Building a Geodatabase for Archaeological Remains at Tumamoc Hill, Tucson

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Overview

- The 2005 UA Archaeological Field School
- Tumamoc Hill
- Data Collection Methods
- The Geodatabase
- Results
- Future Plans

UA Archaeological Field School

- Two field schools each year
  - Summer: at high elevation
  - Spring: in the Tucson basin
- The Spring School has traditionally focused on the Hohokam
  - Marana Mound Site
  - Tumamoc Hill
  - University Indian Ruin

Spring, 2005 Field School

- A collaboration between the Department of Anthropology, The Arizona State Museum (ASM), and the Center for Applied Spatial Analysis (CASA)
- Faculty

  Gary L. Christopherson, Paul R. Fish, and Suzanne K. Fish
- Graduate Students:

  John F. Chamblee, Mathew Hill, R. Emerson Howell, Phillip O. Leckman, and Todd Pitezel
- Undergraduates

  Emilee Ellsworth, Nicole French, Richard Gilmour, Jerry Gray, Lauren Kingston, Margaret Neff, Andrzej Proczka, Estee Rivera, Stephen Summers, and Jessica Webber

2005 Field School Emphases

- Landuse landscape as the interface between societies and their environments
- Societal institutions for the organization of population and territory
- The development of a spatial database that can be used for both data management and analysis

Goals: Education ←→ Production

- Education
  - Learn how to collect data using different technologies
  - Learn how to create a spatial database that would be useful in managing resources, and in surface analysis
  - Determine the best methods to map different feature types
- Products
  - Base map/database
  - High resolution surface map
  - A comparison of mapping technologies

Tumamoc Hill

Prehistoric Tumamoc

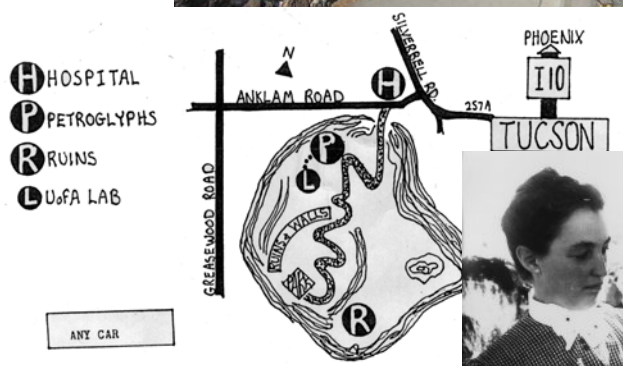
- First period of construction/occupation was during the *Early Agricultural* period between 500 and 300 BC
  - Constructed large *terraces,* characteristic of *trincheras* sites found throughout southern Arizona and northern Sonora
  - Earliest Hohokam evidence for public architecture
- During the *Tortolita Phase:* 400-500 AD
  - Summit was the site of large village (why?)
  - More than 100 pit houses

Archaeological Features at Tumamoc

- Massive/Encircling terrace walls
- Domestic terrace walls
- Enclosures
- Miscellaneous wall lines
- Rock art
- Artifacts
- Bedrock mortar/cupule/ nuttin' holes
- Bedrock "slick"/metates

Tumamoc in Recent Years

- A source of volcanic rock
- A destination for antiquity hunters
- Home of the Desert Lab
- The host of a number of University sponsored experiments
- Location of many communication towers
- A favorite walking route



