

PRODUCTION AND LANDSCAPE IN THE VIJAYANAGARA METROPOLITAN REGION: CONTRIBUTIONS OF THE VIJAYANAGARA METROPOLITAN SURVEY

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The Vijayanagara Metropolitan Survey (henceforth VMS) is a programme of systematic intensive surface survey in the hinterland of the imperial city of Vijayanagara. This project, the first systematic regional survey in India and the only one to investigate non-elite sites of the historic period, has identified a complex landscape of settlements, roads, temples and agricultural facilities. Although analysis and synthesis are still underway, the work of the VMS has already yielded important information on long-term land use and landscape dynamics in northern Karnataka and, more specifically, on the regional structure, organization, dynamics and contemporary impact of Vijayanagara period economic activities, political organization, religious practices and settlement. The project was designed to investigate the operation and structure of imperial economies as they are manifest in an urban and peri-urban archaeological landscape. Research was focused both on the organization of production of a range of goods – food, other agricultural produce, ceramics and metal goods – and on the ways in which agricultural and craft production changed through time. We paid specific attention to the ways in which constraints on and opportunities for production in complex societies structure the economic strategies of a range of producers (people of different statuses, castes, etc., or with variable access to significant resources such as water, arable land, metal ores and so on). One important form of economic change that can be examined in the context of an expanding empire is the intensification of production, a process we find

that was complex and that varied with the specific context of production.

The city of Vijayanagara was the capital of an empire that claimed hegemony over much of peninsular India between the fourteenth and sixteenth centuries. Although we once believed that Vijayanagara was established in an area that had never been politically central or densely occupied, our work has shown that the region actually saw several surges of population as well as associated dramatic changes in land use and settlement intensity. We now know that the survey area saw relatively intensive use by semi-sedentary pastoralists and dry farmers in the Neolithic (*c.* 3000-1000 BC), followed by a period of dense but unevenly clustered population in Iron Age (*c.* 1000-500 BC) and Early Historic (*c.* 500 BC-AD 500) towns, followed by a decline in settlement density in the Early Middle period (*c.* AD 500-1200). In this last period, settlement was widely dispersed across the region, and although there were many good sized towns, there were few truly urban places and none in the Vijayanagara Metropolitan Region. The intensive survey area itself had very limited occupation in the Early Middle period, as did the site of the city itself (in Block N, not part of our survey area).

However, the founding of the empire and the rapid expansion of the city of Vijayanagara in the early years of the fourteenth century prompted dramatic changes in the organization and scale of production of agriculture and craft goods. The initial period of urban growth led to a depopulation of neighbouring towns as the new imperial city swelled in size.

In the early sixteenth-century Vijayanagara again underwent a period of expansion manifest in terms of military conquest, construction of monumental architecture and population growth/in-migration. These two periods of rapid political, demographic and ecological change provide an excellent opportunity to investigate processes of economic change such as productive intensification. We find that each episode of intensification differs significantly from the other, and that both micro-spatial (local) concerns of topography, hydrology, rocks and soils intersect with broader issues of regional transportation and settlement and the location of markets. Together with these locational and organization concerns, the actual course or trajectory of intensification is critically dependent on prior conditions in any given place. That is, the process of intensification itself is powerfully historically contingent, a fact which suggests that studies of intensification – even those that aim at producing broad generalizations – need to be deeply rooted in particular localities and histories (Morrison 1995a and in press).

Building on eleven field seasons, we have been able to elucidate the structure of food and craft production, settlement, transportation, vegetation and fortification in the region immediately surrounding the city of Vijayanagara, the Vijayanagara Metropolitan Region. The following sections summarize some of our approaches and results; for more detailed information, see the VMS papers in this volume and the works cited in the Project Bibliography (pp. 599-606).

Regional Patterns of Production

In this project we were concerned to address two related problems: (1) the nature of imperial and urban economies, particularly as these relate the structure of local production with forms of political and social control; and (2) the intensification of production, both agricultural and non-agricultural, particularly as influenced by urban growth.

