KATHLEEN D. MORRISON

Patterns of Urban Occupation: Surface Collections at Vijayanagara

The expanded role of surface materials in archaeology (cf. Lewarch & O'Brien 1981) is, in part, a by–product of the increasing focus by archaeologists on issues which require large–scale spatial information. That is, cultural activities take place in space as well as through time, and it is incumbent upon us, as researchers, to explore the spatial as well as temporal dimension of the past. The way in which human groups organize their use of space, and the factors conditioning this use of space are important archaeological issues. Recognition of distributional patterns in the archaeological record constitutes the first step in developing understanding of the physical, social, and other conditions which act to create the material record we see. Exploitation of the natural and cultural landscape creates a physical record which may or may not be buried.

Beyond the value of surface artifacts for indicating the presence of sub–surface features, such as site locations, the distribution of such materials may also serve as the source of inferences about the scale of occupation (e.g. Sanders et al. 1979) and the nature and layout of specialized activities. On a regional scale, surface indicators constitute the major class of information for settlement pattern studies. Attempts, at this scale, to describe surface materials in a continuous fashion have been termed 'siteless' surveys (Dunnell & Dancey 1983; Thomas 1975). Such surveys record and analyse individual cultural elements such as artifacts and features, whether or not they are found in discrete clusters or sites.

Within sites, extensive horizontal excavations may provide spatial information; similar data are available from the surface of sites. Surface artifact collections (Brumfiel 1987; Redman & Watson 1970; Redman 1987) and analyses of structural remains (Fritz et al. 1984; Jansen 1984) represent sources of information complementary to those of excavation. Surface remains are not unambiguous reflections of subsurface features, however. Exposed artifacts, in particular, are subject to numerous post–depositional

processes, including seasonal rainfall (Hirth 1978), plowing (O'Brien & Lewarch 1981), and colluviation (Tolstoy & Fish 1975) which alter both size and distribution of the surface assemblage. Recognition of the impact of post–depositional processes on surface assemblages does not negate their value. First, it must be made clear that buried assemblages are also not direct reflections of past activities (cf. Binford & Sabloff 1982). Excavated archaeological horizons were once on the surface (Dunnell & Dancey 1983), and thus subject to the same processes as contemporary surface remains. Assessment of the relationship between surface and sub–surface remains should be an arena of inquiry rather than impediment to the use of surface materials.

There exist numerous experimental studies of surface materials, particularly relating to plow zones (Ammerman 1985; Ammerman & Feldman 1978; Binford et al. 1970). Ammerman (1985) notes that artifacts found on the surface in a plowed area represent only a sample of the total number of artifacts in the plow zone. Further, the size and nature of this sample may vary from collection to collection depending on specific surface conditions (Ammerman 1985; Tolstoy & Fish 1975). Thus, collections made at different times even within the same area may not be directly equivalent, although the relational patterns may be comparable. In the following discussion, collections from two different valleys within the same site, Vijayanagara, collected in different years, are discussed. While overall frequencies are much higher in one case, it is difficult to unambiguously assign this difference to cultural factors. For this reason, emphasis will be placed on the comparison of general patterns.

Spatial Organization at Vijayanagara

Since 1980, the Vijayanagara Research Project has been involved in documenting and analysing the organization of space from surface remains in the medieval city of Vijayanagara. This investigation has focused primarily on structures. Three principale zones of the city having at least general functional implications have been defined – Sacred Centre, Royal Centre, and Urban Core (Fritz, Michell & Nagaraja Rao 1984). Only the Royal Centre and the Urban Core are considered here. The former is architecturally well–defined, and consists of a cluster of walled enclosures surrounded by its own ring of fortification walls. The Urban Core, also contained within massive walls, surrounds the Royal Centre. Although Fritz et al. (1984) consider the Royal Centre to be part of the Urban Core, here the labels are used to differentiate between the two. Thus, the Urban Core refers to

