Excavation Methodology at Eagle Cave

Profile Section Documentation and Sampling

Once the intact stratigraphy was exposed in a Profile Section, we used SfM to document the exposure. Taking between 150 – 200 photographs (depending on the size of the profile), we produced 3D models with sub-millimeter accuracy. Using the 3D models, we would export orthographic photos (below left) to assist in documenting and describing the profiles, and each stratigraphic unit (strat), in the field. In the evenings back in camp, we digitized the hand-drawn annotations on a drawing tablet (below right). These profile illustrations were then used to guide sampling and excavation.

In the Lower Pecos, just downstream from Langtry, Texas, Eagle Nest Canyon is one of the largest canyons of southwest Texas, and has been scene of archaeological investigation since the 1940s. Beginning with E.B. Sayles and J. Charles Kelly in 1933, the Witte Museum between 1934-1936, and finally UT Austin in 1963, archaeologists excavated a long, deep trench through the center of the site. Yearning vestiges of this trench remains today.

The 1963 UT excavations were minimally backfilled. The large trench through the center of the site, as well as the unit on the north side of the trench, were left mostly open. Since the 1960s, these trench walls have slumped, collapsed, and gradually eroded by foot traffic and wind, leaving a massive depression in the center of the site. Since the 1960s, these trench walls have slumped, collapsed, and gradually eroded by foot traffic and wind, leaving a massive depression in the center of the site.

When we began designing our research plan, we wanted to excavate the intact stratigraphy in a Profile Section, and precisely calculate the excavated volume of each stratigraphic unit. To create 3D models of the surfaces we used Structure from Motion (SfM) Photogrammetry.

SfM technology captures overlapping digital images of an object/area being mapped. It uses computer vision techniques to create a high-resolution 3D model of surfaces. It is an extremely low-resolution high-resolution topographic map, with geo-referenced, real-world coordinates (e.g., site grid or UTM coordinates), allowing precise measurements to be made from the modeled surface.

After we defined the stratigraphy on a profile we would decide how best to sample. In most cases we placed a narrow sampling unit directly adjacent to the documented profile. Using the profile illustrations to guide help guide us we were able to excavate each stratigraphic unit, collecting nearly all the matrix for analysis. In addition, we took SfM photos of the top and bottom surface of each stratigraphic unit. Using these models we were able to precisely map any artifacts and samples that were removed, as well as document precisely how we excavated the sampling unit. All of the SfM data could then be loaded into ArcGIS to show the exact depths we excavated on the original profile orthophoto (below left) and precisely calculate the excavated volume of each stratigraphic unit.

In the spring of 2013, Eagle Cave was one of 20 projects internationally included in a study of Low Impact, High Resolution: Ongoing Investigations of Eagle Cave funded by the Texas Archeological Steward Network; 3 New 2015 ENC Interns

Ongoing Analysis and Eagle Cave 2015

The major documentation technique we are employing prior to, during, and after excavation is Structure from Motion (SfM) photogrammetry. SfM is a digital photographic process to create high resolution 3D models. The basic principle by which a 3D surface is created using SfM is to take dozens, or sometimes hundreds, of overlapping photographs of the object/area being mapped. These photographs are then put into specialized software that matches each photograph up to other photographs of the same area to create a 3D “surface” from the 2D photographs. This 3D surface, essentially an extremely high-resolution topographic map, has geo-referenced, real-world coordinates (e.g., site grid or UTM coordinates), allowing precise measurements to be made from the modeled surface.

The 2014 Eagle Cave materials analysis just began – we have over 200 liters of sediment from which we hope to extract many kinds of data. Fortunately, colleagues from Texas and around the world are taking part. From bugs to burned rocks, cut leaf blades to fish bones, from phytoliths to phytoliths, we are taking a multi-disciplinary approach to learn as much as we can from the many samples we collected.

Looking ahead to the 2015 season, our focus will be on profiling, sampling, and stabilizing the south wall of the main trench. During the 2014 season we had an excellent core staff aided by experienced volunteers and educated collaborators. We hope to build on this success in 2015!

In 2014 the Ancient Southwest (ASWT) Project of Texas State University returned to Eagle Cave with the ultimate conservation goal of backfilling all holes and stabilizing the surface of the site. First, however, we want to learn as much as we can about the site without undertaking major excavation.

When we began designing our research plan, we knew we could take advantage of the existing units to expose the stratigraphy. However, we also knew from the previous work that the stratigraphy is anything but layer-cake – dozens of thin, hard-to-trace fragile “strats” (stratigraphic layers) amass thick layers of burned rock, and lots of disturbance caused by rodent burrows and human-dug pits—in short, extremely challenging stratigraphy. Once we expose the stratigraphy, how should we document and sample the complex layering while minimizing the overall impact on the remaining intact deposits? We decided to adapt Steve’s Strat System from his work at Colha, Belize in the early 1980s, and we coined the motto, "Low Impact–High Resolution,” meaning we want to learn as much as we can while doing the least amount of additional damage to the site. As the ASWT continues our ongoing exploration into the sites of Eagle Nest Canyon, this motto guides our research.

Profile Sections

Because of the previously excavated pits (by archaeologists, looters, and animals), we realized we would not have to excavate large units. Rather, we could take advantage of the sloped faces of the pits to clean back and expose intact stratigraphy. During the 2014 field season, we selected five different areas of the site (see map above) that we wanted to target. On each site, we removed the disturbed deposits and could identify intact stratigraphy, we began documenting and sampling the exposed layers. We call these exposures Profile Sections.

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