Methodological advances in recording housepit stratigraphy: Using GIS to integrate disparate data

Matthew L. Sisk[1], Guy Cross[2] and Suzanne Villeneuve[3]

1: Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University: Matthew.Sisk@sunysb.edu

2: Terrascan Geophysics, Vancouver BC GCross@terrascane.ca

3: University of Victoria, Suzanne_Villeneuve@sfu.edu

Abstract

The complex occupation history of housepits has been a long standing issue in the Mid-Fraser region and has received little methodological attention. Work on the South Terrace of Keatley Creek begins to combine systematic micromorphological sampling, extrapolation of micromorphological information using remotely sensed data, and integration of this information with detailed artifact plotting into a spatial database to assist in reconstructing the depositional histories of these structures. GIS work at the site is also developing a method for digitizing old excavation data into a modern spatial database encompassing the entire site grid. Results will help to facilitate comparative analysis.

Introduction

The late prehistoric record of the Mid-Fraser Region of British Columbia has been the focus of intensive investigations into the evolution and organization of complex hunter-gatherer communities (e.g., Stryd 1979; Hayden 2000; Prentiss et al. 2005). The long term excavation program at Keatley Creek has provided some of the most comprehensive data sets for dealing with these issues (Hayden 1997, 2000; Hayden and Spafford 1993; Lepofsky et al. 1996). Excavations at the site have primarily involved full coverage of occupation floors to examine the organization of social units, inter-housepit variability and the internal ranking of corporate group households. Yet, the varied use life of these structures, rebuilding and abandonment histories of these structures can result in exceedingly complex stratigraphy (e.g. Hayden 1997, 2000; Goldberg 2000).

Recent debate concerning the occupation history of large structures has called into question previous stratigraphic interpretations and proposed a revised occupation history of these villages (Prentiss et al. 2003). With the goal of continuing to address issues concerning the occupation history of individual structures as well as the site as a whole, methodological approaches are being developed to refine recording and interpretation of housepit stratigraphy. Methodological goals include using a geospatial database for accurate plotting of artifact and feature location and orientation, and stratigraphic contacts, combined with detailed stratigraphic and micromorphological analysis to refine understanding of depositional components. These data are used to assist with interpretations of high resolution geophysical data, which is then applied to further guide excavations. Initial components of these approaches and pilot testing in Structure 112 on the South Terrace are presented here. Future work will incorporate results from micromorphological analysis.

Methodology

Creating a spatial database

First, the site datum was located, using magnetic north, the site grid was re-established with a Leica Total Station (EDM) (Figure 2). The accuracy of this grid was verified by checking coordinates for house-pits in the main area against those recorded on old site maps (Figure 1). The EDM was moved to the south terrace and tied into the grid by back-shooting onto the site datum. Excavation datums for five of the individual housepit excavations (HPs 9, 107,108,112, and 116) were then recorded with the EDM (Figures 4 and 6). This allows us both to plot excavation data within the larger site grid and to link to separate housepit excavations with each other.

Following this, a brief topographic study of the areas of the south terrace surrounding the housepits was completed. A series of ~ 1800 topographic points were recorded with the Total Station. The topography of the areas between housepits 9, 107, 108, and 116 was also recorded, but because of time constraints the topography of the area between these housepits and HP 112 was not recorded (see Figure 3 for an example).

The topographic points were then used to create interpolated Digital Elevation Models (DEMs) using the 3d Analyst functions or ESRI ArcGIS (Figure 3). Because of the relatively smooth topographic relief of the surface the Spline method of topographic interpolation was chosen. Topographic maps at 10 cm intervals were then created from these interpolated surfaces.

Referencing other data

First, excavation data from archived plan sheets was referenced into the site grid. This was done by creating shapefiles representing each excavation unit in ArcGIS (Figures 5 and 6). Plan sheets were then scanned and referenced to the shapefile of their unit (Figures 7 and 8). The artifact and feature data are then vectorized and stored as point or polygon shapefiles (Figures 9 and 10). Trench sections and preliminary Ground Penetrating Radar (GPR) transects are also being included in the spatial database (Figure), together with localzed micromorphological data.

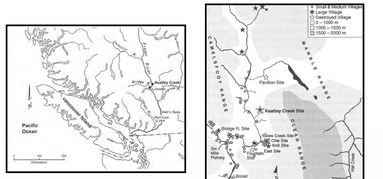

Figure 1: Context of Keatley Creek and the South Terrace (Maps courtesy of B. Hayden)

