İnci Nurgül Özdoğru[1], Gonca Dardeniz[2], Orkan Özcan[1], Fırat Yiğit[3], Serkan Özçelik[3]

# Geophysical and UAV Surveys on Konya Karahöyük (central Anatolia, Türkiye)

## Introduction

### The site

The archeological site of Konya-Karahöyük is located in the Konya plain of central Anatolia, Türkiye. It is at the crossroads from Syro-Mesopotamia to the Aegean (Alp, 1994). The archaeological material collection gathered from the site dates to the 3rd-2nd millennia BC and displays Anatolian, Syrian, and Aegean influences confirming it as a dynamic hub of the Bronze Age.

The mound of Konya-Karahöyük covers an area of 33 ha. With its lower town, which is heavily filled with alluvial deposits, the site spans almost 100 ha.



- Konya Province
- Province boundary
- Mound boundary
- GPR survey
- Magnetic survey
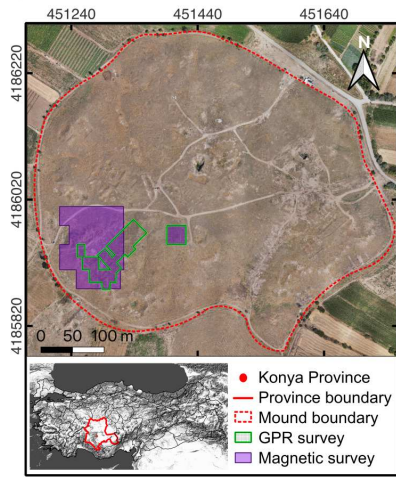
### Project

This project applies a combination of geophysical and UAV surveys at a central Anatolian Bronze Age site in the first archaeological excavation season after 30 years of break.

### Objectives & Approach

- Investigate the possible architectural layouts to provide a brief understanding of the subsurfaces before opening new excavation squares.
- Emphasize crop marks on the mound and investigate the expansion of this multilayered archaeological site.

Thermal Imagery DEM Visualization
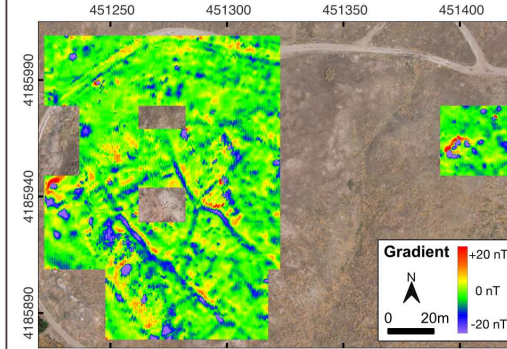
Magnetic Survey GPR Survey

## Geophysical Prospection



Fig. 2. Magnetic survey (Geometrics G-858 MagMapper cesium vapor magnetometer) results are shown. The profile spacing was 0.50 m. It was applied to ~1.2 ha.
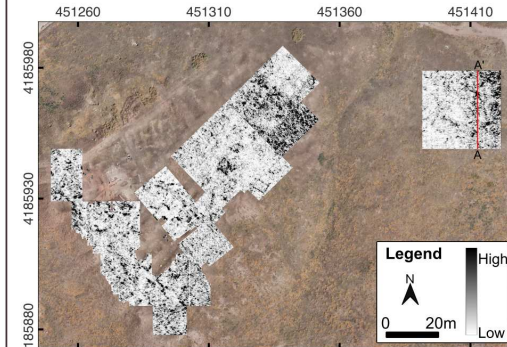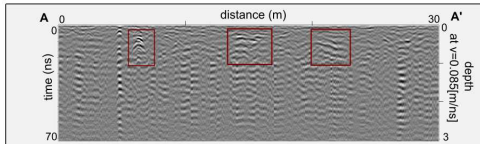


Fig. 3. GPR (GSSI UtilityScan with 350 HS central frequency) results are shown. The profile spacing was 0.25 m. Approximately an area of 4400 m$^2$ was covered.



* The profile was chosen from the A-A' section as an example. GPR was used in areas where the method is applicable morphologically and is comparable to magnetic survey results. For the process of the GPR and magnetic datasets, ReflexW and MagPick software were used respectively.
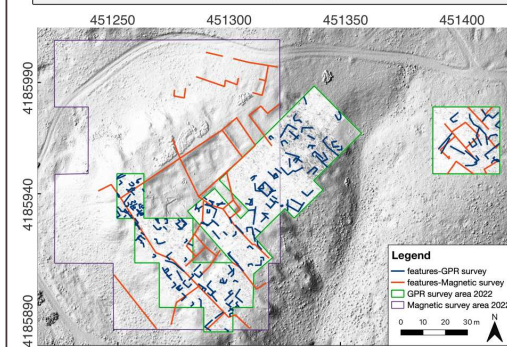


Legend
- features-GPR survey
- features-Magnetic survey
- GPR survey area 2022
- Magnetic survey area 2022

Fig. 4. Interpretation of geophysical surveys shown in comparison.