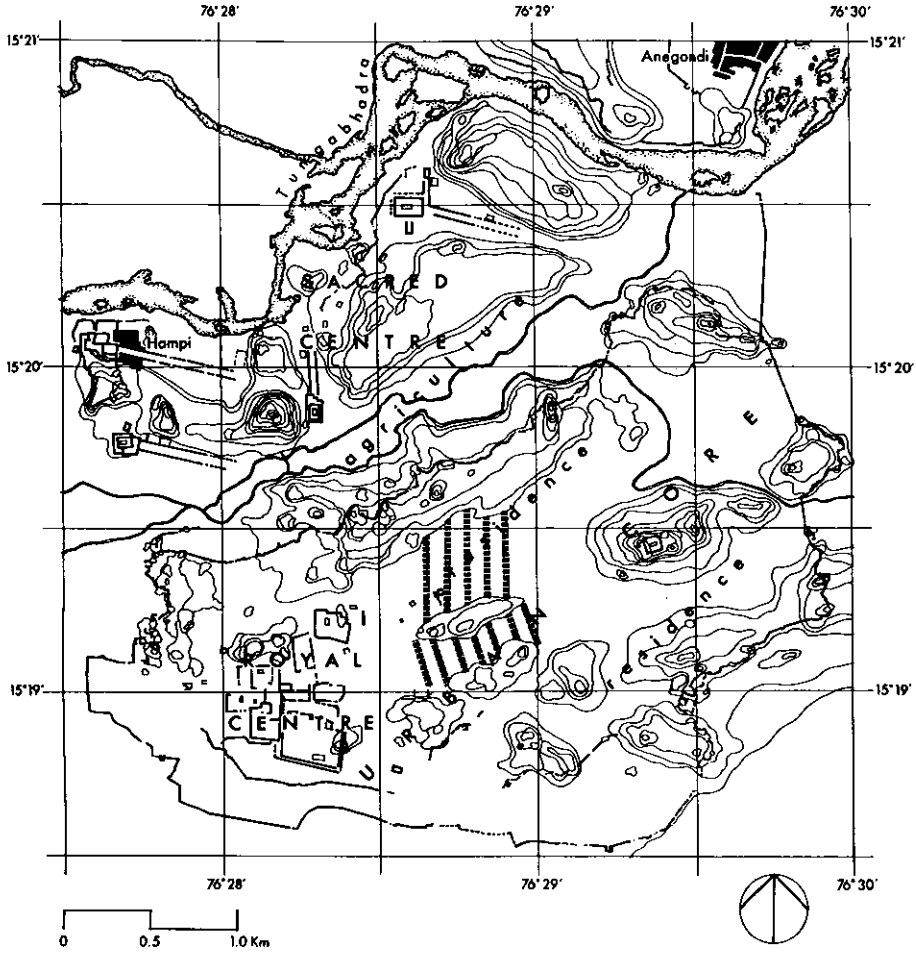

Fig. 1 – City of Vijayanagara with areas of surface collection indicated.

the non 'royal' portion of the city center.

More recently, this program of surface documentation and analysis has been extended to include artifacts as well as structures. In 1984, a surface collection of ceramics and other portable artifacts was made by Dr Carla Sinopoli (1986) in the East Valley, a long northeast–southwest oriented valley falling mostly in the Urban core (fig. 1). A portion of the East Valley sample area did fall in the Royal Centre; the two zones are separated by a gateway and the remains of a fortification wall. Immediately to the north of this area is the Northeast Valley in which an extensive surface col-

lection was carried out in 1987. Preliminary analyses from the latter collection reveal a number of interesting patterns in the organization of space in this valley, and isolate differences between the two valleys which may serve to refine understanding of functional and social zones in the city of Vijayanagara.

The Northeast Valley runs parallel to the East Valley. Both valleys have a similar linar, northeast–southwest oriented configuration, although the Northeast Valley is somewhat broader and longer. It is bounded on the north and south by granitic ridges. The north ridge rises gently from the valley floor, while an abrupt transition from level ground to massive granite boulders characterizes the south ridge. This configuration effectively prevented building on the south ridge. Solid rock proved no barrier to construction where the slope allowed, however, and many structures perch atop granite boulders and outcrops, attached to the rocks via black basalt pegs. The north ridge was apparently a zone of intensive building activity, as the abundant remains of stone structures attest. The structures of the north ridge include numerous masonry structures which appear to be residential (Fritz 1985).

The west end of the valley extends a short distance into the Royal Centre. The boundary between the Royal Centre on the west and the Urban Core on the east is marked by a monumental gateway and associated fortification walls. Most of the valley lies within the fortified Urban Core of the city, however. Now largely under dry–farmed fields, this valley contains abundant evidence of past structures, both standing and fallen.

Surface collections were focused in the west end of the Northeast Valley, covering an area approximately 600 m long and 300 to 400 m wide. The western portion of the sample area falls within the Royal Centre. At this end, the valley contains several temples which line the Northeast Road (Nagaraja Rao 1983a; Fritz, Michell & Nagaraja Rao 1984), one of the main routes of transportation in the city. This road passes through the valley, through the outer walls of the Urban Core, and eventually to Talarighat, the river crossing to the town of Anegondi. At least two branches of this road appear to lead to the north ridge of the valley (Fritz, Michell & Nagaraja Rao 1984). At the eastern end of the valley is the Muslim quarter. This collection came to the edge of, but did not extend into the Muslim quarter.

