

Preliminary Results of Magnetic Gradiometry and Photogrammetric Imagery from La Playa, Sonora, Mexico (SON F:10:3)



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Abstract

Covering an area of nearly ten square kilometers, La Playa (SON F:10:3) is one of the most important archaeological sites in northwest Mexico. While La Playa has been best known for its Early Agricultural occupation, this research, funded through National Geographic, targets the poorly understood origins of the Trincheras Tradition. This poster presents initial results of magnetic gradiometry and photogrammetric imagery collected from the site in April 2017 as part of the ongoing binational project *Proyecto La Playa*. Along with magnetic gradiometry data collection, several unmanned aerial vehicle flights with a Trimble UX5 captured photogrammetric images of the site. This data has yielded the possible presence of irrigation canals, pithouses, and thermal features. With erosion damaging much of La Playa, this research documents at-risk features for future excavation.

Resumen

La Playa (SON F: 10: 3), con una superficie aproximada de diez kilómetros cuadrados, es uno de los sitios arqueológicos más importantes del noroeste de México. Aunque La Playa es reconocida por su ocupación en el periodo de Agricultura Temprana, esta investigación, financiada por National Geographic, tiene como objetivo caracterizar el inicio -todavía poco conocido- de la Tradición Trincheras. En este cartel se presentan las interpretaciones preliminares de la prospección magnética y las imágenes fotogramétricas colectadas en el sitio en abril de 2017 en el marco del Proyecto La Playa. Adicionalmente a la recolección de los datos magnéticos, se realizaron varios vuelos con un vehículo aéreo no tripulado con un Trimble UX5 con el que se capturaron las imágenes fotogramétricas del sitio. Estos datos han mostrado la posible presencia de canales de riego, casas en foso y elementos térmicos. Esta investigación documenta los elementos en riesgo por la erosión que afecta a gran parte de La Playa para posibles excavaciones dirigidas.

