

ARCHAEOMETRIC APPROACHES TO THE ROMAN NEAR EAST

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ABSTRACT

The purpose of my research this summer has been to participate in a full suite of archaeometric and geoarchaeological analyses, particularly as they are applied to sedimentology. The first section of my research focused on an introduction to these procedures at the UT Archaeological Research Laboratory (ARL), including laboratory safety procedures, proper sample collection and processing methods, and introduction to methods and purposes for a variety of laboratory analyses including grain size distribution analysis using a state of the art Malvern Mastersizer 3000 laser diffraction particle size analyzer, organic matter and inorganic carbon analysis, and microartifact analysis. In my proposal, a field collection phase would have taken place later in the summer, recording and analyzing soil stratigraphy and taking soil samples for post-season analysis from the site of 'Ayn Gharandal in Jordan. Because UT canceled student travel to the region, instead of field collection I focused on data analysis for samples taken at 'Ayn Gharandal during the 2015 and 2017 seasons.

BACKGROUND AND TRAINING

Geoarchaeological and geophysical analysis is on-going at the site of 'Ayn Gharandal in southern Jordan, excavated under the direction of Erin Darby and Robert Darby. The site was a Roman military outpost on the eastern frontier of the Roman/Byzantine Empire in the fourth century CE. It is located in the middle of a dune sea in Jordan's southern Arabah Valley, a marginal desert environment that receives less than 40 mm of rainfall per year (Fig. 1). Preliminary geoarchaeological field investigations were carried out by Howard J. Cyr, the project geoarchaeologist (ARL) from July 12-17, 2015 and July 8-21, 2017. The primary research goal was to test the applicability and feasibility of geoarchaeological methods at the site. The work included detailed examinations of the site stratigraphy through deep sediment probing and profile analysis, sample collection, and field reconnaissance.

Before analyzing the 'Ayn Gharandal sedimentological data, I trained in excavation and field collection at the UT Strong Hall excavation site, where I performed field excavation and lab work on the relevant samples. Excavation focused on a Civil War era cottage and adjacent greenhouse (Fig. 2). In the laboratory I was also exposed to particle size analysis and organic and inorganic matter analysis from another ARL project at the Winterville Mounds Site in Mississippi. I then focused on microartifact analysis and its relationship to the data from particle size analysis at 'Ayn Gharandal (Fig 3).