The East Valley Collection

Surface artifact collections in the East Valley were designed in part to obtain materials for detailed analysis of ceramic rim morphology (Sinopoli

1986), in order to define occupational and social differences across the valley. Differences in the intensity of consumption of materials, notably ceramics, may be marked between civic and domestic contexts. Within the same functional context, social differences may greatly affect the quantity of vessels used and the patterns of discard. Thus, it may be difficult to isolate exactly which factor or what combination of factors are determining the observed distribution. Several strong patterns did emerge from the East Valley collections, patterns which will be compared to those from the Northeast Valley. Based in part on Sinopoli's (1986) East Valley collections, a number of expectations about the distributions of surface materials were developed. Expectations are also based on the architectural evidence (cf. Michell n.d.), which forms the foundation of the zonation discussed above (Fritz et al. 1984). The excellent preservation of structural remains on the surface provides a unique opportunity to relate structures with artifacts, an opportunity generally possible only through excavation (Redman & Watson 1970; Tolstoy & Fish 1975).

In the East Valley, earthenware ceramics were clustered into high density zones (Sinopoli 1986). Ceramic densities were higher on the Urban Core side of the sample area and were also high on either side of the gateway in the Royal Centre enclosure wall. Architectural evidence in the East Valley suggests a greater amount of space is devoted to 'public' architecture in the Royal Centre (Sinopoli 1986) and less in the Urban Core. In this valley, the highest densities of iron and iron slag were also found in the Urban Core. Slag was found throughout the valley, but several relatively discrete clusters were noted near the east end of the sample area (Sinopoli 1986). Thus, in the East Valley, low ceramic and slag densities appear to be associated with the Royal Centre, perhaps as a result of the greater concentration of public architecture and élite residence there. That is, although élites might be expected to have greater access to ceramics than lower classes, élite residences are also much more widely spaced. Alternative vessels of porcelain or metal may also account for a lower quantity of earthenware sherds in areas where architecture suggests high status residence.

The significance of distributions of Chinese porcelain sherds is difficult to assess, given the rarity of that category of artifact. Sinopoli (1986) notes little apparent patterning in the distribution of these sherds, although there do seem to be proportionally more in the Royal Centre.

If the East Valley proves to be an appropriate model for the neighboring Northeast Valley, then overall ceramic densities should be higher in areas not devoted to public architecture. In the Northeast Valley collection area to be discussed below, the larger temples bordering the Northeast

Road are found in the Royal Centre portion of the valley. The elephant stables of the Royal Centre lie approximately 400 m to the west of the collection area. Roadside temples are fewer and smaller outside the Royal Centre enclosure wall, and no easily identifiable large 'public' structures are located on this side. Thus, if ceramic densities are sensitive to the presence of such architecture, higher densities should be found in the Urban Core. Iron slag is also expected to be concentrated outside the Royal Centre. The presence of a 'palace' structure outside the Royal Centre is of particular interest; this structure is located in the Northeast Valley, near the north ridge. Although in a poor state of preservation, the characteristic U–shaped plan and multiple levels are evident (NSc/1, Michell n.d.). This west–facing palace is placed within a rectangular enclosure. Surface distributions may reflect the presence of this structure, most likely in terms of low earthenware ceramic densities, low slag densities, and perhaps high densities of porcelain.

Expectations regarding artifact distributions cannot, however, rely solely on functional and social criteria. Patterns of refuse disposal as well as post–depositional forces also play a role in the eventual distribution of materials. As noted above, plowing may have significant effects on the location and quantity of surface artifacts (Ammerman 1985). For this reason, an estimation of the last date of plowing was made for each collection unit, based on the appearance of the soil. Over a meter of colluvium has accumulated in the Northeast Valley since the major period of Vijayanagara occupation. This is quite clear from the foundation levels of structures throughout the valley, some of which have been cleared (e.g. Nagaraja Rao 1983b). The effects of this accumulation of sediment relate to what Tolstoy & Fish (1975) term the 'attenuation effect'. That is, overall artifact densities on the surface are decreased.

Whether artifact concentrations directly reflect past settlement or only do so indirectly, via maintenance and dumping, cannot be determined prior to analysis. In this case, the recording strategy was structured so as to be able to assess the degree of correspondence between structures and artifacts. Areas with high concentrations of rubble, presumably from fallen structures, were recorded, as were distances of collection units from standing structures.

Post–depositional processes may have affected structures as well as artifacts. Many of the houses of the lower classes were undoubtedly constructed of ephemeral materials, and are no longer visible on the surface of the site. There is no reason to believe, however, that *none* of the numerous small rubble structures represent domestic buildings. The Portuguese

traveller Domingo Paes, who visited Vijayanagara in about AD 1520, notes the presence of many merchants' houses and the shops and houses of craftsmen along a large street in the city which may be that running through the Northeast Valley (Sewell 1984). Bedrock and block mortars may also come from household contexts; most but not all of these found in the Northeast Valley come from the 'structural zones', areas in or near standing or fallen structures. Subsurface testing will be required, however, to cast much light on the exact nature of non élite Vijayanagara households.

