The Gaza Maritime Archaeology

LOW-COST DOCUMENTATION OF COASTAL SITES IN AREAS WITH LIMITED RESOURCES

In this section we have seen that a wide range of factors impact the state of preservation of archaeological sites. We have also seen that maritime archaeological sites are exceptionally vulnerable as they are exposed both to land and sea-related processes. The rapid deterioration of maritime archaeological sites (particularly coastal sites) and the relatively higher costs for the documentation and monitoring of such sites is a widely acknowledged challenge in heritage management.

In many parts of the world, including the MENA region, the compounding effects of limited resources/investment for heritage, limited opportunity to develop heritage management expertise, general economic crisis, as well as pollution and environmental processes, particularly erosion create significant hurdles for the documentation and monitoring of vulnerable heritage.

While heritage documentation can be resource intensive, particularly in the context of maritime archaeology, it is important to remember that most maritime archaeological sites are located along the coast or underwater at a low depth, which does not require the use of expensive and inaccessible equipment.

In recent years, low-cost technologies have been implemented in several countries, in order to develop more sustainable workflows for the rapid documentation of vulnerable heritage. We will present one such example that was developed in the context of Gaza Strip between 2021 and 2023.

THE GAZA MARITIME ARCHAEOLOGY PROJECT (GAZAMAP)

The Gaza Maritime Archaeology Project (henceforth GAZAMAP) is the first maritime archaeology project in the Gaza Strip since the 1970s and the first research archaeological project in this area since the early 2000s. The project

concluded a successful first season in 2022, during which eleven students were trained to conduct a maritime survey in a selection of sites.

STEP 1: PRELIMINARY ASSESSMENT USING SATELLITE IMAGERY AND AERIAL PHOTOGRAPHS

A close examination of satellite imagery and historic aerial photographs from the 1970s onward made clear that there are multiple undocumented coastal and partly submerged archaeological features across the coastline of Gaza. The documentation of these features requires a set of knowledge, skills, infrastructures and technologies that are not always (readily) available in many parts of the world and especially in the Gaza Strip.

STEP 2: CREATIVE APPROACHES TO GATHERING EXPERTISE AND EQUIPMENT

A preliminary assessment by local partners has highlighted, however, that despite several restrictions in place, some spatial data collection technologies were available in Gaza, including drones and topographical survey equipment, both of which are used in the private sector. Bringing together heritage professionals with those knowing how to operate these technologies has significant potential for the protection of heritage. Thus, GAZAMAP created a collaborative network of specialists, the complementary skills of whom have produced high-quality archaeological data akin to those produced by better-funded, research projects in the region.

For example, even though local antiquities departments may not have relevant equipment and expertise in collecting **aerial photographs**, such equipment may be available through the private sector. In the case of Gaza, the collection of aerial photos was assigned to a local media production company (Ain Media) following a briefing on best practices in collecting aerial photos for archaeological purposes, including 3D modelling. Subsequently, Ain Media delivered practical training to a number of archaeology students. The students learned how to plan and execute a survey and how to produce 3D models using photogrammetry software.

Practical and theoretical training in archaeological survey methods that can be applied in the coastal and maritime landscape (pictures from GAZAMAP project).