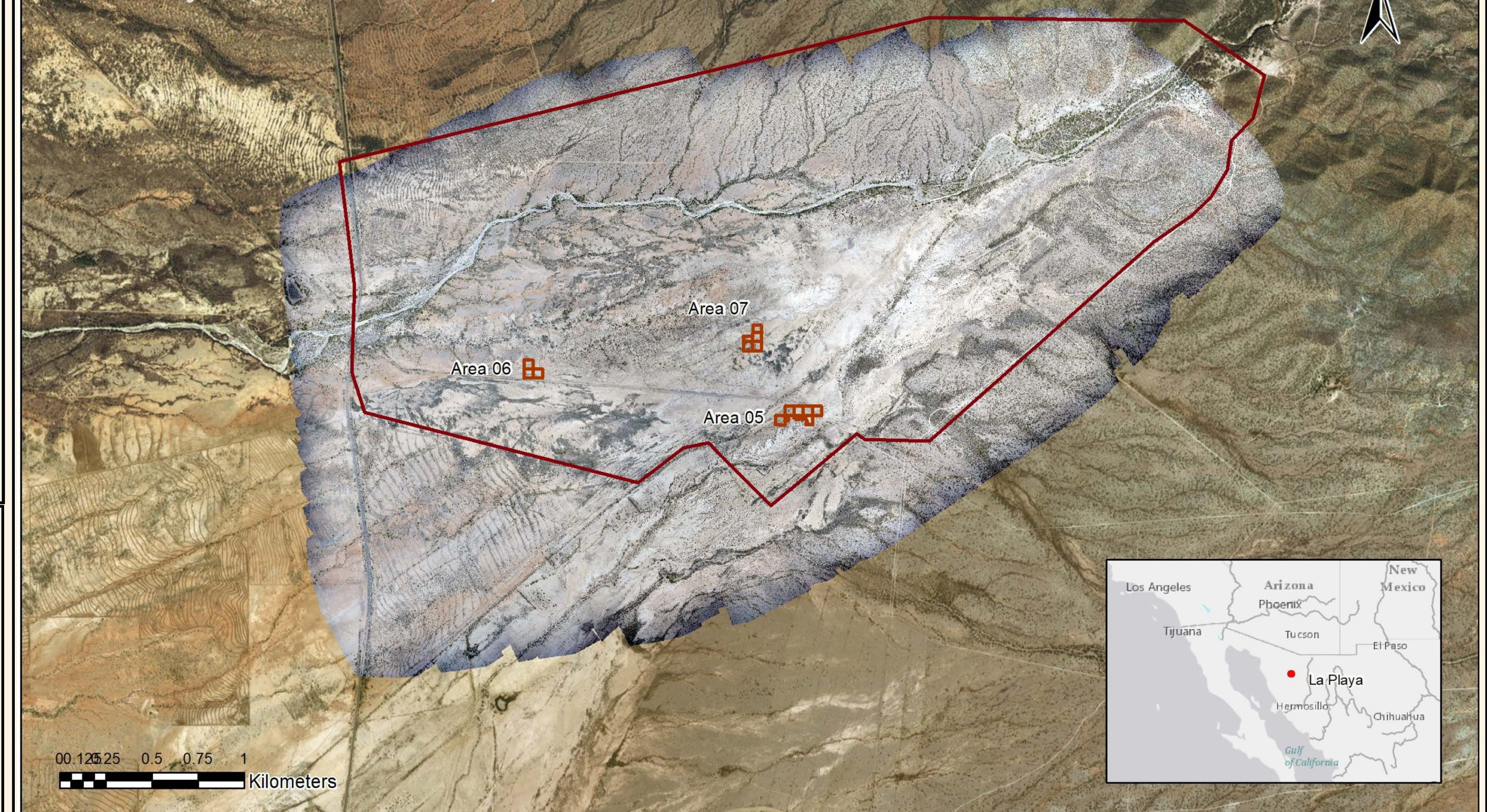
Methods for Data Collection

- Grids were mapped with a total station, then recorded with a Trimble.
- 3 areas were designated: Area 5, Area 6, and Area 7 (to continue numerical sequence begun by Rachel Cajigas).
- Grids measured 50x50 meters or were modified due to heavy soil deflation
- Grids were formed using tapes and ropes. Ropes were laid every 1 meter (50cm intervals) (north/south) with fiducials at every 10 meters (east/west).
- We used a Geometrics G-858 cesium vapor magnetometer, recording data at 10 intervals per-second.
- In all but two cases (in Area 5), grids were recorded bidirectionally.
- Magnetic Gradiometry data was processed with MAGMAP, Surfer 14 and ArcGIS
- We flew a Trimble UX5 at 250m above ground level across the majority of the official site boundary, as well as to the south of the boundary, where additional components of the La Playa landscape are located. We also flew a DJI Phantom 4 Pro Quadcopter at a 50m elevation over each of the magnetic gradiometry areas for higher resolution



Paula Hertfelder, Hunter Claypatch and Alejandra Abrego collecting data in Area 5

La Playa (SON F:10:3)



Site map generated using photogrammetric images taken from the UX5 Trimble. La Playa's site boundary is in red.