The Northeast Valley Collection

The 1987 collection covered a large area (fig. 2) at a low intensity in order to obtain general distributional patterns in a short period of time. One hundred and nine 12.56 sq.m units were completely collected; all analysis was done in the field and no artifacts were removed from the valley. A stratified systematic unaligned collecting strategy (Haggett 1965; Plog 1976) was employed. This collection strategy is a slight variation on a systematic sample, where coverage is entirely even across the sample area. Here the systematic portion of the sampling design is represented by evenly spaced north–south transects placed fifty meters apart. This ensures that all areas receive equal attention. The stratified systematic unaligned sample introduces a random element within the constraints of the systematic placement of sample units. The purpose of this random element is to avoid potential problems of periodicity. That is, if both cultural features and sample units are evenly spaced, the sample units might either fall on all or none of the features, and give a distorted view of the nature of the distribution. To locate collection units in the Northeast Valley, thirteen north–south transects of varying length were spaced at 50 m intervals across the sample area. Each transect was divided into 50 m segments and a point was chosen randomly from each segment. These points became the centers of 4 m diameter circular collection units. Five additional units were collected where random number selection created large areas without collection units. In all, over 522 Kg of ceramics were collected, weighed, and recorded. Other materials analysed include: iron, iron slag, brick, plaster, as well as miscellaneous artifacts such as Chinese porcelain, beads, and steatite cylinders. Observations on slope, vegetation, plowing, and proximity to structures were also made. Preliminary analysis of this information isolates important differences between the Northeast Valley and the adjacent East Valley, and point to the importance of maintenance and refuse disposal in understanding the complex use of space in urban contexts.

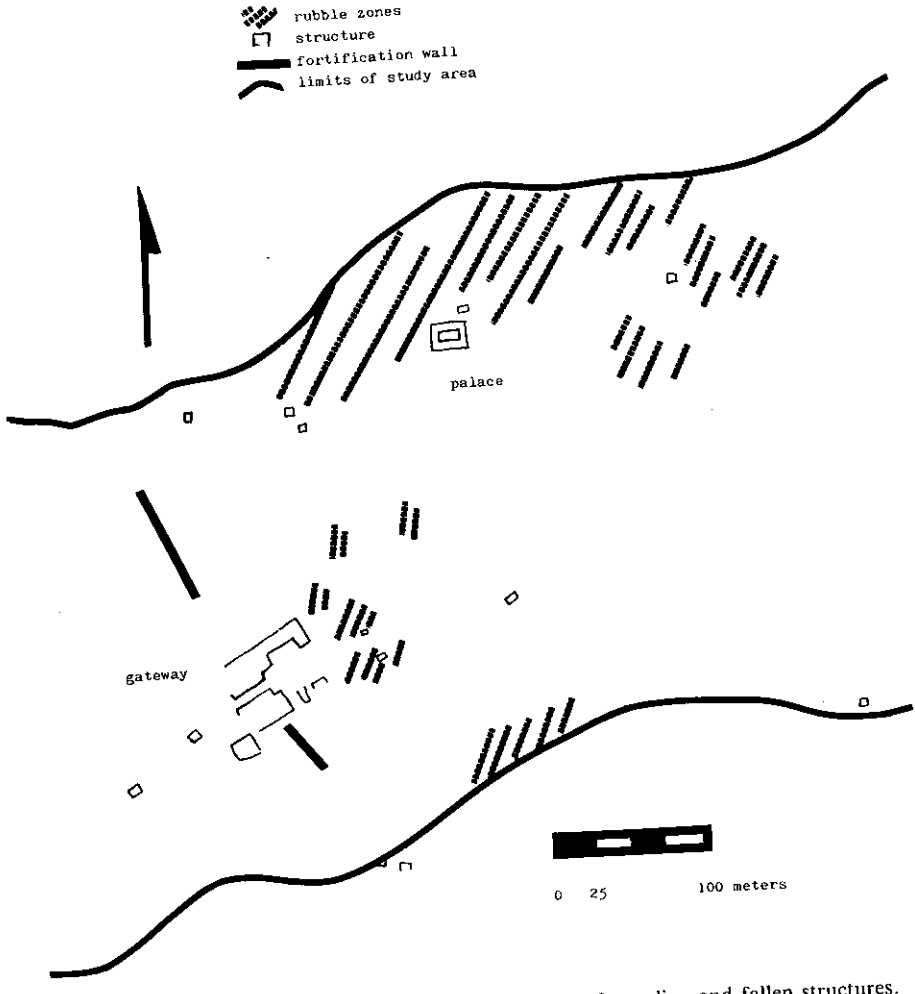

Fig. 2 – Northeast Valley collection area. Position of standing and fallen structures.