We began with a goal of elucidating the operation and structure of imperial economies as they relate to the organization of production and consumption within the polity. In parti-

cular, we documented the powerful impact of the supraregional military, political and other activities of the polity on non-elite producers and consumers at the imperial centre. The rapid expansion of the city of Vijayanagara and its subsequent periods of stasis and growth were, in large part, tied to the fortunes of the empire as a whole. Local agriculturalists and craftspeople both responded to this supraregional dynamic and also created their own nexus of local political and social organization. The increasing demands of the Vijayanagara elite for taxes in cash, the growth of urban markets and the participation of religious institutions in production changed the contexts of production and consumption radically through the period. Even in relatively distant areas, the pull of the city's urban markets and the demands of temples and political leaders for taxes and other obligatory payments helped structure agricultural production. In particular, many farmers focused on cash crops for urban markets; in irrigated areas these included rice, vegetables, coconuts, flowers and sugarcane. Numerous roads radiate out from the city to connect it with surrounding agricultural areas. Elite involvement in outlying areas is also well documented through the presence of temples and reservoirs, many of which were commissioned by local political leaders. Both temples and reservoirs vary a great deal in their architectural elaboration, size and ritual associations. Although this is not the context to discuss the complex interplay between local elites, the central government, temples and other corporate groups, we have been able to document, using both archaeological and textual remains, the dense relational networks between city, village and countryside, and to detect something of the "reach" of political and ritual power into areas far from the city (Morrison in preparation).

With the large-scale abandonment of the city in AD 1565 and the loss of much of the urban population, agricultural production was again radically restructured. However, this post-Vijayanagara agriculture was no "reversion" to the pattern of the Early Middle period. Instead, some of the most uncertain and high-maintenance facilities, runoff-fed reservoirs, were preferentially abandoned, as were areas

of risky dry farming. The intricate network of canals constructed during the Vijayanagara period continued in use, as indeed it still is today. Even though these facilities required massive initial investments in labour, once they were built, they required only a moderate amount of maintenance and supported very reliable and intensive forms of production. Thus, the course of change associated with the fall of the city – here from more to less intensive agriculture if viewed in an overall regional context – actually involved the maintenance of certain high-intensity cropping practices and the abandonment of some extensive practices. On the other hand, other land-extensive practices such as pastoralism continued.

In contrast to the marked patterns of change in agricultural production, producers of low-status earthenware ceramics apparently varied their production strategies very little over the three hundred years of the city's occupation, producing large quantities of wheel-made vessels in small, perhaps family run workshops (Sinopoli 1998, 1999 and 2003b). Although we documented numerous villages or towns in the intensive phase of the survey, in neither this nor phase II survey did we identify any definite Vijayanagara-period ceramic workshops. Nevertheless, metric analyses by Sinopoli indicate a multitude of small production locales and we can expect that earthenwares were produced all across the study area.

Metal production did, however, change significantly through time. Textual sources make it clear that the volume of iron production in the sixteenth century was considerable, with iron and steel finished goods and ingots exported from South India to South-West Asia. XRF analysis by Gogte of metal objects, ores, bloom, slag and furnace elements from surface contexts indicate that Vijayanagara-era iron producers used local ores in a relatively efficient process of iron smelting (cf. Lycett, Morrison and Gogte in preparation). Surface indications make it clear that this activity was seasonal in nature and small in scale, and that it took place in contexts (usually in dry-farmed areas) as much as 1 km from the edges of a settlements; in a few cases, iron working took place away from any habitation

(Lycett 1995). In most cases, these small-scale iron smelting operations seem to have been positioned on or near the edge of the water-spread of a reservoir. In spite of the vast size of the city of Vijayanagara – estimates range up to 500,000, though this is probably overly generous – iron production in the region was organized into small productive units throughout the Vijayanagara period. This raises the likelihood that most of the city's metal needs were met by production elsewhere, most probably in the iron and steel producing regions of neighbouring Andhra Pradesh, where industrial-scale production dating back to the sixteenth century has been recorded. Thus, it seems that the Vijayanagara Metropolitan Region was integrated into international and subcontinent-scale exchange networks primarily as a consumer of iron goods, though small-scale smelting and smithing of Sandur ores was carried out in the area.