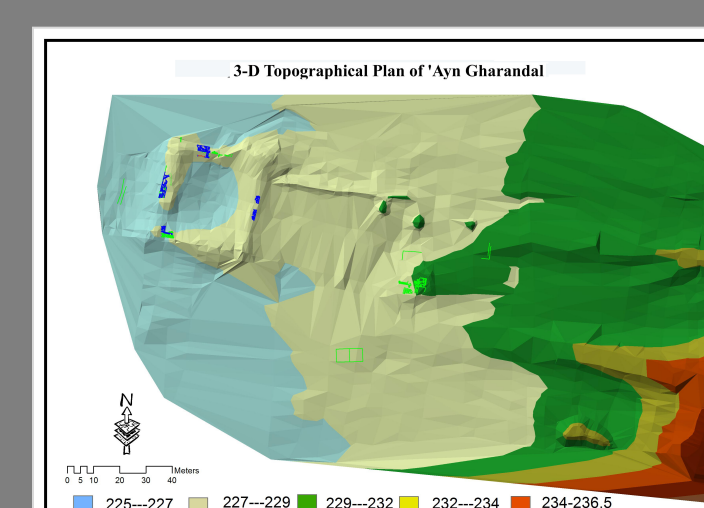
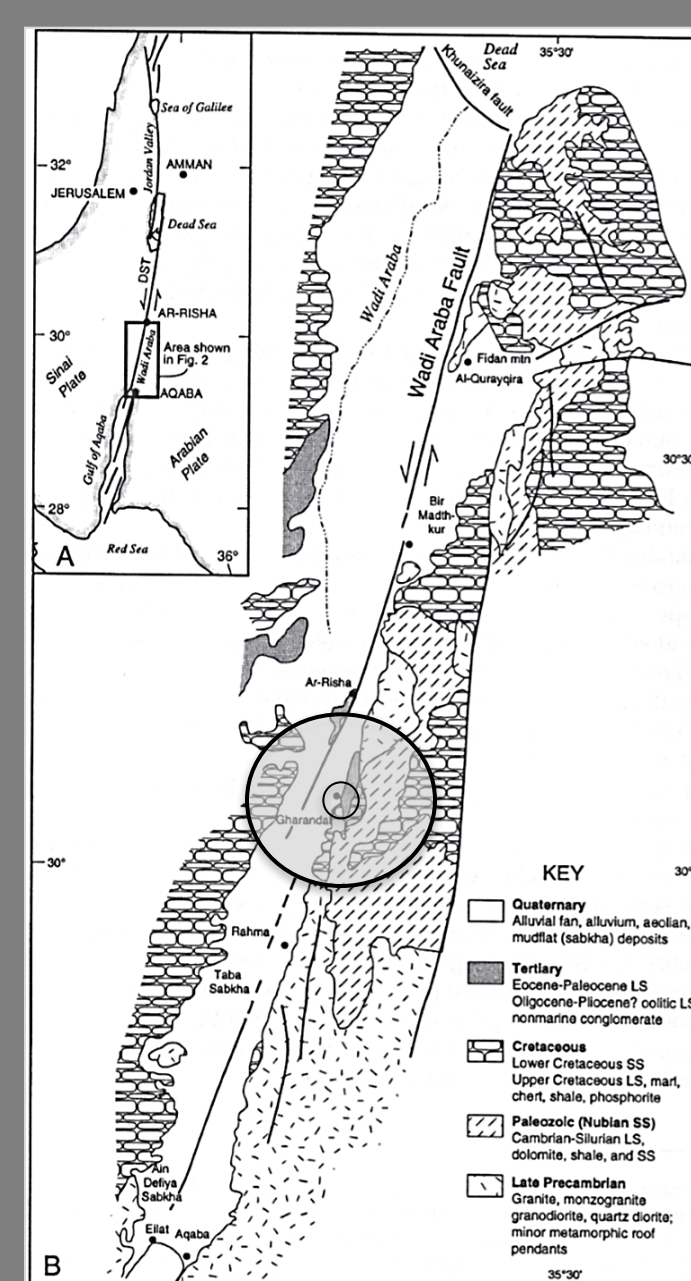
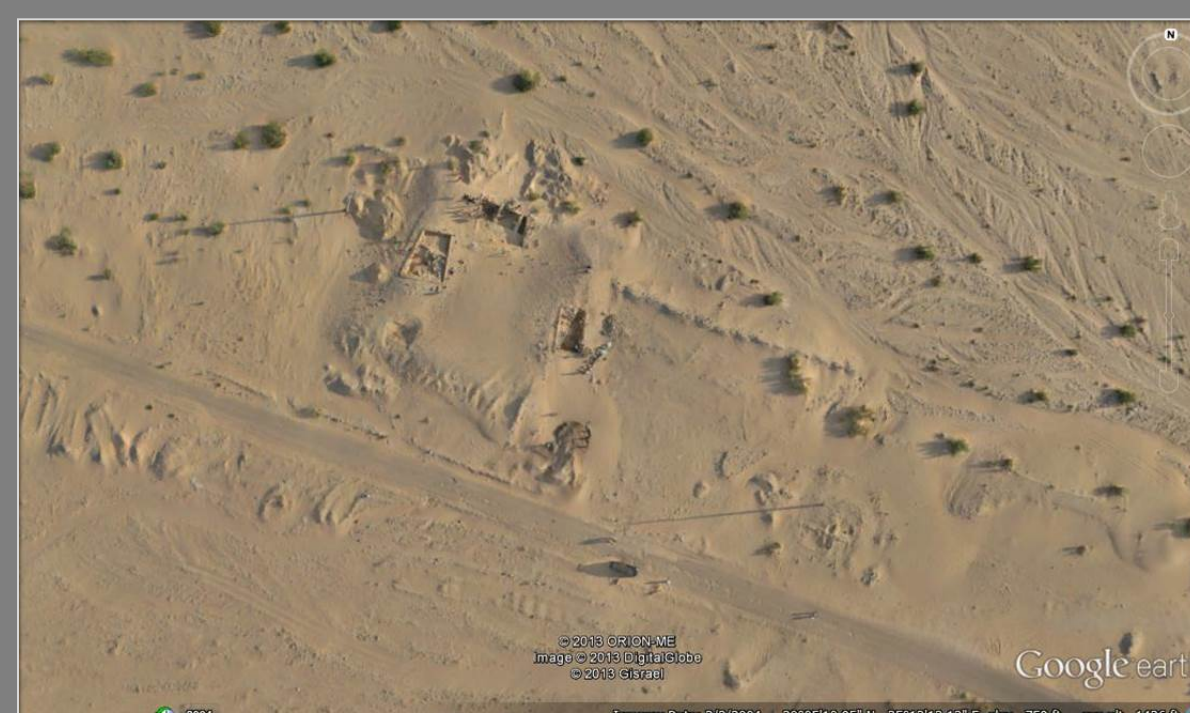