Available Technology

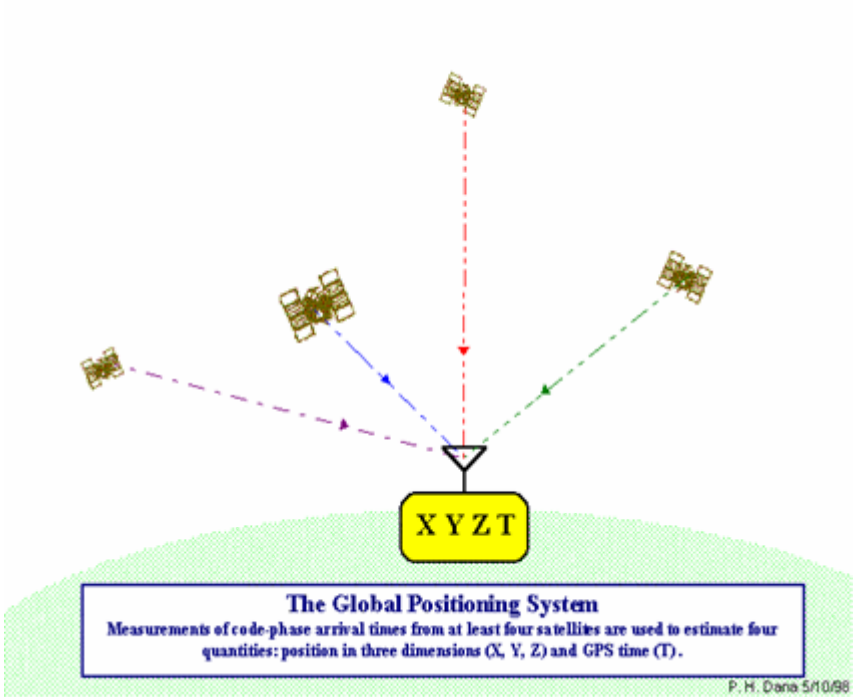
- Hardware
  - 2 Leica total stations
  - 3 Trimble GeoXT GPS devices
  - Plenty of PC's
  - Large format plotters, b/w and color laser printers
- Software
  - Proprietary software for total stations
  - Trimble's TerraSync data collection software
  - ESRI's ArcPAD data collection software
  - ESRI's ArcGIS software

Total Station

- Uses the station and a reflector on a rod
- Measures direction, distance, and angle
- Calculates *x, y, and z*
- Variety of models with different levels of sophistication
- Ours determine position with great accuracy, but have limited data collection capabilities

GPS

- GPS uses the time it takes a microwave to travel from a satellite vehicle to a GPS receiver to trilaterate x, y, and z
- GPS have varying degrees of accuracy and data collection capability
- Ours have good, not great accuracy, and excellent data collection software



Data Collection

Archaeological and modern features at Tumamoc are divided vertically

Slopes have large, linear features

Summit has smaller point and area features

Slope Collection

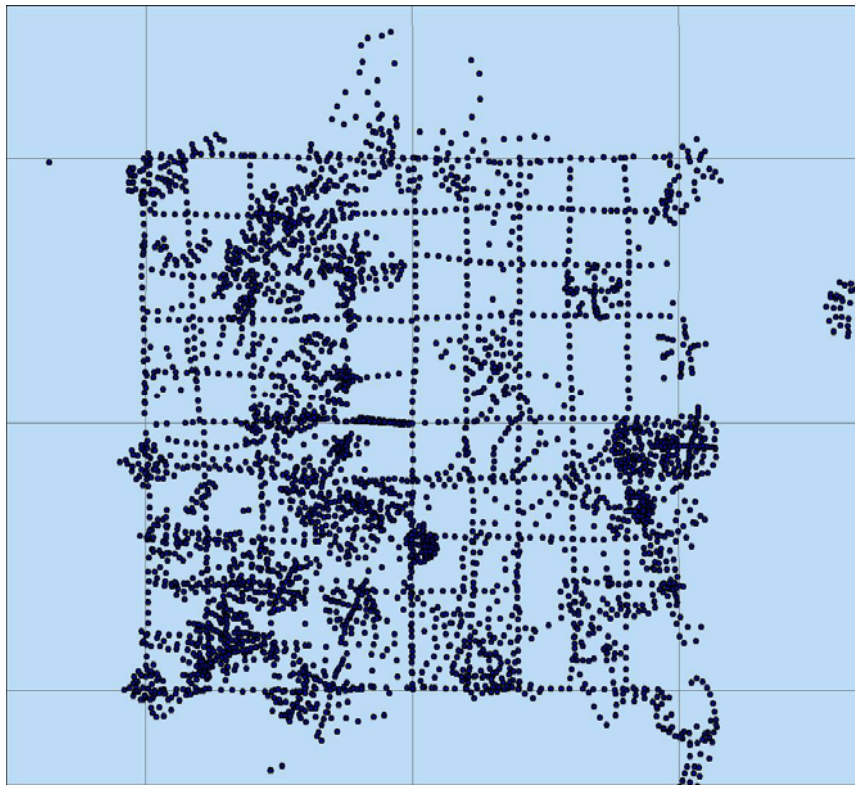
One student recorded the features with the GPS

While two students formed a (short) picket line and looked for features that might be associated with the feature being recorded

