train the AIA staff to use geospatial databases for research and heritage preservation. Due to the ongoing COVID-19 disruptions of international travel and health/safety concerns, our international team continued to work remotely on all our projects in tandem with the on-site work conducted by our Afghan project staff and local partners in Kabul.

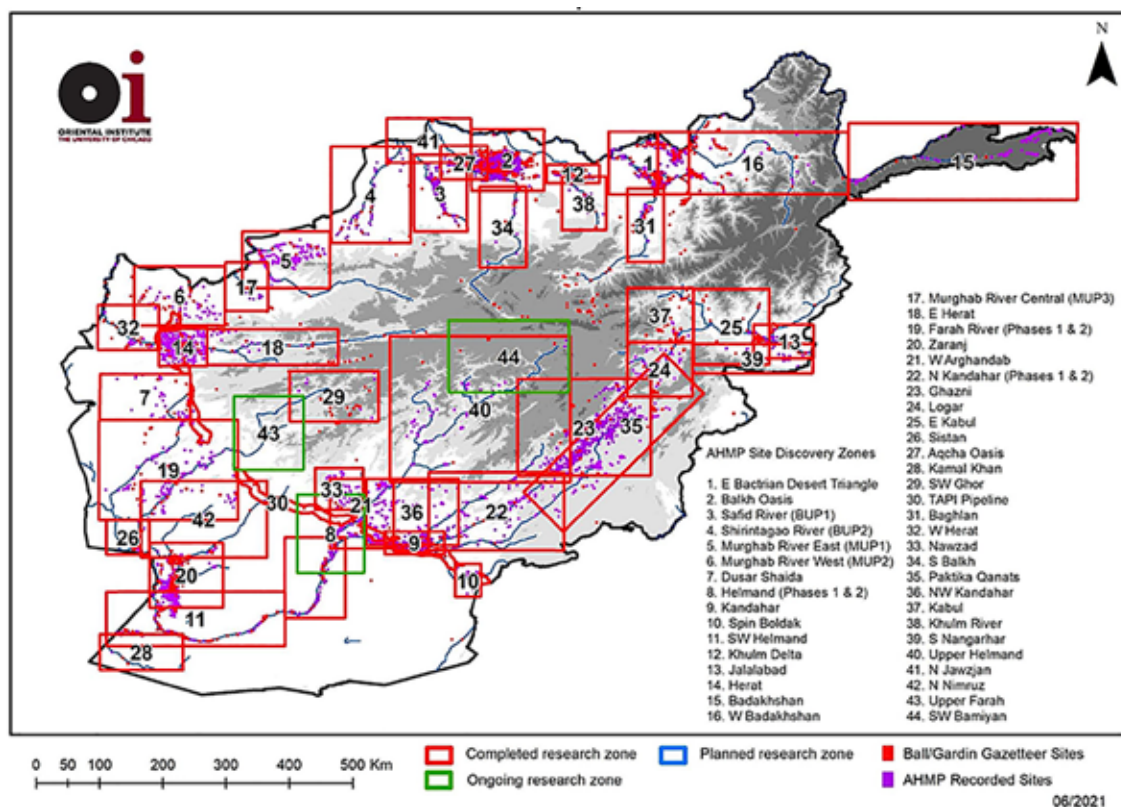
Figure 2. The Afghan Heritage Mapping Partnership identifies sites where illicit excavations and looting are taking place through time-series analysis of remote-sensing images. Comparison of the satellite image from 2018 (left) with one taken a year later in 2019 (right) shows new looting activities at the southern end of the mound in the area highlighted by the red oval.

## THE AFGHAN HERITAGE MAPPING PARTNERSHIP

Our partnership with the AIA focuses on three key areas: (1) discovery and spatial inventory of archaeological sites across Afghanistan; (2) documenting the condition of archaeological sites and monitoring looting activities (fig. 2); and (3) training the AIA staff in geospatial techniques for heritage preservation and management. The AHMP Chicago staff are Tony Lauricella (CAMEL lab acting director), Andrew Wright (project manager), Jennifer Feng (assistant project manager), and three students (data analysts).

The AHMP continued its core mission of finding archaeological sites throughout Afghanistan. In our 44 search zones examined as of June 2021, we have identified 11,996 sites and 16,423 *qanat* irrigation systems, for a total cleaned dataset of 28,419 significant ancient heritage sites (fig. 3). In 6 years, we have covered 245,153 km<sup>2</sup>—about 37 percent of the area of Afghanistan. But our current system of discovering sites by visual examination is labor intensive and far too slow. We need to develop more efficient methods to complete our inventory of heritage sites while doing so is still possible.