Fig. 1: Geological map of the Wadi Arabah and 'Ayn Gharandal (left); topographical map of the site (above); view before excavation (top right); sand dunes around fort and bathhouse (bottom right)



FIELD COLLECTION

There were two parts to the training and exposure I received while working at ARL. The first part was field excavation, where we dug at the site near Strong Hall for ca. three weeks. We also performed stratigraphic analysis and collected samples from the different layers we found. The second part of the summer involved lab work and training with lab equipment. It included learning the different processes to analyze the samples, including sample preparation, organic matter, inorganic matter, particle size, and microartifact analysis.



Fig. 2: (From left to right) Measuring a unit, mapping the finds, and screening soil for artifacts at the Strong Hall site on the UTK campus

LAB METHODS

All of the 'Ayn Gharandal samples were taken from an excavated profile in the south baulk in Square D:5/12, to the west of the site's bathhouse (Fig. 3a). All laboratory analyses on 'Ayn Gharandal materials were carried out at the ARL's Geoarchaeology Laboratory in Knoxville, Tennessee. Geoarchaeological laboratory analyses included particle size analysis, organic matter content, inorganic carbon content, and microartifact analysis of bulk sediment samples

- Particle size analysis measures the size distributions of mineral grains within a sample, the results of which relate directly to depositional environments and soil formation processes.
- Organic matter concentrations were measured using the loss-on-ignition technique outlined by Broadbent (1965), in which approximately 50-g of sample is placed in a tared quartz crucible, dried for 8 hours at 105° C and weighed. The sample is then placed in a muffle furnace and heated at 375° C for 12 hours and reweighed. The resulting weight loss is an estimation of the organic matter evolved during the burning process. The baked sample is then placed back in the muffle furnace and heated to 800° C for 8 hours, allowed to cool, and reweighed. The resulting weight loss for the between the post-375° C baked sample and the post-800° C scorched sample is an estimation of the inorganic carbon evolved during the scorching process.
- Microartifact analysis was conducted on 11 bulk sediment column samples collected from the south bulk wall of the West Block trench (D 5/12). Samples were passed through a series of sieves: 4 mm, 2 mm, 1 mm, and 0.5 mm, and then analyzed with a low-power stereoscopic microscope. Microartifact analysis was carried out on the greater-than-2mm fraction. Eight categories of microartifacts were quantified using the MMCount2 program developed by Sherwood and Ousley (1995). Categories used here include unmodified rock, charcoal, ceramic, bone, lithics, mollusk/snail shell, fish scale, and egg shell.