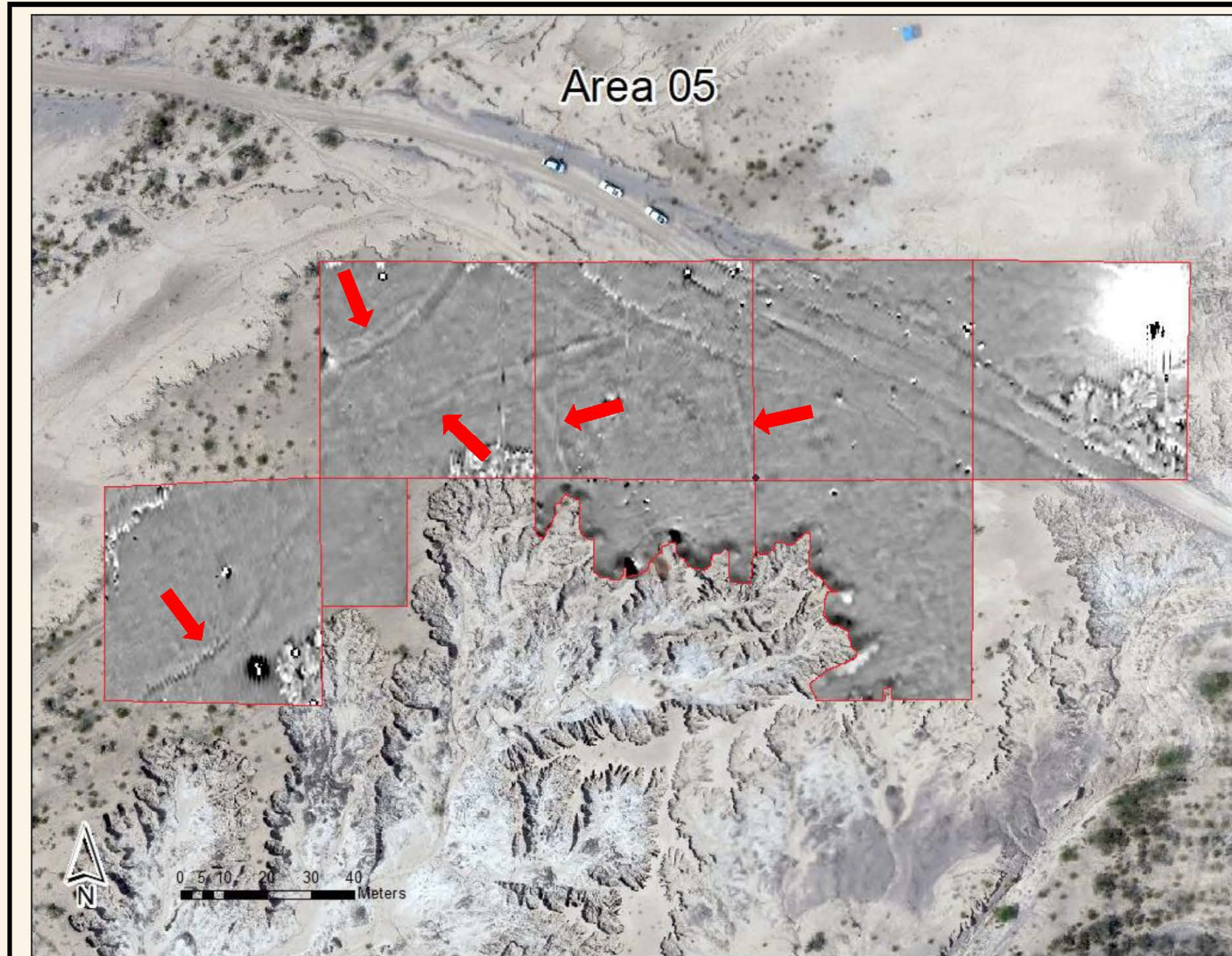
Photogrammetry



Christopher Lee launching the Trimble UX5 fixed wing drone

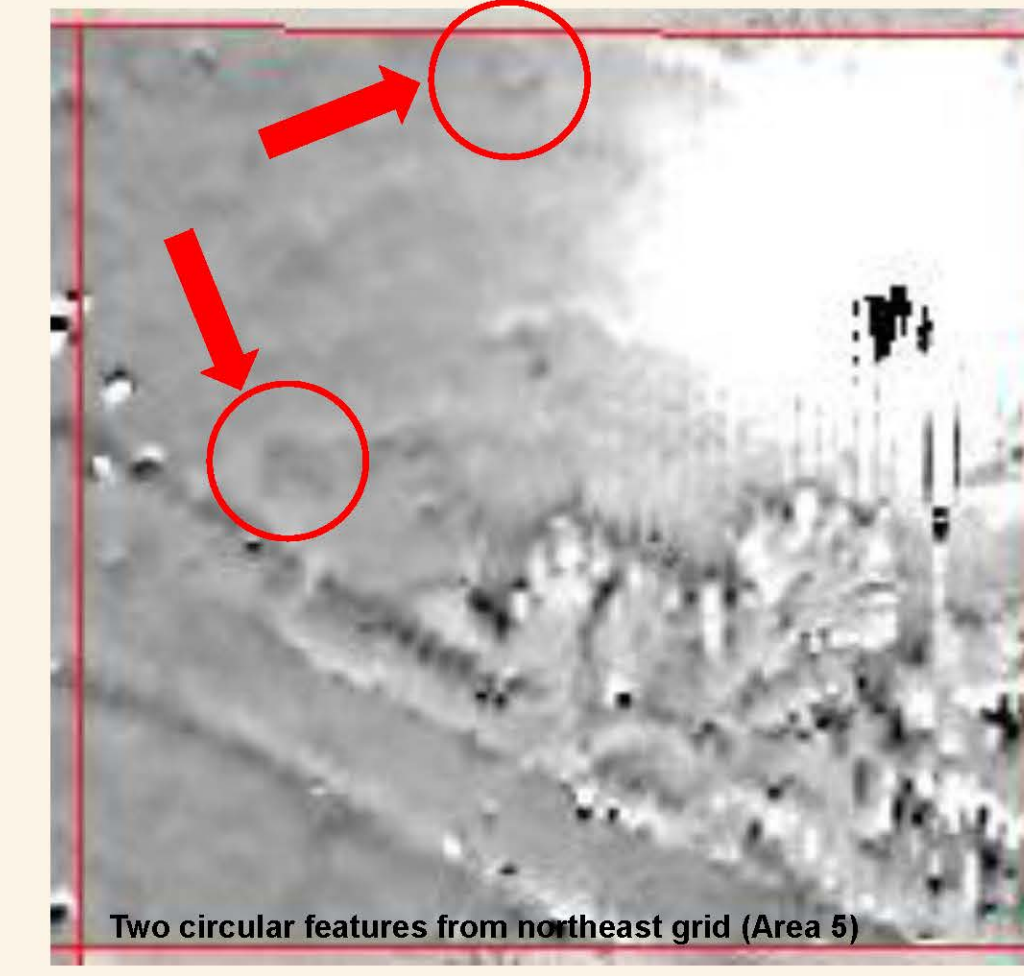
- Photogrammetric images from the Trimble UX5 provide 10cm resolution of the entire site
- Images from the Phantom 4 Pro provided a 3cm resolution of magnetic gradiometry survey areas
- Images are currently being processed with Pix4Dmapper software. Initial results are displayed in the map to the right
- Photogrammetric images will be used to create a DEM and a topographic map of the site

Area 05



This area was located south of a previously excavated Trincheras structure (Abrego et al. 2016). The grid transects a contemporary dirt road to the north, and contains heavily deflated soil to the south. Trincheras Lisa and Purple-on-red ceramics were present on the surface of northern portions of this study area.

