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Ancient Towns and New Methods: A GIS and Remote Sensing-Guided Archaeological Survey in the Western Nile Delta

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Archaeological sites are often acknowledged as the basis for regional studies of settlement patterning,[1] even as archaeologists have noted that the site concept itself has become more fractured.[2] Legislative developments[3] and Egyptological research Egypt since the early 19th century have intertwined to produce artifacts of land called "sites" or "antiquities" which have been artificially segregated and spatially bounded on the basis of overlapping bureaucratic and academic priorities and processes. However, in many cases the archaeological site boundaries that result ignore the behavioral and environmental factors in their own continual formation and/or destruction. The conceptualization of site in Egypt and the technologies of their investigation over the past two centuries have had a direct impact upon what places are considered significant for research and how they are mapped, and thus much of the Nile Delta floodplain has remained relatively unexplored. Such a circumstance stands in direct contrast to the Delta's potential contributions to a fuller narrative of Egyptian culture.[4] Examining a portion of the western Delta as a case study, this research proposes a broader behavioral definition of "site" based on the material remains of dynamic human-environmental interactions. A regional survey conducted under the aegis of the Durham University mission to Sa el Hagar allowed these ideas to be tested and refined with new geoarchaeological and archaeological data. These datasets have been assembled within a Geographical Information System to enable their integration and analysis with a variety of historical maps and remote sensing imagery.

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[1] Cherry 1993.

[2] Dunnel 1992; Tainter 1983.

[3] Khater 1960.

[4] van den Brink 1987.

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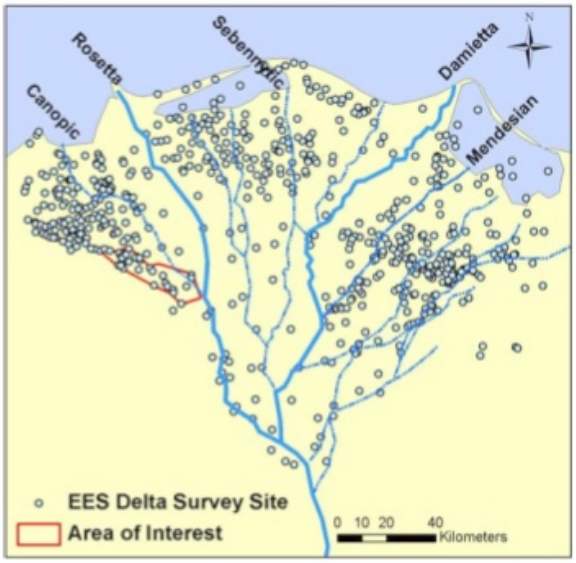

Fig 1. Author's area of interest in the southwestern Nile Delta. Sites identified by the Egypt Exploration Society Delta Survey are also shown. Though the EES' work suggests dense settlements in the area, little is known about their fluvial systems.

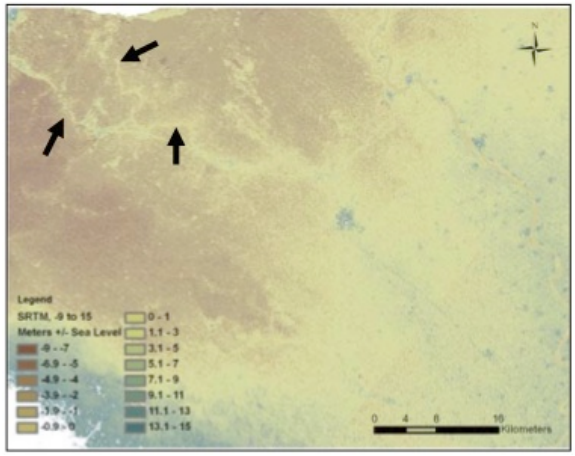

Fig 2. Shuttle Radar Topography Mission data of the western Delta displays the sandy bodies of relict water channels as localized, curviliear elevations.

Butzer (1976) has offered that due to the predictable flooding of the annual inundation, the lowland areas of the Nile floodplain remained unsuitable for permanent human occupation until the previous century. Assuming that permanent human settlement in the floodplain was confined to areas elevated above the annual flood, it was hypothesized that field boundary curvature and orientation as well as localized elevations will suggest former mound boundaries and hydrological features. It was further argued that controlled, systematic surface collection of artifacts on and around the surface of these areas will highlight areas of intensive human presence.[5] Ideas about former hydrology or human occupation from surface collection or field boundaries could then be independently checked with drill auguring. The sedimentological profile will show evidence of sandy and gravely soils for former waterways and organic, anthropogenic, artifact-rich soils in areas of intense human occupation. Sites would then emerge as non-definitive recommendations to bureaucratic authorities based on the analysis of material culture (both soils and artifacts) on the surface, in the soil profile, and in combination with analysis of remote sensing data.

Recent research by the Durham University mission to Sa el Hagar team has integrated GIS-guided analyses of remote sensing imagery, historical maps, ceramics, and geoarchaeological data to elicit a history of settlement in the western Delta, specifically in the southwest el Beheira governate (Figure 1). This data was primarily drawn from the historical archive of spatial data provided by the Center for Ancient Middle Eastern Landscapes (CAMEL) and previous archaeological fieldwork.[6] Ancient

[5] Bintliff 1988; Whallon 1979.

[6] Coulson & Leonard 1982; Egypt Exploration Society Delta Survey.