Summit Collection

On the summit, collection was done with a total station

Data was collected in a grid pattern, with points or clusters of points for individual features

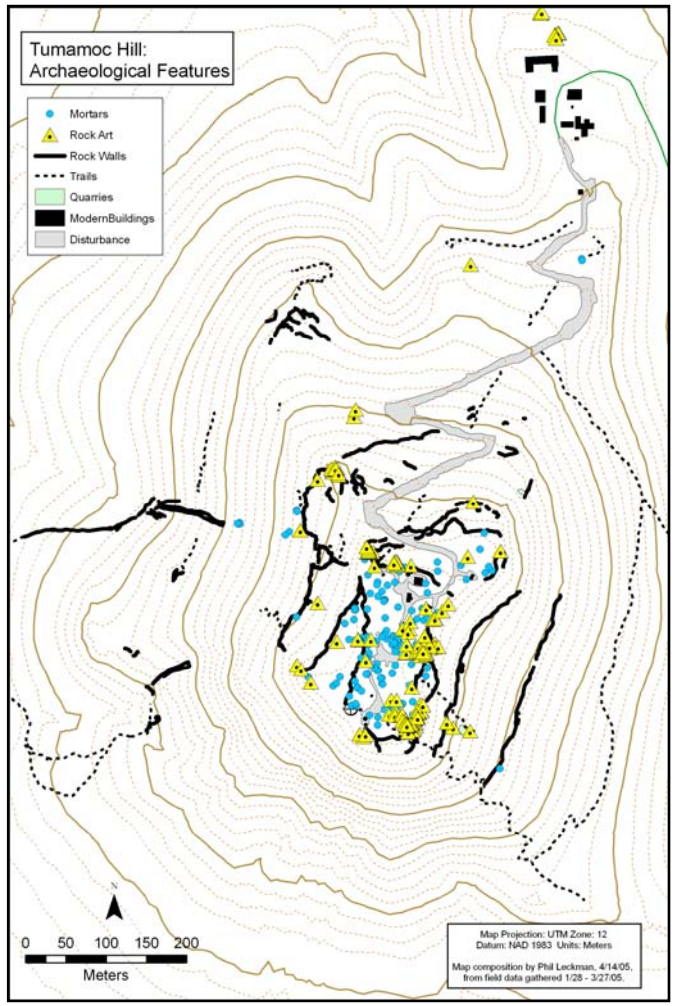


A Sample of the Results – 15 field days

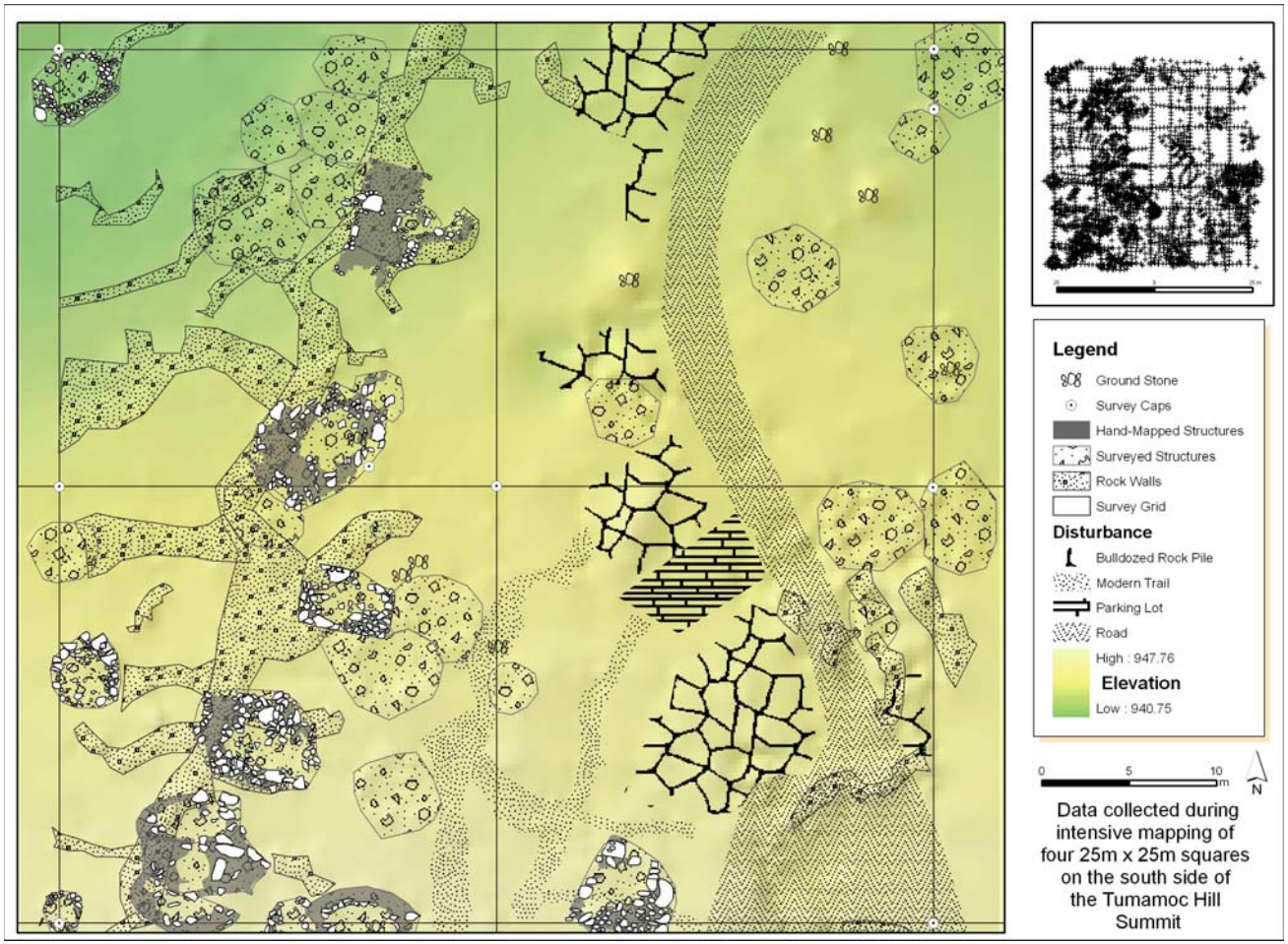
- Collected over 1000 features using GPS and total station
- Created a high resolution surface map
