



# K-Dig. An integrated GIS tool for recording and managing an excavation, its environment, and 3D data

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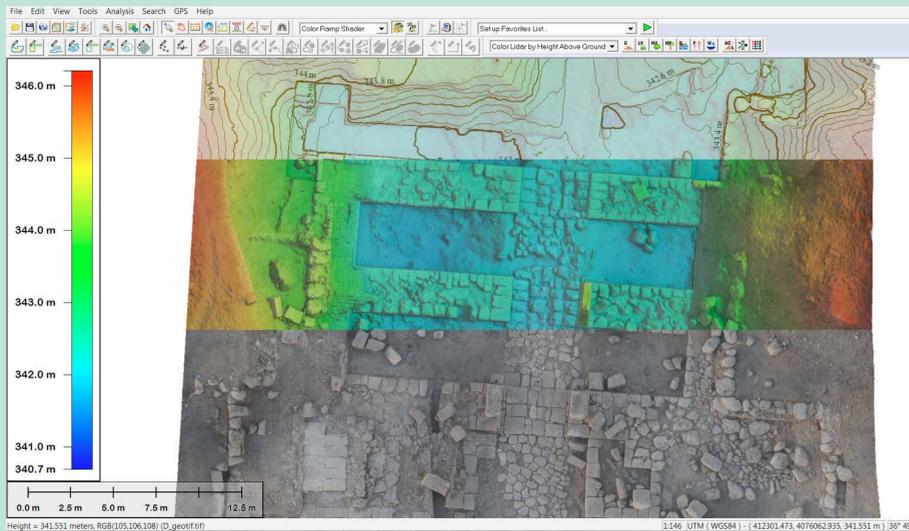


Fig. 1. View of the South Gate in a GIS environment after photogrammetric processing.

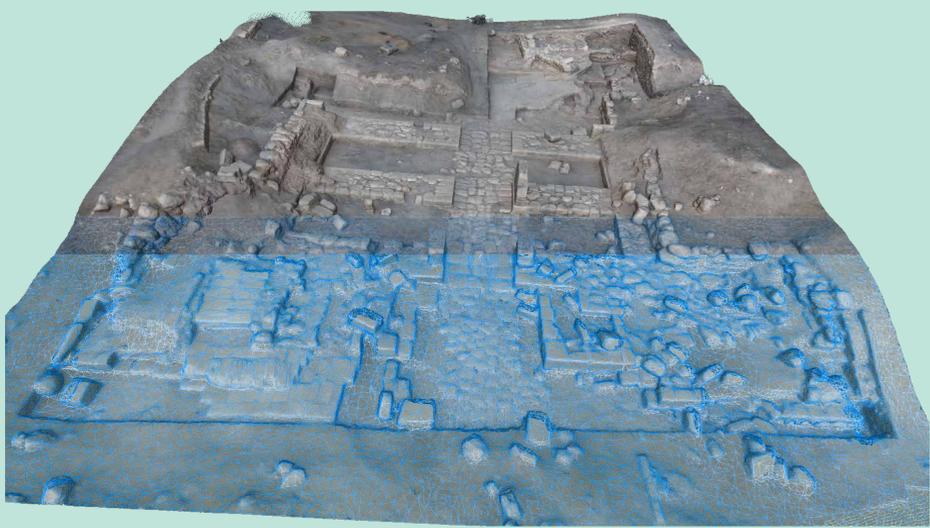


Fig. 2. View of the South Gate from North. From mesh to 3D model.



Fig. 3. Rendered view of the South Gate after processing.

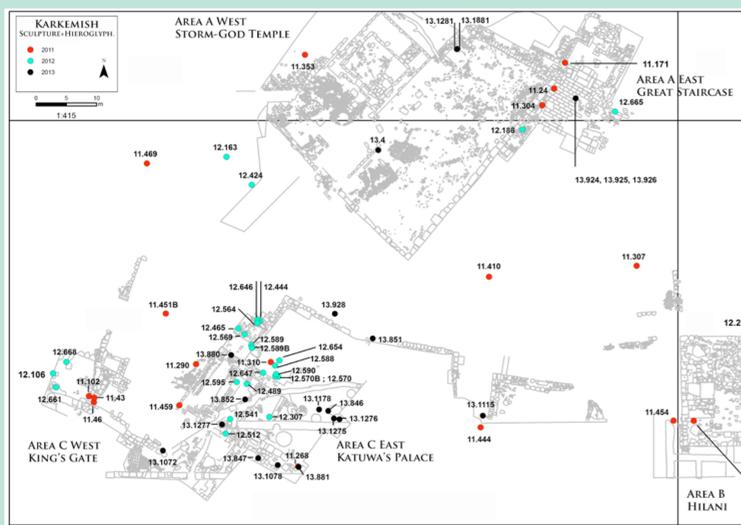


Fig. 4. GIS distribution within the Lower Palace Area of sculpture and hieroglyphic finds 2011-2013.