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hydrology was initially reconstructed from Shuttle Radar Topography Mission (Figure 2), Landsat MSS, TM, and ETM+ satellite imagery, Corona spy satellite photography, and historical map data. Sources of historical map and remote sensing observations were recorded as vector topologies and measured qualitatively according to the strength of the signature. In 2007 a list of forty-one archaeological areas of interest (AOIs) in the el Beheira province was developed in order to evaluate surface archaeological remains of mounds adjacent to hypothesized relict water features. Field research also built up a series of field observations of vegetation with respect to archaeological and hydrological features with the use of a GPS-enabled tablet PC provided by University of Chicago Humanities Computing (Figure 4). Ten AOIs received more in-depth study in 2008, including drill auguring, systematic surface collection, and topographic survey. Systematically arranged surface collection units and subsurface drill auguring transects were arranged both inside and beyond the visible boundaries of AOIs in order to test hypotheses about settlement extent. Topographic survey with a Leica Total Station supplied by CAMEL enabled the reconstruction of subsurface architectural features.

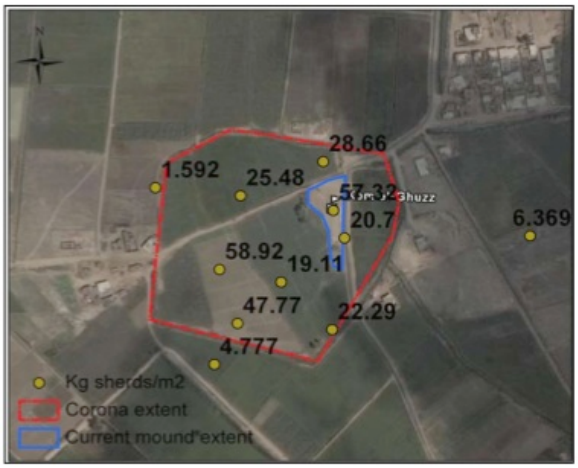

Fig 3. At Kom el Ghuzz, ceramic density drops off precipitously at "off-site" collection units, while remaining concentrated on once and currently visible portions of the elevated mound. The red line represents the extent of this mound in 1970 on a declassified Corona satellite photograph.

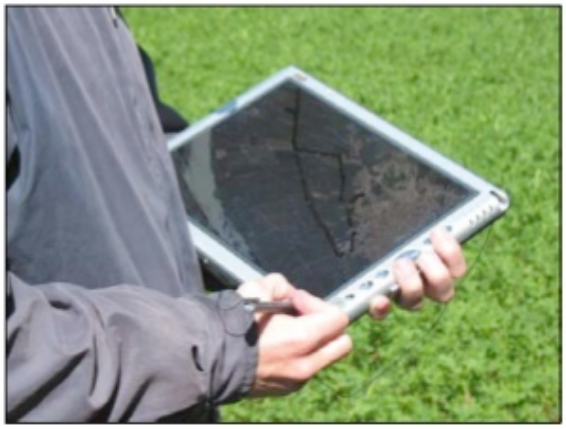

Fig 4. GPS-enabled tablet PC used for "walking through" satellite images and historic maps, enabling precise targeting of archaeological features

Integrating surface observations of historical maps, remote sensing, and artifact distribution with soil profiles elucidated the depth and extent of intense human occupation. In general, bounded areas of human behavior emerged from the material remains. Preliminary observations suggested that ceramic density drops off precipitously in "off-site" areas, whether by this term one refers to its current or historically visible vegetation and field boundaries (Figure 3). Settled mounds consisted of fine loamy sands and silts mixed with extensive ceramic and mudbrick fragments in the upper portion of the section. These settlements were often found(ed) atop buried medium-coarse sandy-loam levees of adjacent waterways, revealed both in the sedimentary profile and on historical satellite photos (Figure 5). A previously unknown and unmapped hydrological system of several meandering channels supplied this region with water during the mid-late Pharaonic to late antique periods (1250

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B.C.E. – 600 C.E.). The system appears to have been a distributary of the Canopic branch of the Nile, though it has not been noted in Classical sources.[7]

Knowledge of "sites" as historic areas of intense human occupation is emergent from several complementary datasets. Environmental factors affecting settlement, such as mound formation during the late Pleistocene and early Holocene, as well as water supply (and lack thereof) impacted the available areas for permanent human settlement. Visible clustering of material remains on the surface and in the sedimentological profile support boundaries that materialize from observations of satellite data. Future work will continue ceramic analysis and create density plots of ceramic spatial distribution by historical period. Overall, this work has contributed to a broader perspective on this little understood border land and developed a methodology for evaluating the untapped archaeological potential of the Nile Delta floodplain. Such a combination of prospection and groundtruthing fieldwork supports current trends in archaeological research of the Middle Eastern landscape.[8] Non-destructive methods of investigation have been emphasized in this research because archaeological sites are finite resources and a limited cultural heritage that must be carefully targeted and managed much like oil or water in today's society. It is hoped that future archaeological work will continue in a similar spirit of conservation.

Fig 5. A Corona image (1970) of Kom el Barud and environs. A silted-up, sinuous waterway winds along the west side of the bright sandy mound. Traces of the channel appear as a series of dark cropmarks. A transect of cores was placed to sample the sediments of floodplain, channel, and settlement mound.

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Ashraf Abdulrahman, Egyptian Supreme Council of Antiquities representative
Mustafa Abou Hussein, Egyptian Supreme Council of Antiquities representative
Yasser Mohammad Nada, Egyptian Supreme Council of Antiquities representative

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7 Ball 1942.

8 Hritz 2005; Parcak 2007; Ur 2003; Wilkinson 2003; Wunderlich 1989.

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