- Discovered 148 previously unknown burials
- Spatial information added to the rock art catalog
- Mapped all massive terraces
- Compared GPS to TS
- Education – spatially aware students

Results: Spatial Database

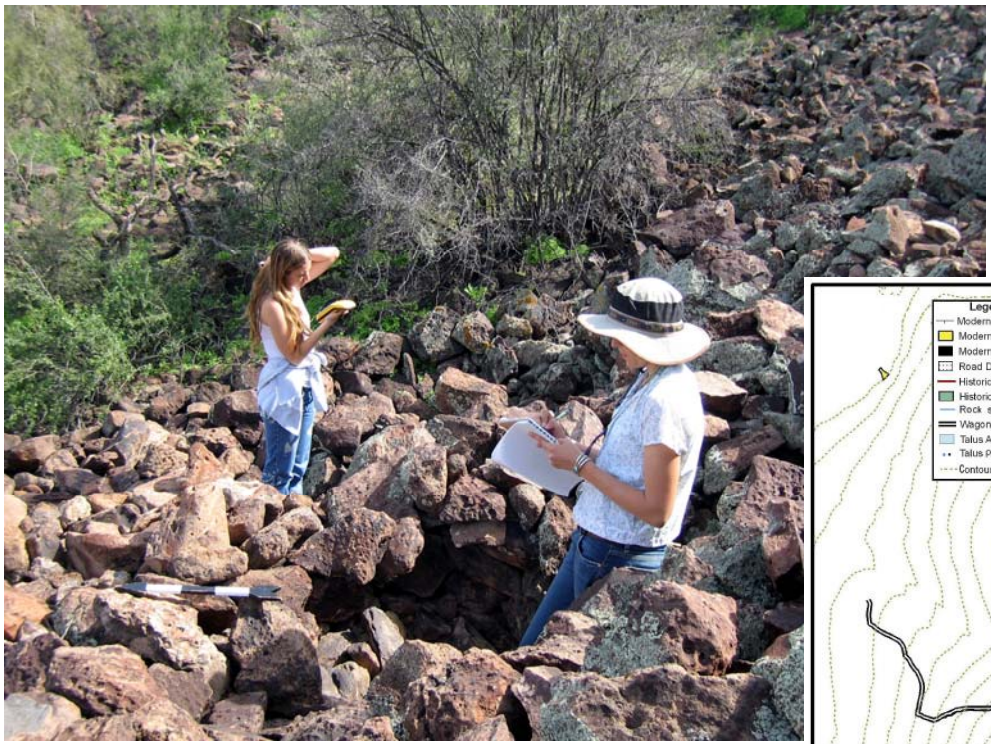
- Prior to 2005, no comprehensive database of archaeological features
- After 2005, an increasingly comprehensive spatial database
- Improved management of the site

