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What lies beneath: The union of geophysics and archaeology at the Larder Archaeological Site in the Clark County Wetlands Park

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In March 2015 a geophysical survey of a prehistoric archaeological site, named the Larder Site, in the Clark County Wetlands Park provided promising preliminary results, which may be applicable to future archaeological research and preservation projects throughout the Mojave Desert region.

The Larder Site is a rich prehistoric archaeological site located along Las Vegas Wash in the Clark County Wetlands Park (Wetlands Park). The site was discovered in 2005 during Reclamation-sponsored cultural resources surveys in the Wetlands Park. The surveys were conducted under contract with HRA, Inc. (HRA) in support of Clark County's recreation development projects in the Wetlands Park and for Southern Nevada Water Authority's (SNWA) erosion control and wetlands habitat improvement projects in Las Vegas Wash.

View to the north of the incised channel of Las Vegas Wash, which defines the west boundary of the Larder Site. Note the erosion and advancement of the cut bank, which is impacting the site. *LCR photo by Alex Stephens*

HRA's surveyors found a few scatters of pottery shards and chipped stone artifacts on the surface of the ground at the site. The depth and richness of the site was not known until test excavations were conducted in 2006. The site is located on a terrace along Las Vegas Wash. Testing involved the excavation of parallel backhoe trenches across the terrace. Backhoe trenching allows archaeologists to quickly and effectively examine large areas within a site for buried cultural deposits and features.

The excavations exposed the buried remains of semi-subterranean dwellings, called pit houses, and a total of 56 pits, which were used for either food storage or roasting. HRA then excavated selected features that were exposed in the backhoe trenches by hand. Hand excavation is slower than using a backhoe, but provides more spatial control and is needed for the removal of fragile objects. The roasting pits provided charcoal samples of wood and burned food that were radio-carbon dated (C-14), and the storage pits provided pollen and macrobotanical remains that were collected to study what foods were stored in them.

The number of storage pits at the site distinguishes it from other known sites in the Mojave Desert. Why was the Larder Site a popular place to store food in underground pits? HRA's Field Director Rick Ahlstrom proposed that the site was a particularly good place to store food in pits because the gypsum soil is a natural desiccant that helped keep food stored in the underground pits dry.

Photo shows a flaked stone drill from the Larder Site. *LCR photo by Alex Stephens*

Photo shows a cross section of a roasting pit at the Larder Site recently exposed by erosion in a cut bank along Las Vegas Wash. The dark stained area contains sediment with charcoal and pollen that can be recovered and analyzed to determine what was in the pit. *Photo by Wetland Park volunteer*

When the laboratory analysis of the samples that were collected from the roasting and storage pits was completed, the results were surprising. As expected, the samples from the storage pits contained pollen and macrobotanical remains of wild plants that were gathered from the local area. However, what surprised the archaeologists was the discovery of maize (corn) pollen in several of the storage pits. Burned maize kernels and cobs were also found in the charcoal samples from the roasting pits. The C-14 dating of charcoal from the roasting pits greatly surprised the archaeologists.

One of the charred maize samples provided a C-14 date of 350 B.C. The Larder Site grew in significance because the archaeological record of the site provided the earliest evidence of farming in the Las Vegas Valley over 2,000 years ago. Additional refinements of the C-14 dates indicate that there were three distinctive periods of use at the site from 350 B.C. to A.D. 250, A.D. 400 to 1100, and A.D. 1100 to 1900.

In February 2014, Reclamation's Archaeologist James Kangas and SNWA's Archaeologist Nathan Harper worked together to develop a research plan for a geophysical survey of the Larder Site. Because archaeological excavation actually destroys cultural deposits and features, Kangas and Harper wanted to test the effectiveness of a geophysical survey to remotely sense buried features. They considered the potential yield of geophysical survey methods to be great.

Except for a geophysical survey of the prehistoric sites at the Springs Preserve, and of located walls and other buried structures associated with the Old Mormon Fort in Las Vegas, no similar research has been reported elsewhere in the Mojave Desert region. In this respect, the research at the Larder Site is on the cutting edge. The previously discussed backhoe trench excavations at the site examined

only a fraction of the total site area, leaving the remaining portion of the site in good condition and presumably with more intact buried pit houses and roasting/storage pits. In March 2015, SNWA contracted with HRA and Dr. Michael Rogers, an Associate Professor in the Department of Physics and Astronomy at Ithaca College in New York, to conduct the survey.

Dr. Rogers (left) and James Kangas (right) discussing the parameters of geophysical survey. LCR *photo by Alex Stephens*

A geophysical survey involves the use of sensing equipment to identify buried objects and structures in a non-destructive way. Two types of equipment were used at the Larder Site, a magnetometer and ground-penetrating radar (GPR). A magnetometer can be calibrated to easily recognize the unique magnetic properties that are characteristic of iron and steel, brick, burned soil, decayed organic materials and many types of rock. This is possible because different types of materials below the ground can cause local disturbances in the Earth's magnetic field that are detectable with magnetometers.

A GPR detects the reflected signals from subsurface structures. The travel time of the reflected signal indicates the depth. Subsurface objects, such as pits having stratigraphy (layered deposits), have unique reflections of their own. The data can be plotted as profiles, plan view maps isolating specific depths, or as three-dimensional models. Fine-grained sediments consisting of clays and silts like those found at the Larder Site have high electrical conductivity, which can cause loss of signal strength. One goal of this project was to determine the effectiveness of the GPR compared to the magnetometer at locating subsurface cultural features such as house pits, storage pits and roasting pits.

Ithaca State College geophysical graduate student conducting a magnetometer survey at the Larder Site. *LCR photo by Alex Stephens*

The proper calibration of the equipment is important because it affects the ability of the instruments to find buried features. When the magnetometer survey was started, Dr. Rogers promptly provided HRA with preliminary data showing the locations of several anomalies detected by the magnetometer. HRA easily identified these locations on the ground because the entire site had been gridded for mapping purposes.

Ithaca State College geophysical graduate students establishing a mapping grid at the Larder Site for the geophysical survey. *LCR photo by Alex Stephens*

Despite the overall goal of non-destructive testing, some archaeological excavation of buried features was needed to determine whether the magnetometer needed further calibration and to test for

false positives. HRA conducted excavations of two large circular anomalies that were found with the magnetometer. There was no evidence of these anomalies on the ground surface. As HRA's excavations deepened, the floors of two house pits became visible.

HRA's excavations positively verified the result of the preliminary magnetometer survey data, which successfully located the two buried house pits. There were numerous anomalies identified in preliminary data that have not been excavated.

HRA researchers excavating an anomaly identified by the magnetometer. As the excavation progressed, it was found to be a pit house feature. In archaeology, meticulous record keeping during fieldwork is a must! *LCR photo by Alex Stephens*

Dr. Rogers is currently processing the final magnetometer and GPR data at his computer lab back at Ithaca State College. Kangas and Harper are eagerly awaiting the report that will describe the result of the geophysical survey data.

The signature and reflective properties of features such as house pits, roasting pits and storage pits are unique to each feature type. The archaeologists are interested in conducting further research to verify the reliability of using data for identifying buried features, thereby precluding the need for destructive test excavation. Kangas and Harper think if the geophysical data can reliably be used to classify features throughout the Larder Site, this may be used as a tool for future archaeological research and preservation projects in similar environments throughout the Mojave Desert region.