Earthenware ceramics display a highly patterned distribution in the Northeast Valley (fig. 3). As in the East Valley (Sinopoli 1986), there exist localized areas in which a very high density of ceramics are found; over 11 Kg of sherds were collected from a single four meter diameter unit. The concentration of ceramics in these areas cannot be explained either by slope angle or by evidence for recent plowing. The absence of a strong association of ceramic density with either slope or recency of plowing suggests that the clustered surface distribution of earthenware ceramics is not solely

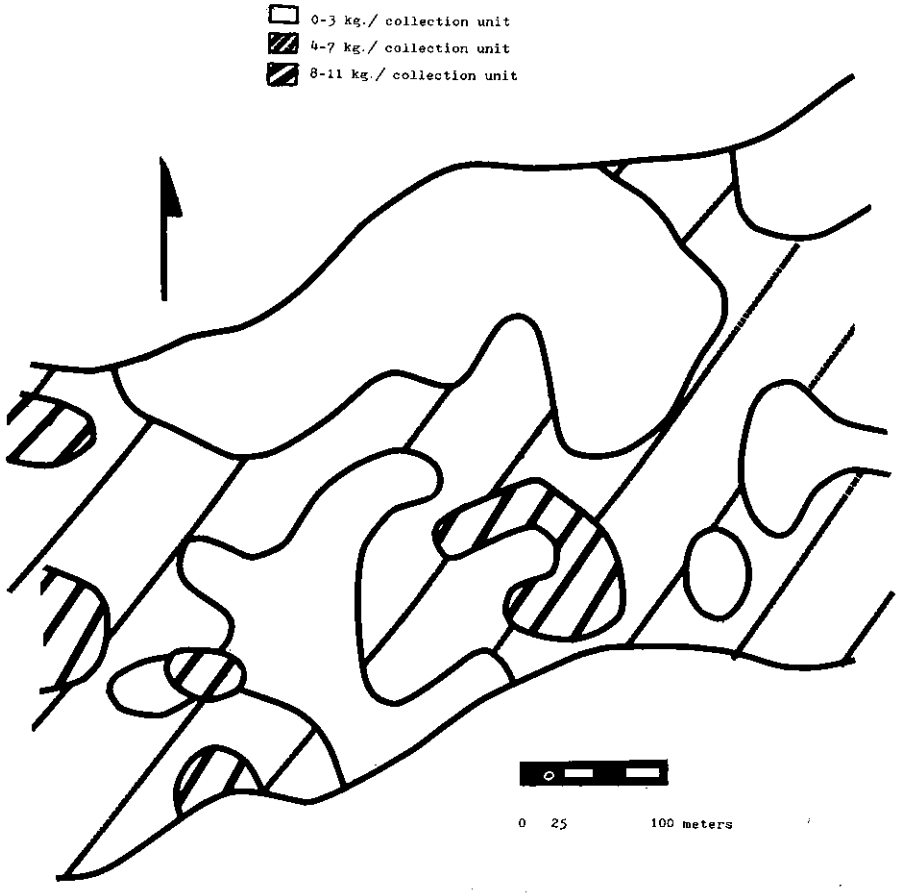

Fig. 3 – Northeast Valley collection area. Zones of ceramic density.

an artifact of post–depositional forces, but rather does reflect in some way the activities of the medieval inhabitants of the city. In general, ceramic density is much *lower* along the gently sloping north ridge of the valley. Recall that this ridge is densely covered with structures; its worn outcrops and numerous small stairways attest to the volume of traffic it once received. It is adjacent to the steep south ridge where ceramic densities are highest. Only at the extreme west end of the north ridge, where a section of sheer rock face prevents easy access, are areas of relatively high ceramic density found. These still tend to be lower than those to the south, however. Several

high density areas are also located to the west of the large gateway, within the Royal Centre.

It may be suggested that the density of earthenware ceramics is not a direct reflection of population density. Instead, the observed density distribution appears to be primarily a product of discard practices. That is, high density refuse zones do not correlate with high density structural zones. In fact, when all collection units were coded as in, near (within 10 m), or away from standing and/or fallen structures, significant differences[1] in the overall ceramic weight were found between each category, with structural zones having the lowest mean ceramic weight (1749 grams), and nonstructural zones the highest (6196 grams). Thus, areas of dumping appear to have been segregated from areas of residential and commercial occupation.

Comparable data are not available for the East Valley. However, there are 13 documented standing structures in the Royal Centre portion of the sample area, and only four in the Urban Core portion (Sinopoli 1986), with a correspondingly greater density of materials on the less built up side. In the East Valley, however, functional and social issues confound the picture and it is not certain whether we are seeing open space maintained around structures or differences in consumption due to functional or social factors.