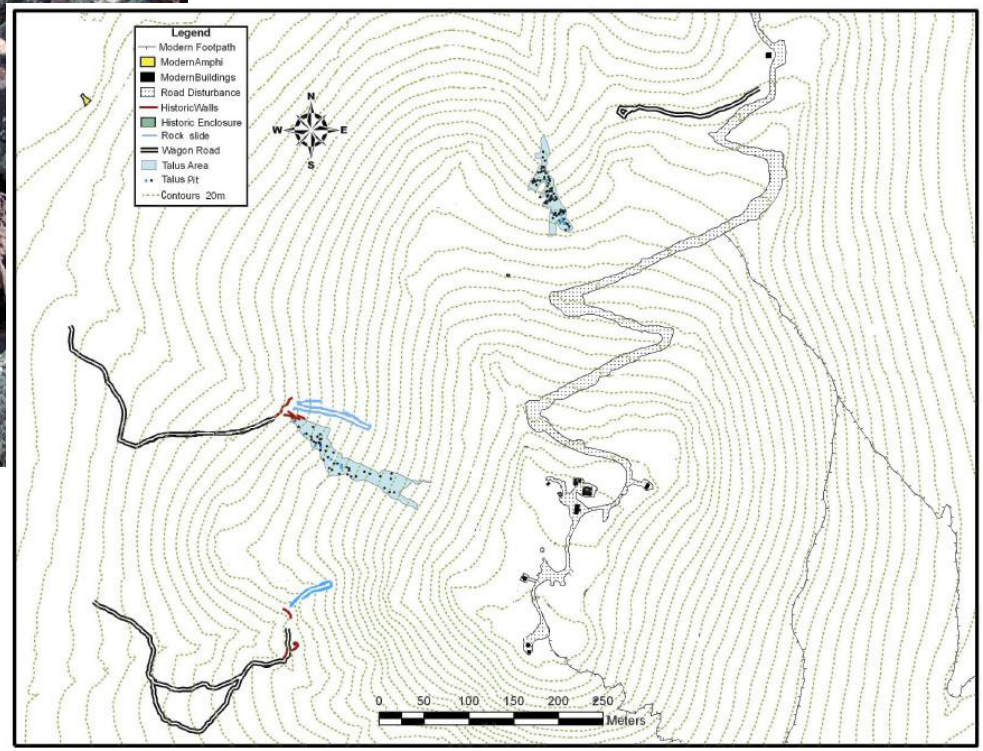


Results: High Resolution Data on the Summit

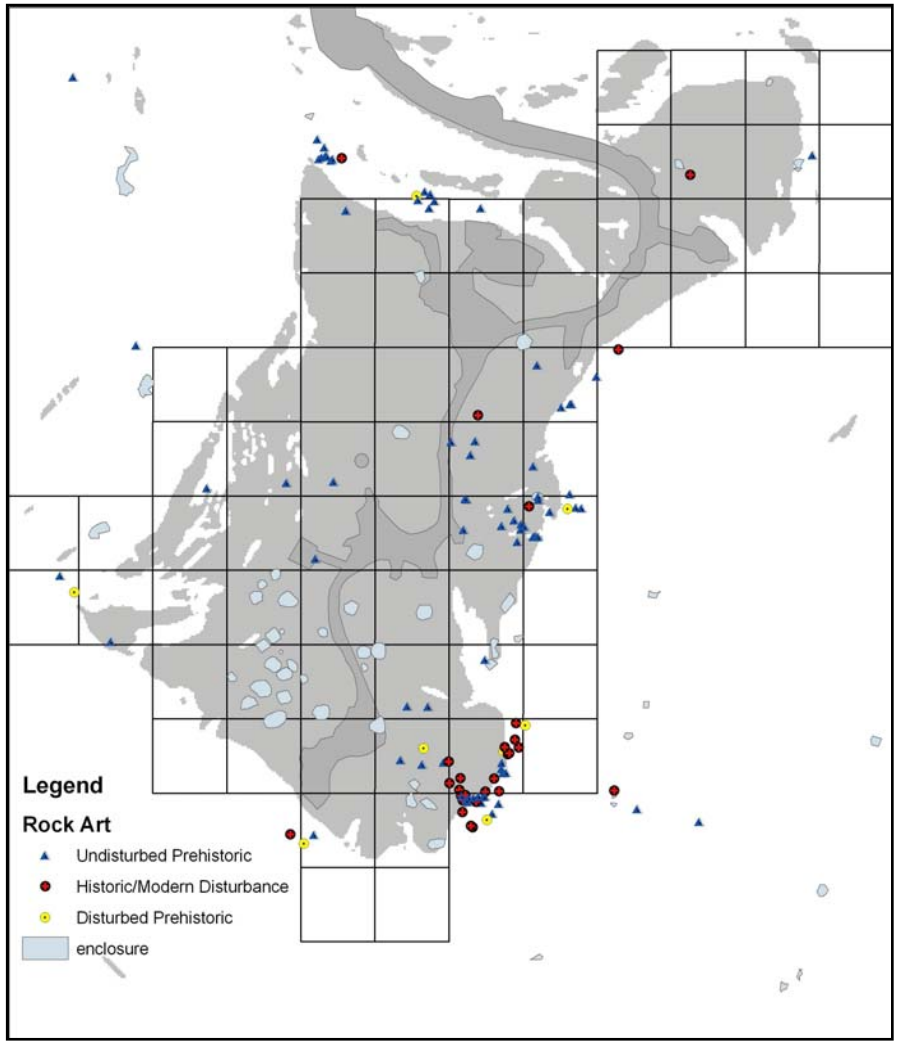


Results: Talus Pit Burials



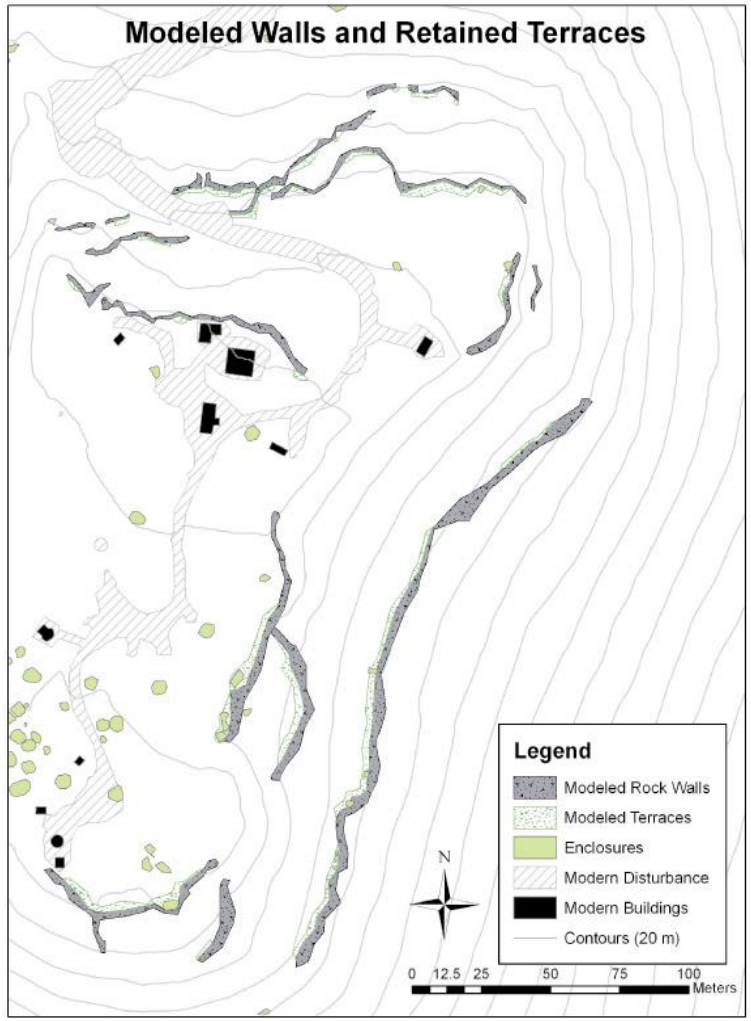


Results: Rock Art Catalog



Results: Terrace Walls

- 43 massive terrace walls recorded
- Located from lower slopes to hilltop
- Size
  - 5 → 252 meters long
  - 1 → 9 meters thick
- Function?
  - Defensive?
  - Agricultural?
  - Habitation?
  - Symbolic?