Recent developments in the field of artificial intelligence provide a way to accelerate significantly the AHMP's work. Deep learning uses neural networks designed to emulate human brain processes so computers can be trained to solve complex identification problems. Learning through repeated trial and error, with corrections by human experts, the computer develops an increasingly accurate "map" of the specific object it is searching for. This map can then be used to detect that same feature when examining new, unknown images. Deep-learning models have enormous potential to identify archaeological sites in the landscapes recorded in satellite images.



In spring 2021 we began a collaboration with the University of Chicago Research Computing Center to develop and implement a deep-learning model for computer identification of archaeological sites in remote-sensing images across Afghanistan. Starting with high-resolution LiDAR images, we used a training set of two thousand mounds that we had already identified visually to teach the computer model how to recognize archaeological mounds and pick them out of the surrounding landscape (fig. 4). The model has been repeatedly tested and improved and is now ready to search the entire area of Afghanistan to identify archaeological sites. Our team will visually check and correct the computer's site identifications. We are on track to complete the coverage of the remaining 63 percent of the country and create the first comprehensive archaeological map of Afghanistan by the end of 2021.

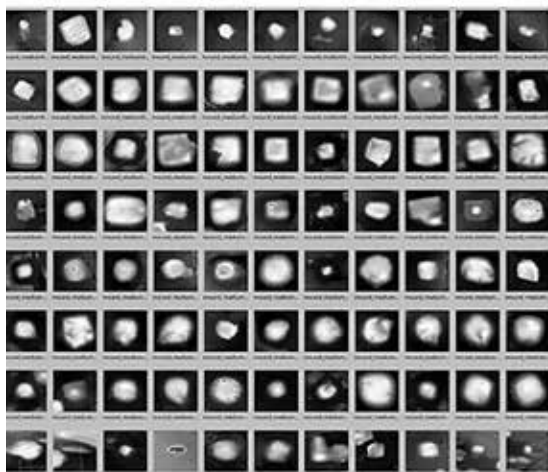
From January 9–21, 2021, Dr. Pietro Calogero (of San Francisco State University) taught our third remote training course for the AIA staff focused on the QGIS geospatial database—an open-source version of the standard GIS software. This intensive course emphasized hands-on training in QGIS applications for cultural resource management (fig. 5).

Figure 3. Map of Afghanistan showing the search blocks where archaeological heritage sites have been located through analysis of satellite imagery, archaeological gazetteers, historical maps, and inventories assembled by the Afghan Institute of Archaeology. To date, the AHMP has documented 28,419 heritage sites across the country.



## Train set

## Mounds -- positives



## Non-mounds -- negatives



TOP: Figure 4. The Afghan Heritage Mapping Partnership is collaborating with the University of Chicago's Research Computing Center to develop an artificial intelligence deep-learning model that identifies archaeological sites in remote-sensing images. The Partnership's analysts used a training set of two thousand features that had already been identified visually as mounds (at left) to teach the computer model how to recognize archaeological mounds and distinguish them from *non-mound* search units (*tiles*) in the surrounding landscape (at right).

BOTTOM: Figure 5. In 2021, the Afghan Heritage Mapping Partnership taught its third remote training course for the Afghan Institute of Archaeology focused on QGIS—an open-source version of the standard ArcGIS geospatial database. This intensive course emphasized hands-on training in QGIS applications for cultural resource management—in this case, the identification and documentation of heritage sites threatened by the construction of the TAPI natural gas pipeline across Afghanistan.

Recording

## Skill: TAPI Pipeline Case Study and Remote Survey

- AHMP discovered over 400 archaeological sites within 5km of the pipeline through remote survey
- Used the TAPI Pipeline dataset as a case study in the use of time series imagery to assess site risk

CORONA: (1965-05-27)

BuckEye: (2012-09-30)

DigitalGlobe: (2020-12-21)