As an unexpected bonus, we were able to study iron working in the Early Historic period as well as in the Vijayanagara period, with our excavation of VMS-110 (Morrison and Johansen in preparation). Although we had expected the iron smelting here to be contemporaneous with the nearby Vijayanagara period reservoir (VMS-1004), in fact, it turned out to be associated with a specialized iron-production site dating to between 200 BC and AD 100. Here, local Sandur ores were collected from a seasonal stream channel, broken into small chunks and roasted before being fed into simple bowl-type furnaces for smelting (Lycett et al. in preparation). Tuyeres, also made of local materials, supplied air to the furnaces. Ore reduction, roasting and smelting all took place in discrete areas (Humayun and Gogte in preparation). The smelting activities produced a mountain of slag; some 1,500 years later this was modified into a reservoir embankment. There was clearly some permanent occupation associated with the Early Historic iron production site; however, the scale of production was quite large, dwarfing anything in the region associated with the Vijayanagara period (in spite of its vastly greater population), and thus it seems that most of the iron produced at VMS-110 must have been meant for consumption further

afield. This is partially supported by XRF and chemical and morphological studies of slag and iron from other Early Historic settlements in the survey area. These indicate that other contemporaneous settlements used iron objects which were made from Sandur ores, and were technologically similar to those produced at VMS-110. Further, slags from other Early Historic settlements (all of which are located along the Tungabhadra River to the north of VMS-110) are all associated with smithing, not smelting, suggesting that they employed material brought in as bloom or ingots. It may be the case that although the scale of iron production in the Early Historic was much greater than that of the later Vijayanagara period, the regional networks through which raw materials and metals circulated were actually spatially smaller. More work remains to be done on this topic.

Beyond the production of foodstuffs, ceramics and metals, we were also able to document residues of the production of basalt pegs which were used for anchoring masonry walls to sheet-rock. Peg production was primarily expedient, using material mined from basalt dykes in the dominant granite formations. However, one small settlement in Block S, on the outskirts of the city where pegs were widely used (due to the density of structures; elsewhere walls were more rarely built up over granite boulders or sheet-rock), seems to have been a locus of peg production. Even though this settlement did not itself employ any pegs, there were pegs at all stages of manufacture across the settlement, as well as abundant remains of chipping debris. Other kinds of craft production indicators included lime kilns (for plaster) in which calcium carbonate or *kankar* nodules were processed. Finally, we documented a great many locales of granite quarrying and a few places in which sculptures and architectural elements such as columns were being created. In all cases, granite sculptures and architectural elements were made on the spot, adjacent to the quarrying locale (and see Sinopoli 2003b). Evidence from inside the city suggests that many columns were simply "roughed out" at the quarry and then finished (sculpted, dressed) in the process of construction.

Changes in Production: Intensification

A particular focus of our research on urban economies has been the process of productive intensification. Understandings of intensification underlie much of the debate about subsistence change and about the development of surplus production and of social complexity. Although discussions about the cause(s) of intensification abound, much less attention has been paid to the actual paths and process of intensification. We suggest that documenting the variability and locally inflected nature of such paths or trajectories is critically important for constructing more general models of change. This documentation, then, requires the reconstruction of structures of and changes in productive strategies. If we begin to develop an understanding of the course of intensification in different situations, we might, for example, be able to determine whether or not there is but a single route of intensification, measurable by a single parameter such as cropping frequency. Further, if we can begin to understand specific instances of change and the roles that, for example, elites played in different aspects of production, we might be a better position to evaluate the causal efficacy of elite demands in stimulating productive intensification, a topic much discussed in the literature. The special circumstances of Vijayanagara, with an excellent and accessible archaeological record, a record of vegetation and burning preserved in precolonial reservoir sediments, and a rich historical record provide the ideal opportunity for the study of intensification and of imperial economies.

In setting out to address issues of regional economy and productive intensification, we begin with the goal of documenting from survey data basic information on regional patterns of settlement, transportation and production. We have documented significant shifts in the location of settlements and their relation to agricultural facilities and other production locales, shifts that correspond with the hypothesized changes in productive organization and political economy in the fourteenth and sixteenth centuries. Briefly (see Morrison 1995a and in preparation),

fourteenth-century Early Vijayanagara settlement was clustered in a few places, primarily associated with permanent water sources, either natural (the Tungabhadra River) or anthropogenic (river-fed canals and a river-fed reservoir). There were a few outlying Early period villages, though some of these may actually pre-date the Vijayanagara period. In the fifteenth century, or Middle Vijayanagara period, few new settlements were established and indeed few (dateable) structures of any kind were built at this time. This tempo is entirely consistent with inscriptional and paleobotanical data (see Morrison this volume, and Morrison and Lycett 1994) and suggests that the dynamic settlement expansion of the fourteenth century had slowed by the fifteenth century. Throughout the first 200 years of the Vijayanagara empire in this region, population was concentrated in and near the city; smaller walled towns and villages were strung out along major roadways connecting the city with a few nearby towns and, ultimately, with far-off markets and ports.