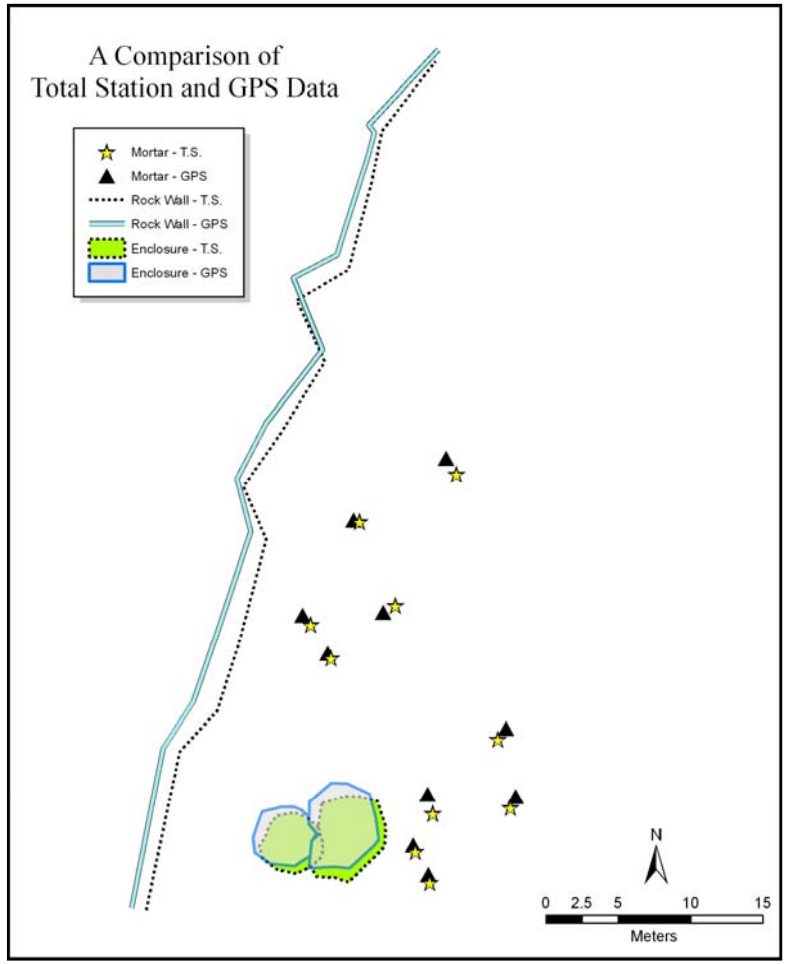


Results: TS vs GPS, or Accuracy vs Production

Processing Step	Person Minutes for Total Station	Person Minutes for GeoXT
Equipment set up	34	1
Collect spatial and attribute data for 10 points	15	10
Collect spatial and attribute data for a wall line	20	5
Collect spatial and attribute data for enclosures	20	14
Upload data to PC	10	1
Differential correction	0	1
Export to GIS format	3	0.5
Edit Features	3	0
Create Feature Class	3	0.5
Attribute Features	20	0
Totals	**128**	**33**

Results: TS vs GPS, or Accuracy vs Production

- A question of how much more accurate
- Mean difference between TS and GPS was 88 centimeters
- GPS is great for features larger than this difference
- TS is preferable for features smaller than this difference



Education & Production Goals Were Met

- Education
  - Learn how to collect data using different technologies
  - Learn how to create a spatial database that will be useful in managing resources, and in surface analysis
  - Determine the best methods to map different feature types
- Products
  - Base map/database
  - High resolution surface map
  - A comparison of mapping technologies
  - Whatever else we found along the way

Future of this Project

- 50 of the 52 grid squares on the summit are waiting for high resolution data collection
- There are a large number of features on the plains surrounding Tumamoc Hill
- We will begin examining these in the Fall, and perhaps return with the field school in the Spring