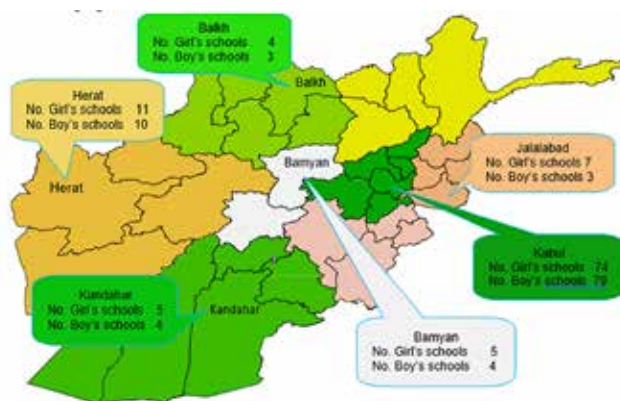
*ADRASKAN RUD, threatened by urban expansion*

## THE MOBILE MUSEUM PROJECT

The MMP is a collaboration with the NMA to implement an educational outreach program designed to raise awareness among high-school students of the NMA’s important collections through in-class presentations in boys’ and girls’ high schools and orphanages in the six largest cities across Afghanistan: Kabul, Herat, Mazar-i Sharif, Bamiyan, Kandahar, and Jalalabad. The Mobile Museum uses innovative digital technology, object-based learning, and traditional educational tools to engage with students. Our in-class presentations include video, 3D printed replicas of museum objects, posters and banners for permanent display, and notebooks with information about the NMA for students to take home. In 2020–21 we presented in-class or webcast programs to 10,504 students at 160 schools, orphanages, and Lincoln Learning centers in Kabul and Bamiyan (fig. 6). Our school programs halted on May 29, 2021, due to COVID-19 and the declining security situation in Afghanistan.

Fortunately, we were able to continue with two additional MMP outreach projects. In June 2021 we published two books to raise awareness about Afghanistan’s cultural heritage: a children’s book, *A Gift from Our Ancestors*, and a book for high-school students, *The National Museum of Afghanistan and our Cultural Heritage*. Four thousand books were published in separate Dari and Pashto versions (fig. 7). In June 2021 we also arranged the broadcast of our MMP video documentary on two Afghan television networks: TOLO TV and 1TV.

RIGHT: Figure 6. The Mobile Museum Project was designed to reach high school students in both the capital Kabul and in the largest provincial capitals across Afghanistan - Bamiyan, Herat, Mazar-i Sharif, Jalalabad and Kandahar.



BELOW: Figure 7. As part of the Mobile Museum Project’s public outreach, we collaborated with the Afghanistan Center at Kabul University to produce a short book titled *The National Museum of Afghanistan and Our Cultural Heritage*. Thousands of copies were produced in both Dari and Pashto—the two national languages of Afghanistan.



## THE HADDA SCULPTURAL PROJECT

In parallel with the MMP, one of our main projects at the NMA is the Hadda Sculptural Project (HSP). The 1,500-year-old sculptures from Hadda in the NMA comprise one of the most important collections of early Buddhist (Gandharan) art in the world. These priceless sculptures were systematically smashed by the Taliban in 2001 in the months leading up to their destruction of the giant standing Buddhas at Bamiyan. At great personal risk, the NMA staff secretly collected and stored more than 7,600 fragments of these sculptures. From 2016–21, the OI team has worked to clean, stabilize, and restore these rare examples of early Buddhist art. Our team consists of head conservator Fabio Colombo, assistant conservator Elisa Pannunzio, Prof. Giuseppe Salemi (Padua University) for 3D modeling, and Kabul field director Alejandro Gallego Lopez, who has been identifying the partially reassembled sculptures from field numbers, museum records, and catalogs of the NMA's pre-war collections. We have processed more than 7,600 sculptural fragments and partially reassembled 432 of the Hadda sculptures.

The COVID-19 pandemic in early 2020 forced us to suspend on-site work at the NMA. We adjusted by working remotely in *virtual* missions on the data we have accumulated thus far. Team members in Europe work remotely while linking with the Chicago team in weekly online update meetings. The virtual missions focus on four goals: (1) organizing our archived photos taken from 2016–21; (2) implementing a Digital Asset Management (DAM) searchable image database for Hadda project photos and videos; (3) building 3D renderings of selected sculptures; and (4) documenting all of our partially reassembled sculptures from Hadda.

From 2016–21, we have generated 18,144 still images and videos to document the sculptural fragments, conservation interventions, and procedures. The complete images are entered into Daminion—a cloud-based DAM system to enable searches and location of the necessary image data by conservators, art historians, archaeologists, and museum curators. Daminion allows us to group together all related images and documentation for each of these partially reassembled sculptures (fig. 8). The images are tagged with keywords to facilitate searches. At the same time, we are matching registration numbers against old accession records and published catalogs to identify the sculptures and locate photos of the objects in their complete form before they were smashed by the Taliban. In some cases, matching the fragments to the old museum registration photos allowed us to reassemble the sculptures digitally (fig. 9).