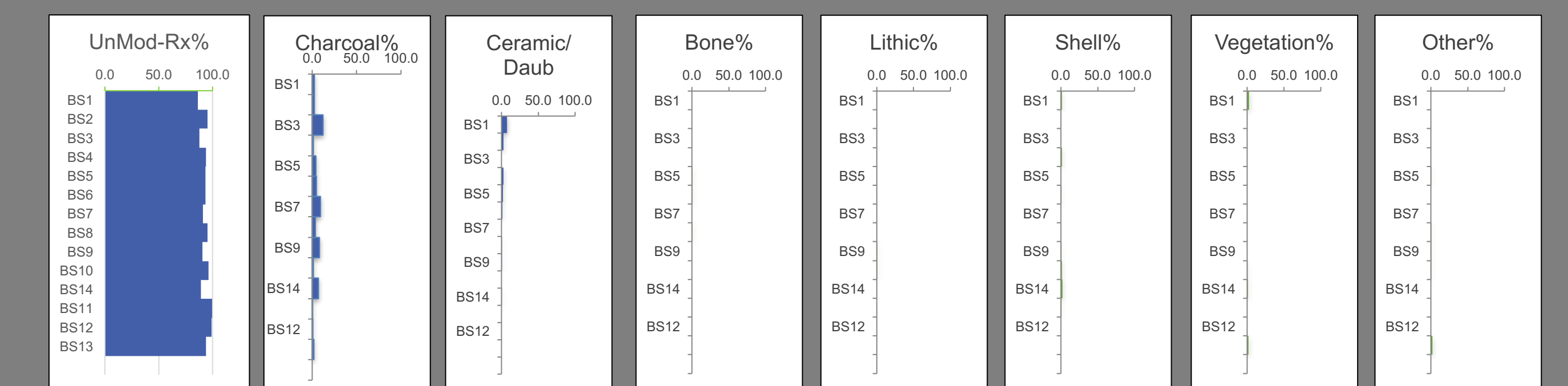
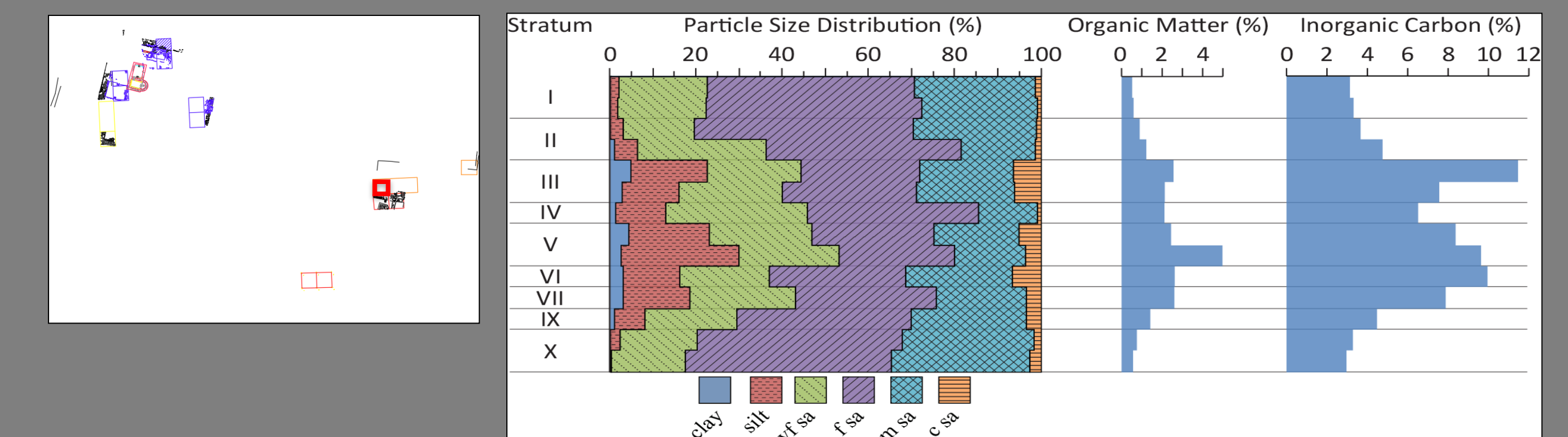


Fig. 3: Location of profile and soil samples from inside a room built outside the bathhouse (top left); results of particle size analysis (middle); results of microartifact analysis (bottom)

DATA AND RESULTS

The goals for sedimentological analysis in this area were to identify natural environmental change and anthropogenic impact.

As is clear in the particle size distribution (Fig 3b), Stratum 10 is pure sand with low organic matter and low inorganic carbon. Stratum 10 was probably trench fill in the gap between the natural wadi and the bathhouse wall and may have served as construction material. The stratum also contained almost no microartifacts (Fig. 3c). This can be compared with Stratum 9 that formed on top of the sand and extends over the wadi wash. This stratum has a marked increase in clay and silt and an increase in organic matter that suggests the presence of vegetation and soil formation, indicating stability in that stratum for some length of time. The increase in organic carbon associated with this stratum further suggests some evaporation of soil moisture.

Between Strata 9 and 3 there may be a series of separate buried soils or surfaces that might represent separate occupational periods. There is also a strong increase in organic matter and sulfide from Strata 6 to 5. It is possible, given the dry environment, that the increase of silt could be the result of dung incorporated if the area was used as a shelter. In sum, microartifacts, organic, and inorganic matter in the strata do suggest a change in site use overtime.

Turning to natural environmental change, the increase in inorganic carbon in Strata 5-7 may reflect an increase in aridity. There may be additional changes in soil moisture and evaporation in Strata 2-1 indicating increases in aridity and dune migration. Although some microartifacts were uncovered in these levels, they most likely represent contemporary activity from local Bedouin or even residual wind-blown materials, as are common across the site. Strata 2-1 probably mark the onset of the modern, natural environment currently visible at 'Ayn Gharandal (Fig. 1). Prior to this point, the area would have been generally dry, but vegetated, reflecting a wadi environment rather than a dune sea. This may suggest that the natural landscape as it appeared in the Roman period continued for some time and differed significantly from the landscape as it appears today.