## UAV Survey
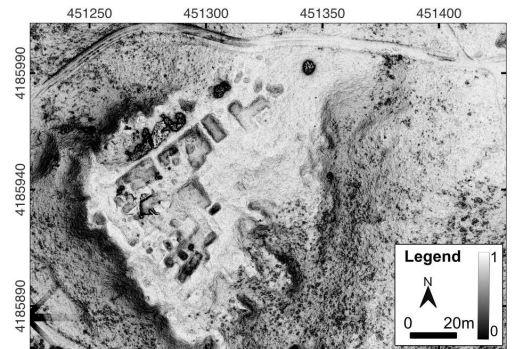


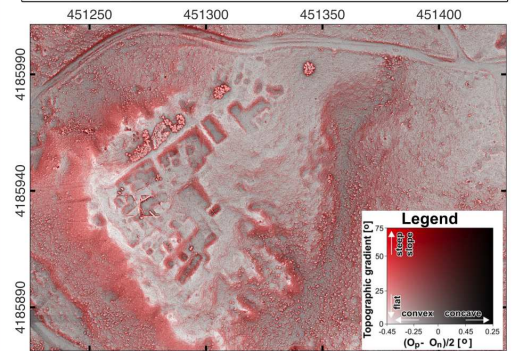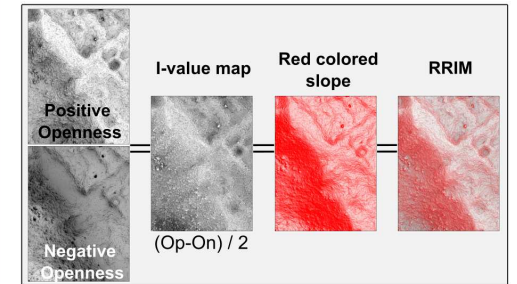Fig. 5. DEM visualization with Sky view factor, computed in 8 directions.



Positive Openness — Negative Openness | I-value map $(Op-On) / 2$ | Red colored slope | RRIM



Fig. 6. Red relief image map of the study area.
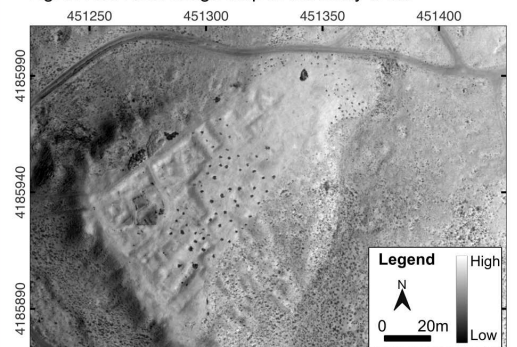


Fig. 7. Thermal image of the area taken at 10:30 am by DJI Mavic 2 Enterprise Advanced drone.

## Results

-The preliminary results of the geophysical exploration identified several architectural layers at different depths. The structures were mostly starting from 0.5m below the surface.
-Along the NW-SE direction, the produced profiles identified two linear marks that could possibly be walls of a monumental structure extending approximately 70m. The results are in accordance with the thermal images and DEM. Between these linear structures, nearly perpendicular walls were also identified.

## Future directions

- The 2023 season at the site will ground-truth the results via excavation.
- The thermal imagery results of our first survey season and DEM indicate that the rest of the mound requires further research and intensive survey in the following excavation seasons.
- Subsurface structures at the other zones of the mound revealed by the thermal images and DEM will be confirmed with geophysical methods and test trenches in time.
- Thermal images will be taken at different times of the day and in different moisture content to provide the best guidance to the geophysical measurements.

## Affiliations

1  Department of Ecology and Evolution, Eurasia Institute of Earth Sciences, Istanbul Technical University, Türkiye
2  Director of Konya-Karahöyük Excavations, Department of Protohistory and Near Eastern Archaeology, Istanbul University, Türkiye
3  SER Engineering Co., Istanbul, Türkiye

Contact:
ozdogru@itu.edu.tr