In addition to high ceramic density, areas of low structural density (the possible midden areas), share a number of other characteristics. The weight of brick and plaster found on the surface in nonstructural units is significantly higher than that in units either in or near structures [2]. Thus, it seems clear that in this context, brick and plaster are not directly associated with the presence of Vijayanagara structures. Instead, they occur most commonly in the nonstructural units, where the highest ceramic densities

[1] Mann–Whitney U Test employed, since values are not normally distributed. Gross ceramic weight compared for units coded as structural, near structures (10 m), and nonstructural. Z scores are as follows:

nonstructural *vs.* structural = 6.03
nonstructural *vs.* near structure = 3.74
structural *vs.* near structure = 3.87

All are significant at the .05 level.

[2] Mann–Whitney. Brick and plaster weights combined, compared via same categories as above. Z scores are as follows:

nonstructural *vs.* structural = 2.34
nonstructural *vs.* near structure = 0.49
structural *vs.* near structure = 3.00

All except second are significant at .05 level.

are also found. In spite of the presumably precipitous abandonment of the city in AD 1565 (Fritz et al. 1984), it appears that stray brick and plaster now present on the surface have been cleaned up and brought to areas of intensive trash deposition. In addition to the possibility of continued maintenance in the latter part of Vijayanagara occupation of the city, this finding also cautions against the simplistic use of surface building débris as proxy evidence for the layout of subsurface structures.

The distribution of iron slag in the Northeast Valley fails to reveal any localized concentrations which might result from specialized dumps of iron processing workshops. Rather, the material is thinly scattered throughout the valley, not clustered as in the East Valley (Sinopoli 1986). However, the concentration of slag even in the East Valley clusters never approaches that found on sites in the Greater Metropolitan Survey area (Morrison in press) identified as iron smelting sites. Significant differences [3] do exist, however, between slag weights in structural units, nonstructural units, and units close to structures, again with nonstructural units containing the highest mean weight of slag (63.8 grams) and structural units the lowest (6.8 grams). While iron slag is concentrated in the high ceramic density zones, it is by no means confined to those areas, suggesting that it may have been used as structural fill as well as trash. That slag was sometimes used as fill is supported by evidence from site VMS–7, south of the modern village of Kamalapuram, a largely obliterated iron workshop in which a great deal of slag and part of the furnace have been incorporated into the fill of a later structure.

Royal Centre vs. Urban Core

In light of the patterning evident in the East Valley, differences in artifact distribution were expected between the eastern portion of the sample area, the Urban Core, and the western portion, the Royal Centre. In fact, significant differences [4] in ceramic density *were* found between these two

[3] Mann–Whitney. Slag weights compared to categories as above. Z scores are as follows:
nonstructural *vs.* structural = 4.06
nonstructural *vs.* near structural = 2.86
structural *vs.* near structure = 1.26
All except third significant at .05 level.

[4] Mann–Whitney. Gross ceramic weights compared for Royal Centre and Urban Core. Z score as follows:
Royal Centre *vs.* Urban Core = 2.55
Significant at .05 level.

presumably functionally distinct zones. No differences in slag densities were evident [5]. Both of these findings run counter to expectations based upon the East Valley data. While ceramic densities in the Royal Centre and Urban Core differed significantly in each valley, in the East Valley sherd densities were, on the average, greater in the Urban Core than in the Royal Centre. In the Northeast Valley, the situation is reversed, with a mean ceramic weight in the Urban Core of 4441 grams, and in the Royal Centre of 6025 grams, a difference of nearly 2000 grams. This finding suggests that important differences exist within the Royal Centre, even between segments not far distant nor architecturally distinct.

One cannot be certain of which of the factors influencing the distribution of ceramics are operative here. Geomorphologically, there are no apparent major differences between the valleys (B. Marsh, pers. comm. 1987). Both have experienced some colluviation and both are currently dry farmed in small–scale fields. The layout of Royal Centre fortifications containing major gateways is also similar, as is the disposition of small temples along the major roadway of each valley. These considerations suggest social or functional differences in the two segments of the Royal Centre, rather than some disparity in artifact visibility, although the experimental studies cited above would lead us to be cautious in comparing these collections made in two different years.

The lack of differentiation in slag distribution between Royal Centre and Urban Core also stands in contrast to the East Valley pattern. As noted above, spatially discrete slag concentrations were found outside the city; such concentrations contained densities several orders of magnitude higher than those in either valley (Morrison in press). While the evidence is very sketchy, these data seem to suggest that none of the iron slag collected in either the Northeast or East Valleys is indicative of the location of iron workshops, but rather that it represents trash or structural fill. In this sense, then, the slag distribution is explicable in the same terms as that of ceramics.