Professor Salemi continued integrating thousands of still images to build 3D models of the forty best-preserved examples of our 432 partially reassembled sculptures (fig. 10). Not only are these 3D models useful for documenting the sculp-

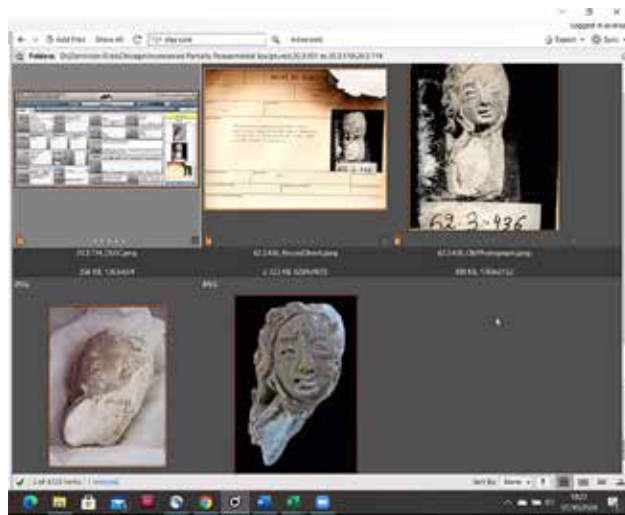
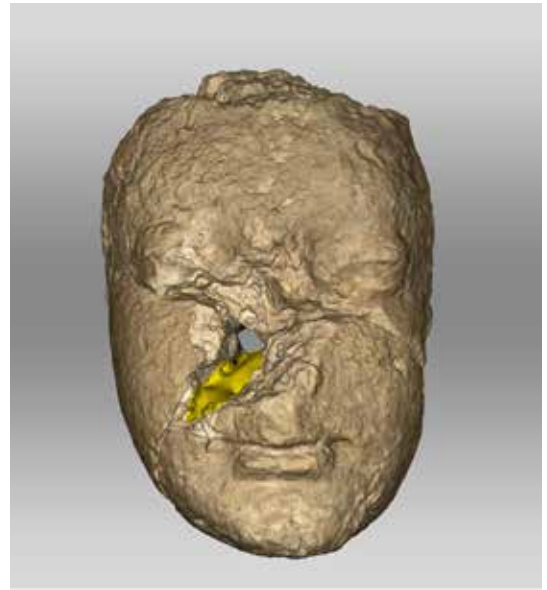


Figure 8. The Hadda Sculptural Project's Digital Assets Management system organizes our images of the early Buddhist sculptures, especially the 432 partially reassembled objects. This folder pulls together images of the OI-NMA computer inventory record of the sculpture (top left), its partially burnt original museum registration card (top center), photos showing the condition of the sculpture when it was first registered (top right), and a current photo showing the fresh break from when it was smashed by the Taliban (bottom left).



LEFT: Figure 9. A digitally reassembled sculpture of the Buddha in which color images of the reddish sculptural fragments have been superimposed at the same scale over the pre-war museum black-and-white original accession photo of the sculpture before it was smashed by the Taliban in 2001.

RIGHT: Figure 10. Computer-generated 3D model of a sculpted head of the Buddha. Professor Guiseppe Salemi, of the Hadda Sculptural Project, has stitched together thousands of overlapping digital images to create 3D renderings for forty of our partially reassembled sculptures.

tures—they also provide a valuable tool to make detailed conservation studies of the preservational condition of the objects.

In 2020–21 we also conducted three three-day training workshops for the NMA’s conservation staff and curators. The workshops focused on training in conservation and documentation skills using the Hadda sculptural fragments as the case study. Topics covered included an orientation to the site of Hadda and its excavations, object photography for conservation, and museological documentation. Participants also were trained in editing digital photographs using Photoshop.

## CONCLUSIONS

Our three ongoing projects in Afghanistan span a range of approaches to preserving different aspects of cultural heritage in this embattled country. Our conversion to online remote work combined with the exceptional work of our Kabul-based Afghan staff colleagues has enabled us to keep these programs active throughout the COVID-19 pandemic. As we move into the final year of our grants, we hope to complete these projects of documentation, conservation, cataloging, training, and educational outreach.