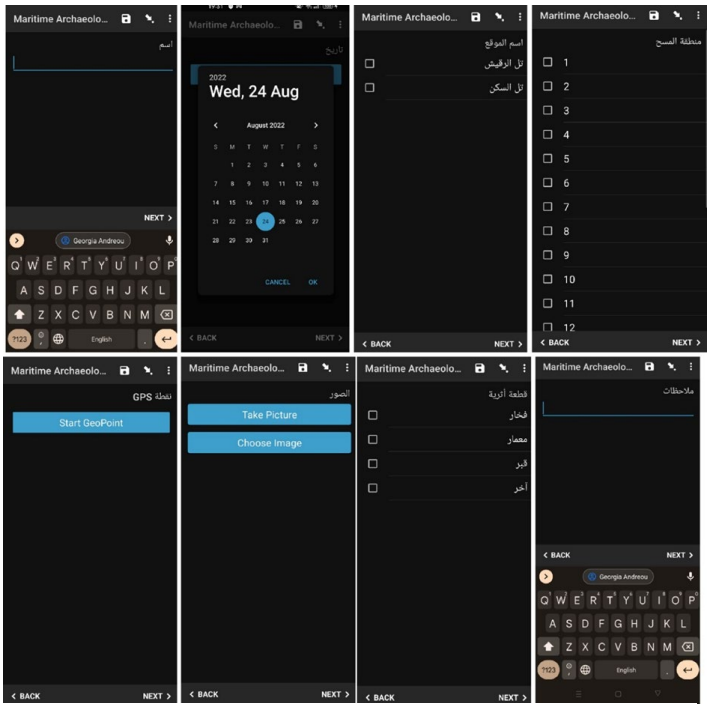
STEP 3: IDENTIFYING FREE AND ACCESSIBLE GEOSPATIAL DATA COLLECTION APPS:

Some of the key limitations of conducting an archaeological survey in Gaza was the limited or sometimes restricted access to location devices from hand-held GPS units to professional surveying equipment. In response to that, GAZAMAP identified smartphone apps that could leverage the GPS of personal phones in order to collect observations in the form of geotagged photographs with notes. These photographs can subsequently be processed and further analysed using GIS.

GAZAMAP selected Kobo Collect app (https://www.kobotoolbox.org/) due to its offline functionalities, in response to internet restrictions in Gaza. Unlike traditional archaeological surveys that collect surface finds, we created a large digital record of all our observations (photographs) accompanied by their geographic coordinates. This allowed us to create find density maps and have a

photographic archive of all finds, including architecture. This also provided essential information for the future location and monitoring of architectural features, without the need of storage and conservation infrastructure for surface finds.

KoBotoolbox (https://www.kobotoolbox.org/) an open-source software used both for online and offline field data collection, KoBotoolbox was particularly useful in GAZAMAP because it uses existing GPS from the users' smartphones to save the location of any observation (e.g. pottery, architecture, tomb). The users of the app were also able to take scaled photographs and accompany them with field notes, all of which comprise the full record of the survey of each site. Information is stored in the form of tables (excel) and separate .jpeg files for the photographs.



Example of geospatial data collection form produced on KoboCollect (picture produced by GAZAMAP).

Dedicated training on how to develop data collection forms and design a survey are available in Arabic through the American Society of Overseas Research: ASOR CHI TUTORIALS - American Society of Overseas Research (ASOR)