## INTRODUCTION

Building upon a GIS architecture (an essential tool not only in landscape archaeology, but also in intra-site data management), a new integrated software system has been developed and tested in the excavations of Karkemish (S-E Turkey). The project, called K-Dig, provides archaeologists with a complete recording and visual tool both at the dig - through client devices (10" tablets) connected via wi-fi to a server - and at the excavation house. Operational protocols include creation of records and extensive photogrammetry on the field, transformed almost in real time into high-precision 3D textured models. Within these georeferenced models, any information concerning finds, stratigraphic units, archival and photographic documentation can be accessed by combining Cad, MySQL GIS and 3D visualization tools. Queries typical of GIS may be performed, as well as data retrieval and filtering, while for example an historical 3D visualization of the progress of the excavations through time and even the virtual combination of dismembered monuments may be obtained (although at present not yet from within the system). K-Dig is an open source project, based on libraries supported by a community of developers.

## PHOTOGRAMMETRY

Surveying at the site of Karkemish entailed the need of coupling standard surveying methods with more advanced ones such as 3D photogrammetry. Both aerial and ground photogrammetric shootings (taken through drones or telescopic rods) are processed through specific softwares (U-MAP, PHOTOSCAN, PIX4D). The results (either point clouds or meshes) allow to obtain and represent a digital 3D model which has many spatial, metrical (x, y, z) and color (RGB) information embedded in it, thus joining the potential of images with the precision of the survey. Using 3D photogrammetric techniques has led us, on the one hand, to optimize and speed up surveying operations at the site, thus strongly reducing the use of total stations and, on the other hand, creating new infographic representations such as 3D orthophotos, profiles and sections, contour lines, geotiff images, DEMs, meshes etc., all well integrated in 2D and 3D CAD, as well as in GIS environments.

## WEBGIS (HTTP://137.204.128.221/)

GIS provides an essential tool in landscape archaeology and in intra-site data management. On this matter the site of Karkemish represents an excellent case study in order to understand the development of the settlement and its hinterland during time. While an accurate investigation of the territory around Karkemish has been planned for the next seasons, presently the GIS has been extensively used for intra-site data management and elaboration. The site is covered by different types of topographical maps, hi-res satellite imagery (Quickbird and WorldView-1), and the general DEM obtained after the acquisition of several thousands of points by differential GPS. All the sectors excavated have been recorded through georeferenced photogrammetry, which was also used to generate a very hi-res DEM, useful for better understanding architecture on the surface and studying the different occupation phases.

## K-DIG (HTTP://WWW.ORIENTLAB.NET/KDIG/)

K-Dig is a system for the management of archaeological data integrated with a webGIS. It is born from the need to have a database available for all users who want to access archaeological information within an immediate and simple system. It is based on an architecture web-server (LAPP - Linux, Apache, Postgres, PHP), which can be accessed through a standard web browser without installing any additional software. Being located on a web server, it can be accessed by many users at the same time having directly access to the data, which may be inserted into the system through a simple and intuitive interface. K-Dig has been developed under an open source philosophy and has a MIT licence. It can be downloaded and tested from the website <https://github.com/nephilimdie/kdig2>.

## ACKNOWLEDGMENTS

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fig. 5. Acquisition method with camera.

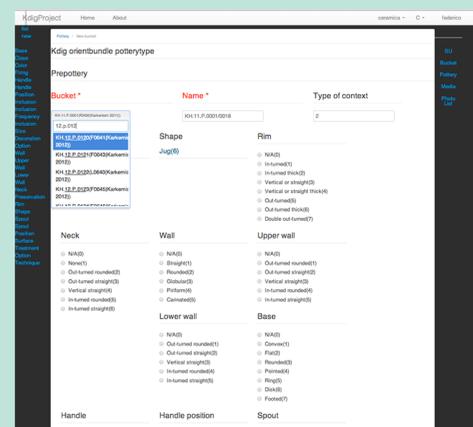


Fig. 6. K-Dig: pottery form.