The amount of refuse present in the portion of Royal Centre located in the Northeast Valley is both relatively as well as absolutely greater than in the corresponding area of the East Valley. It would be easy to argue that in the Northeast Valley, more people lived inside the wall of the Royal Centre, whereas in the East Valley, more people lived outside. However, the relationships between ceramics, slag, brick, and plaster distributions

[5] Mann–Whitney. Slag weights compared as above. Z score as follows:
Royal Centre *vs.* Urban Core = .003
Not significant at .05 level.

and the distribution of structural zones caution against such an interpretation. Instead, any interpretation must recognize the complex use of space in urban contexts and the importance of regular maintenance. Perhaps the Northeast Valley, being much broader and longer than East Valley, provided a more convenient dumping ground for trash than did the smaller, narrower East Valley.

Only in one respect are the expectations based upon patterning in the East Valley fulfilled. Although the total number of Chinese porcelain sherds collected in the Northeast Valley was extremely low (N = 29), in the Royal Centre, 42% of all collection units contain one or more such sherds, while in the Urban Core only 22% do. There was no increase in porcelain density near the palace structure, although the scarcity of this artifact class makes this finding less remarkable.

Discussion

Although the work of interpretation is still in its preliminary stages, it has become clear that there are many factors involved in the determination of the contemporary surface artifact distributions of Vijayanagara. The lack of direct association between zones with high densities of structures and structural débris, and zones with a high density of artifacts argues against simplistic use of surface materials as proxy measures of population size or number of households. The co–occurrence of materials such as sherds, iron slag, and fragments of plaster and brick in these nonstructural zones suggests that these are primarily refuse areas, a conclusion which implies ongoing maintenance of residential and other zones, and the structured use of urban space. Given more information, some secure interpretations of population distributions may be possible. The relatively greater overall density of material in the Northeast Valley may reflect the high intensity use of the north ridge of the valley, from which trash was deposited on the south side of the valley. Or, the configuration of the Northeast Valley may have made it an attractive depository for trash from many zones of the city. Temporal factors may also play a role, although these are not considered in this preliminary analysis.

Despite these unresolved issues, the program of surface collection at Vijayanagara has been successful in isolating differences where differences were not previously known to exist. Although there are many formal similarities between the East and Northeast Valleys in terms of fortification, roadways, and sediment deposition, the functional and social separation of space between the Royal Centre and Urban Core may have been quite differ-

ent in each case. The only apparent architectural clue to these differences is the palace structure NSc/1 in the Urban Core of the Northeast Valley; the placement of other structures such as temples is not dissimilar. Thus, the systematic collection and analysis of surface artifacts at Vijayanagara has identified a number of unexpected patterns of similarity and difference in intra–site spatial organization reflected in architecture, which otherwise may have remained obscure.

TABLE 1 – *Northeast Valley ceramic, slag, and structural débris weights. Comparison between collection units on, near, and away from structures.*

	ceramic weight (grams)		
	mean	standard deviation	coeff. of variation
Structural units	1748.6	1790.5	102.4
Near–Structural units	4148.2	1975.9	47.6
Non–Structural units	6195.8	2206.9	35.6
	slag weight (grams)		
	mean	standard deviation	coeff. of variation
Structural units	6.8	14.9	218.9
Near–Structural units	25.6	48.9	191.2
Non–Structural units	63.8	79.0	123.8
	brick & plaster weight (grams)		
	mean	standard deviation	coeff. of variation
Structural units	256.4	345.1	134.6
Near–Structural units	220.7	337.1	152.7
Non–Structural units	455.7	452.3	99.2

TABLE 2 – *Northeast Valley ceramic and slag weights. Royal Centre and Urban Core comparison.*

	ceramic weight (grams)		
	mean	standard deviation	coeff. of variation
Royal Centre	6025.0	2740.3	45.5
Urban Core	4440.7	2610.0	58.8
	slag weight (grams)		
	mean	standard deviation	coeff. of variation
Royal Centre	37.1	59.5	160.3
Urban Core	44.2	69.9	158.1

ACKNOWLEDGEMENTS

This research has been made possible by the kind permission of the Government of India and the Archaeological Survey of India. I carried out the 1987 surface collection as a fellow of the American Institute of Indian Studies; their assistance is gratefully acknowledged. Without the hospitality and interest of the Directorate of Archaeology and Museums, Karnataka, none of these collections could have been made. Their support took the form of Ashok, Aruna, and Kamalakshmi, to whom the real credit is due. Fellow members of the Vijayanagara Research Project, Ben Marsh, Simon McCudden, and Phil Wagoner, provided encouragement and volunteer labor in the hot sun. As always, Drs John Fritz and George Michell were there to lend advice and support. Finally, many thanks to Carla Sinopoli for generously sharing her East Valley data.