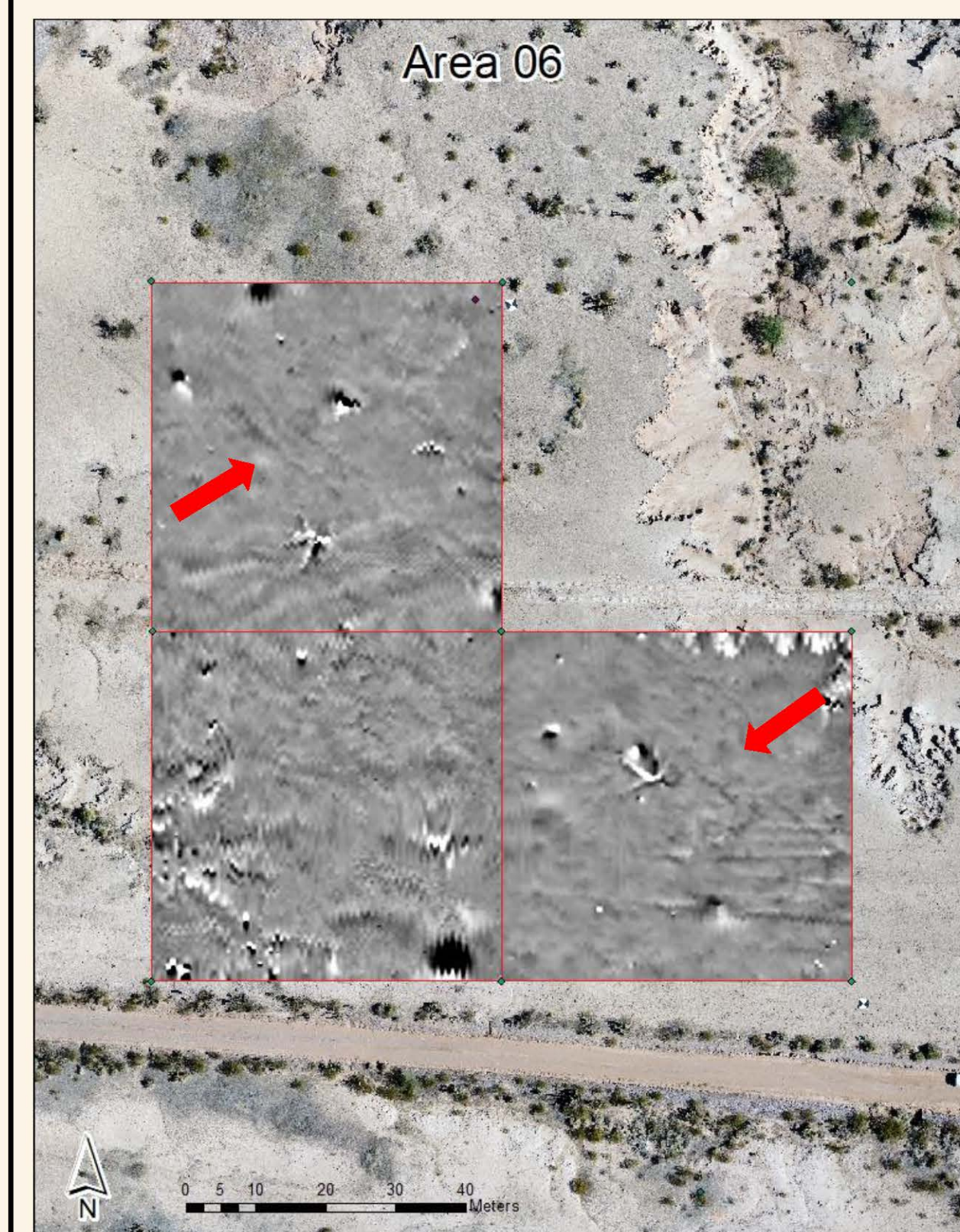
- The far northeast grid yielded two circular features that are consistent with previously excavated pit structures. Given their proximity to the previously excavated Trincheras structure, these features provide excellent areas for subsequent testing.



Two circular features from northeast grid (Area 5)

- Several (possibly 5) linear anomalies have been identified. While some of these anomalies may represent prehistoric irrigation canals, others may be the result of contemporary soil deflation.