Figure 2: Using the total station to record topography

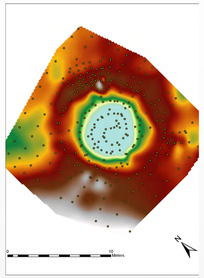

Figure 3: Topographic points and interpolated surface for HP 112

Figure 4: Contour lines and excavation datum for HP 112

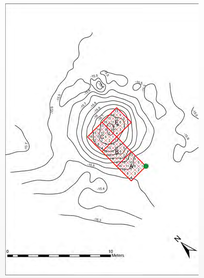

Figure 5: Excavation grid associated with HP 112

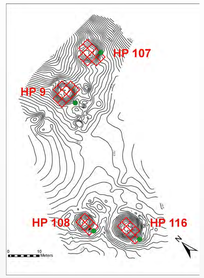

Figure 6: Excavation grids and topographic data for HPs 9, 107, 108, 116

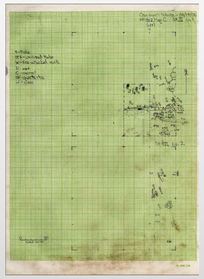

Figure 7: Scanned excavation sheet for HP112

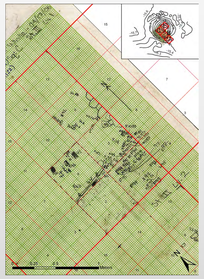

Figure 8: Excavation sheet referenced to grid

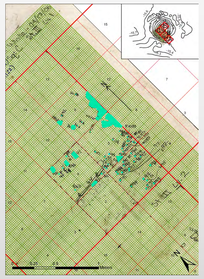

Figure 9: Digitization of artifact and feature data from excavation sheet

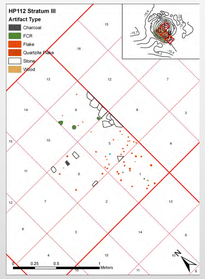

Figure 10: Digitized artifacts

Pilot-Scale Ground Radar Investigations

Following excavations and subsequent micromorphological sampling in Structure 112, ground penetrating radar (GPR) scans were acquired to investigate potential for remote interpolation and extrapolation of archaeological information. Georeferenced transect locations are indicated in Figure 6. Ideally, radar scans would be acquired prior to excavation to permit direct correlation between radar reflectivity and archaeological features, including significant stratigraphic horizons, related depositional units and isolated deposits. In the present case, transects were sufficiently offset from back-filled excavations to avoid interference due to related scattering of the radar pulse. Radar scans were acquired using a GSSI SIR-2000 digital radar with 400 MHz antenna.

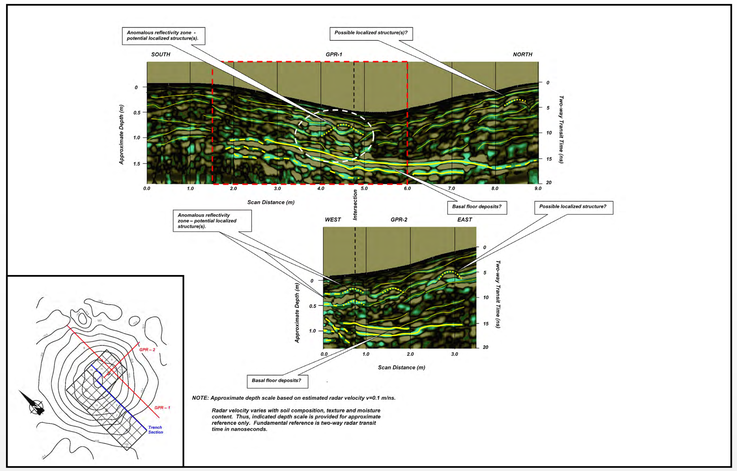

Figure 11: Preliminary Ground Penetrating Radar Data

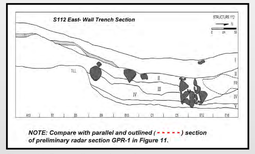

Figure 12: East wall trench section

Resulting radar cross-sections are displayed in Figure 11. Preliminary analysis and interpretation presented here was undertaken in absence of archaeological information as a "blind test". In general, interpreted radar stratigraphy appears to be roughly consistent with corresponding trench sections (e.g. east-wall trench section in Figure 12) and suggests that GPR can be usefully employed to guide further excavations and for efficient extrapolation of stratigraphic information and related micromorphological data.

Works Cited

Goldberg, Paul (2000) Micromorphological Aspects of Soil Formation at Keatley Creek. In The Ancient Past of Keatley Creek, Volume I: Taphonomy, edtied by B. Hayden, pp. 81-94.
Hayden, Brian (1997) The Pithouses of Keatley Creek. Harcourt Brace College Publishers, Fort Worth.
Hayden, Brian (2000) The Ancient Past of Keatley Creek: Volumes I-III. Archaeology Press, Burnaby, British Columbia.
Hayden, B. and J. Spafford (1993) The Keatley Creek Site and Corporate Group Archaeology. B.C. Studies 99:106-139.
Lepofsky, D., K. Kusmer, B. Hayden and K. Lertzman (1996) Reconstructing Prehistoric Socioeconomies from Paleobotanical and Zooarchaeological Data: An Example from the British Columbia Plateau. Journal of Ethnobiology 16:31-62.
Prentiss, W., M. Lenert, T. Foor, N. Goodale, T. Schlegel (2003) Calibrated Radiocarbon Dating at Keatley Creek: The Chronology of Occupation at a Complex Hunter-Gatherer Village. American Antiquity 68(4):719-735.
Prentiss, W., J. Chatters, M. Lenert, D. Clark and R. Boyle (2005) The Archaeology of the Plateau of Northwestern North America During the Late Prehistoric Period (3500-2008LP): Evolution of Hunting and Gathering Societies. Journal of World Prehistory 19(1):47-118.
Stryd, Arnold (1978) Reports of the Lillooet Archaeological Project No. 1. National Museum of Man, Mercury Series No. 73. Ottawa.

Poster generously printed by: Dayton & Knight Ltd. CONSULTING ENGINEERS