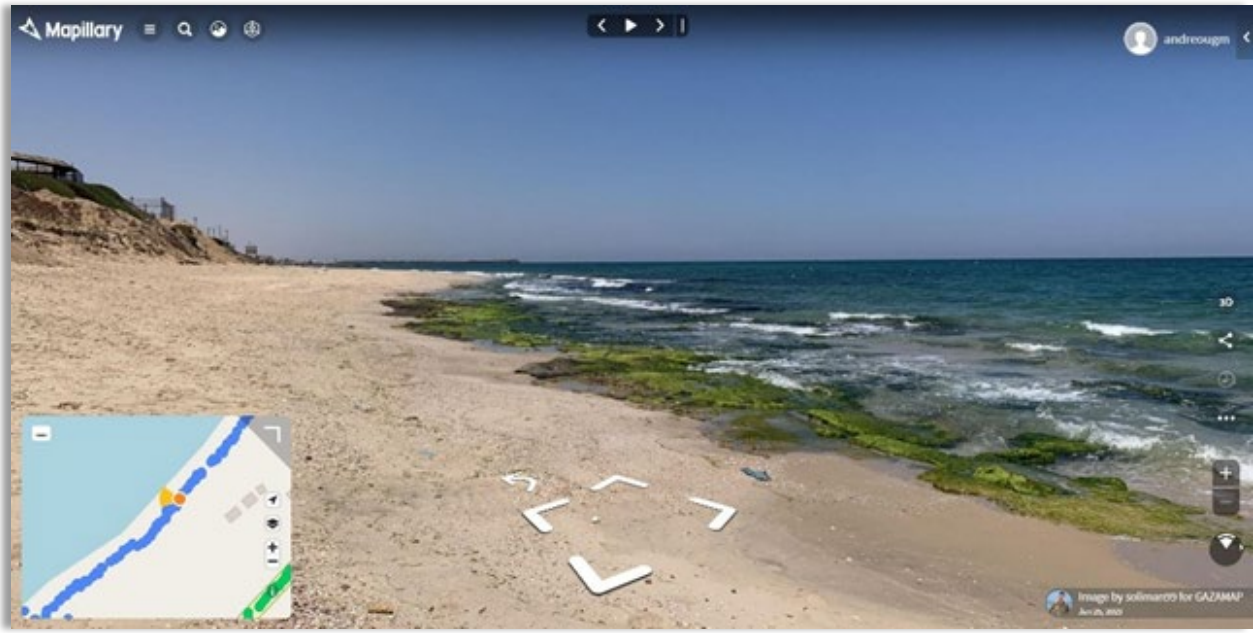
OPEN ACCESS STREE-LEVEL IMAGERY

The students received training on a new open access app collecting street-level imagery. Mapillary, an alternative to google street view, is typically used to document streets.

Mapillary is a collaborative platform for street-level imagery and mapping, leveraging community contributions to create a visual representation of the world.

Users can upload photos from smartphones or cameras, which are processed and stitched into immersive street-level views. These geotagged and **timestamped** images offer dynamic, up-to-date visual documentation of various areas. Mapillary has diverse applications, benefiting both public and private sectors. Urban planners and city officials use it to monitor infrastructure and identify maintenance needs. Environmental projects use Mapillary to document landscape changes and support conservation efforts. In the context of archaeology, Mapillary has been used for the first time to document the coastal scarp of the southern coast of the Gaza Strip.

The Mapillary app works by allowing users to capture images of their surroundings using their mobile devices. Once captured, these images are automatically uploaded to the platform, where they are processed and integrated into the global map. The app utilises GPS data to geotag images and advanced algorithms to ensure seamless stitching and object recognition. Users can explore and contribute to the growing repository of street-level imagery, helping to keep the map accurate and up-to-date. This participatory approach ensures a rich and detailed visual record of locations,



accessible to anyone using the app.

Example of imagery collected via Mapillary. A user can see both the precise location of the features and a photo. A user can also travel through various photos and examine the spatial relation of the documented features, as well as their association with modern structures.

In Gaza, our team used it to collect and publish geotagged photographs of the beach and the exposed coastal scarp. The pictures form a baseline for future assessments of the condition of the coastline through regular monitoring. The collected imagery is available at: mapilary.com.

Using these two free and open-access apps, the surveyors collected over 15000 photos of archaeological features and artefacts, which were subsequently plotted on a GIS software to produce synthetic maps of archaeological sites.

Map showing the density of surface archaeological finds. The yellow and red colours indicate high density. The blue indicates low density.

Left and Middle: Large fragments of recently exposed (likely eroded) pottery at Tell Ruqeish. Right: actively eroding mudbrick wall at Tell Ruqeish, all documented using KoboCollect.

Conclusion:

The use of these technologies has bipassed significant, financial and infrastructural limitations in coastal heritage documentation including access to location devices, access to cameras, uninterrupted access to electricity and internet, as well as archaeological storage infrastructure where typically survey artefacts are being stored and need to be managed. Moreover, the two apps have allowed for faster, consistent and more streamlined archiving of the geotagged photographs, which can be revisited by researchers in the future. The resulting maps are akin to those produced by more resource-intensive survey projects.