REFERENCES

Ammerman, A.J. (1985) Plow Zone Experiments in Calabria, Italy. *Journal of Field Archaeology* 12(1), pp. 33–41.

Ammerman, A.J. & Feldman, M.W. (1978) Replicated Collection of Site Surfaces. *American Antiquity* 43, pp. 734–40.

Binford, L.R. & Sabloff, J.A. (1982) Paradigms, Systematics, and Archaeology. *Journal of Anthropological Research* 38(2), pp. 137–53.

Binford, L.R.; Binford, S.; Whallon, R. & Hardin, M.A. (1970) *Archaeology at Hatchery West.* Society for American Archaeology, Memoir 24. Washington.

Brumfiel, E.M. (1987) Elite and Utilitarian Crafts in the Aztec State. *Specialization, Exchange, and Complex Societies,* ed. E.M. Brumfiel & T.K. Earle, pp. 102–18. Cambridge.

Dunnell, R.C. & Dancey, W.S. (1983) The Siteless Survey: A Regional Scale Data Collection Strategy. *Advances in Archaeological Method and Theory,* 6, ed. M.B. Schiffer, pp. 267–83. New York.

Fritz, J.M. (1985) Features and Layout of Vijayanagara: The Royal Centre. *Vijayanagara: City and Empire,* ed. A.L. Dallapiccola. Beiträge zur Südasienforschung, Südasien–Institut Universität Heidelberg, 100, pp. 240–56. Wiesbaden.

Fritz, J.M.; Michell, G. & Nagaraja Rao, M.S. (1984) *The Royal Centre at Vijayanagara: Preliminary Report.* Vijayanagara Research Centre Series, no. 4. Melbourne.

Haggett, P. (1965) *Locational Analysis in Human Geography.* London.

Hirth, K.G. (1978) Problems in Data Recovery and Measurement in Settlement Archaeology. *Journal of Field Archaeology* 5, pp. 125–31.

Jansen, M. (1984) Preliminary Results of Two Years' Documentation in Mohenjo-daro. *SAA 1981,* pp. 135–53.

Lewarch, D.E. & O'Brien, M.J. (1981) The Expanding Role of Surface Assemblages in Archaeological Research. *Advances in Archaeological Method and Theory,* 4, ed. M.B. Schiffer, pp. 297–342. New York.

Michell, G. (n.d.) *Architectural Inventory of the Royal Centre at Vijayanagara,* Vijayanagara Research Centre Series. Mysore.

Morrison, K.D. (in press) The Vijayanagara Metropolitan Survey: Preliminary Investigation. *Vijayanagara: Process of Research 1985–1987,* ed. A. Sundara. Mysore.

Nagaraja Rao, M.S. (1983a) Nomenclature of a Royal Road of Vijayanagara. *Vijayanagara: Progress of Research 1979–1983,* ed. M.S. Nagaraja Rao, pp. 57–60. Mysore.

Nagaraja Rao, M.S. (1983b) Ahmadkhān's Dharmasala. *Vijayanagara: Progress of Research 1979–1983,* ed. M.S. Nagaraja Rao, pp. 65–66. Mysore.

O'Brien, M.J. & Lewarch, D.E., eds. (1981) *Plowzone Archaeology.* Nashville.

Plog, S. (1976) Relative Efficiencies of Sampling Techniques for Archaeological Surveys. *The Early Mesoamerican Village,* ed. K.V. Flannery, pp. 136–58. New York.

Redman, C.L. (1987) Surface Collection, Sampling, and Research design. *American Antiquity* 52, pp. 249–65. Washington.

Redman, C.L. & Watson, P.J. (1970) Systematic Intensive Surface Collection. *American Antiquity* 35, pp. 279–91.

Sanders, W.T.; Parsons, J.R. & Santley, R.S. (1979) *The Basin of Mexico.* New York.

Schiffer, M.B. (1972) Archaeological Context and Systematic Context. *American Antiquity* 37, pp. 156–65.

Sewell, R. (1984) *A Forgotten Empire (Vijayanagara).* Repr., New Delhi.

Sinopoli, C.M. (1986) *Material Patterning and Social Organization: A Study of Ceramics from Vijayanagara.* Ph.D. dissertation, University of Michigan. Ann Arbor.

Thomas, D.H. (1975) Nonsite Sampling in Archaeology: Up the Creek Without a Site? *Sampling in Archaeology,* ed. J.W. Mueller, pp. 61–81. Tucson.

Tolstoy, P. & Fish, S.K. (1975) Surface and Subsurface Evidence for Community Size at Coapexo, Mexico. *Journal of Field Archaeology* 2, pp. 97–104.