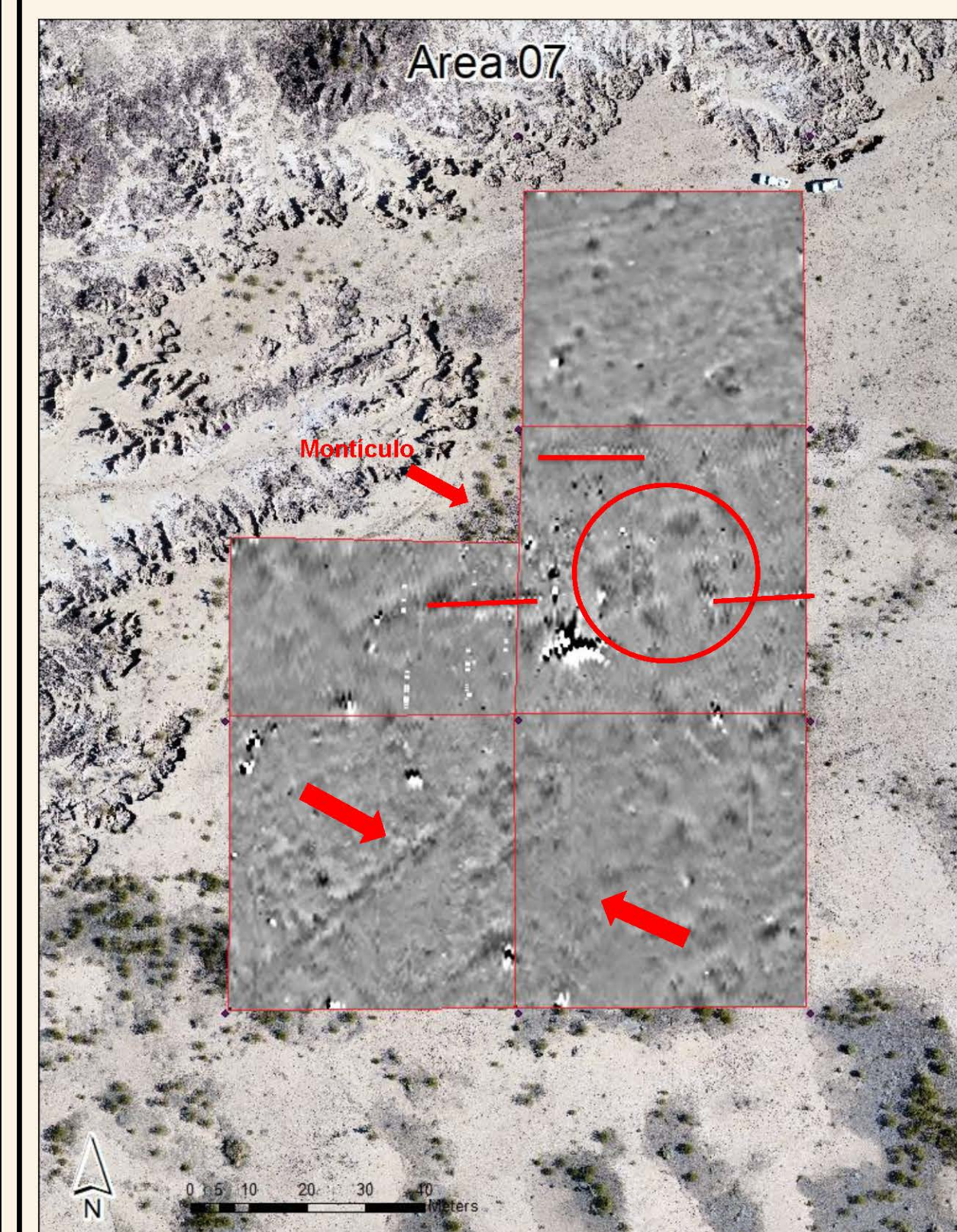
Area 6



Very little archaeological work had been conducted in Area 6. It was located north of a utilized road, and contained many historic metal artifacts that were removed from the area prior to data collection. The remains of a historic road also appear within the area.

- A prominent double-lined linear anomaly was observed in this area. This feature crosscuts two grids in a southeast direction.
- Subsequent research aims to continue targeting this area.

Area 07



This area improved subsurface knowledge in one of Cajigas' previous areas by targeting one of the site's *monticulos* (or large cultural mound of fire-cracked rock). Area 7 was also located near several previous INAH test-trenches.

- At least two linear anomalies are observed transecting northeast.
- The region to the east of the *monticulo* contains several potential features—including possible pit structures and/or thermal features.
- Three INAH test-trenches are visible in the data.

Discussion & Future Research

- Photogrammetric images, once fully processed, will produce high quality maps of La Playa
- Additional UAV flights in December of 2017 provide images of areas missed during the April 2017 fieldwork
- The area of geophysical remote sensing at La Playa has more than doubled since Cajigas' geospatial work.
- Two circular features in Area 5 represent possible pit structures. Further features may be represented in Area 7. Linear anomalies may represent possible prehistoric irrigation canals.
- As part of *Proyecto La Playa*, possible features will be targeted for test excavations.

References Cited

Abrego Rivas, Alejandra, Emmanuel Alejandro Gómez Ambríz, and Cynthia Isabel Vidal Aldana
 2016 Excavación de la Unidad 2016. In *Proyecto La Playa (SON F:10:3): Informe 2015-2016*, edited by E. Villalpando, J. Carpenter, and J. Watson, pp. 32-63. Centro INAH Sonora, Hermosillo.

Cajigas, Rachel
 2015 "Advances in Shallow Geophysical Prospection on a Floodplain Site in Sonora, Mexico: Identifying Irrigation Canals Using Magnetic Gradiometry." Poster presented at 127th Geological Society of America Conference, Baltimore, Maryland

2016 Geoarqueología de los canales de irrigación. In *Proyecto La Playa (SON F:10:3): Informe 2015- 2016*, edited by E. Villalpando, J. Carpenter, and J. Watson, pp. 64-96. Centro INAH Sonora, Hermosillo.

Carpenter, John, Elisa Villalpando, and Guadalupe Sánchez
 2009 La Playa: An Early Agricultural Period Landscape. *Archaeology Southwest* 23(1):14.

Carpenter, John, Guadalupe Sánchez, James Watson, and Elisa Villalpando
 2015 The La Playa Archaeological Project: Binational Interdisciplinary Research on Long-Term Human Adaptation in the Sonoran Desert. *Journal of the Southwest* 10(2-3):213-264.

Gallaga, Emiliano and Gillian E. Newell
 2004 Introduction. In *Surveying the Archaeology of Northwest Mexico*, edited by G. Newell and E. Gallaga, pp. 1-23. University of Utah Press, Salt Lake City.

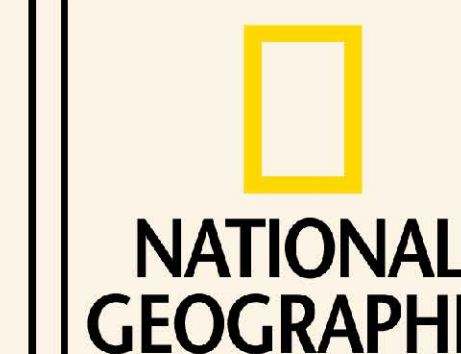
Johnson, Alfred E.
 1960 *The Place of the Trincheras Culture of Northern Sonora in Southwestern Archaeology*. Masters Thesis, Department of Anthropology, University of Arizona.

Morales Monroy, Juan Jorge
 2006 *Las Arenas de La Playa (SON F:10:3): Estudio de Composición Cerámica*. Thesis, Departamento de Antropología, Universidad de las Américas, Puebla.

Sauer, Carl and Donald Brand
 1931 *Prehistoric Settlements of Sonora, with Special References to Cerros de Trincheras*. University of California Press, Berkeley.

Acknowledgments

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Previous Research at La Playa

La Playa is located along the Río Boquillas in the Trincheras Municipality of Sonora (Gallaga and Newell 2004), and is the largest Early Agricultural Period (EAP) site in Northwest/Southwest. La Playa's unique geomorphology, and vast cultural deposition, were initially described by Sauer and Brand in 1931. While Alfred Johnson (1960) conducted the first testing at the site, further excavations were not conducted until Centro INAH Sonora's establishment of *Proyecto La Playa* in the 1990s (Carpenter et al 2009).

Ongoing work at La Playa examines the transition from the EAP to the subsequent Trincheras Tradition. It is presently unclear if the Trincheras tradition (ca. 450(?) -1450 CE) emerged via population influx, or if it was the result of an *in situ* development (Carpenter et al. 2015). Recent work through INAH's *Proyecto La Playa* unearthed a small structure at the site which produced the earliest Trincheras Tradition dates, however additional work is still needed (Abrego et al. 2016).

Research presented in this poster targets deposits believed to be associated with this transitional phase, and provides the most comprehensive geospatial coverage conducted on the La Playa landscape.



Previous geophysical remote sensing work demonstrates the success of magnetic gradiometry at La Playa. Rachael Cajigas (University of Arizona) collected fifty-seven 30x30 meter grids over four areas of the site. Cajigas' research identified several linear anomalies that were subsequently excavated by Centro INAH Sonora (Cajigas 2015; Cajigas 2016).