In the sixteenth century there were significant changes in regional settlement distributions and overall regional population. There appears to have been a major influx of population into the region, reflected in massive building programmes throughout the survey area. Not only was there a regional boom in the construction of monumental architecture, well-attested to in the city itself (manifest in outlying areas primarily in terms of temples and reservoirs), but there were also many new settlements established. Some of these filled in areas in between older villages and towns, especially on the outskirts of the city (Sinopoli 1997). Other settlements appeared in area that had previously been only sparsely occupied and used for more extensive activities such as grazing and collecting. These new settlements are associated with facilities relating to dry farming and often with newly built, runoff-fed reservoirs, facilities which required a considerable amount of resources and labour to construct and maintain, but which helped mitigate the effects of the region's low and variable rainfall. Areas that saw a major sixteenth-century expansion include the Daroji valley and the Dhanaya-

kanakere area southwest of Hospet (Morrison in preparation).

Inhabitants of the Vijayanagara Metropolitan Region included royalty, imperial officers and soldiers, as well as agriculturalists, craft producers, merchants, labourers, even mobile pastoralists and, possibly, foragers. As noted, settlement beyond the urban core of the city was discontinuous, with population mostly clustered into nucleated settlements. Some 73 sites in the intensive survey area were classified as residential. We have already noted the dense zone of settlement within the outer city walls that emerged in the sixteenth century as the Vijayanagara urban core expanded outwards to the south and east. Beyond the core area of urban settlement, the largest settlements such as Malapannagudi and Bukkasagara ranged from 20 to 70 ha in area and were spaced at intervals of 2 to 4 km along major roads. The populations of these towns ranged from a few thousand to possibly as many as 10,000-15,000 inhabitants. They were typically walled and heavily fortified, and contained multiple temples and shrines. At least one (Old Venkatapur, VMS-2) revealed traces of an elaborate residential compound, similar in plan to structures that archaeologists in the urban core have referred to as "palaces"; surface collection at this settlement also yielded a fragment of Chinese porcelain. Many of these large Vijayanagara settlements are inhabited today, which has resulted in the destruction of many Vijayanagara period features, making precise estimates of site size and content problematic.

Several smaller nucleated villages were also documented in the Vijayanagara Metropolitan Region. These ranged from 1.5 to 6 ha in area and were often located near areas of low-lying agricultural land. Architecture was less elaborate in these sites and largely consisted of rubble wall foundations to structures that would probably have had wattle-and-daub or earthen walls. Small one- or two-room shrines and sculptures were present in most of the sites, as were high densities of domestic artefacts. At least a few of these smaller settlements were enclosed within masonry walls.

Other residential sites documented by the VMS included isolated houses or structures,

many of which may have been occupied seasonally. Concentrated surface scatters of ceramics and other artefacts have also been interpreted as being associated with residential activities in the region, as have rock shelters containing domestic artefacts. These last two site categories were probably occupied for brief periods by mobile groups, including pastoralists, local farmers engaged in collecting firewood, plants, etc. Written sources of the Vijayanagara period note that there were large military encampments on the city's outskirts, and some of the diffuse artefact scatters we find in open areas of the Vijayanagara Metropolitan Region may relate to such activities.

The baseline patterns of regional settlement dynamics sketched above help us to address more specific issues of change such as the intensification of production. In tracing the effects of intensification on the Vijayanagara agricultural landscape we expected to see an increasing pace of construction in soil and water control facilities during the early fourteenth and sixteenth centuries, with sixteenth-century changes strongly affected by the nature of existing facilities. In particular, the early focus on intensive forms of wet agriculture such as canals and canal-fed reservoirs was expected to lead to strategies both of intensification proper (increased intensity or frequency of cropping on the same land, including the development of irrigation facilities allowing multi-cropping and labour-intensive forms of cropping such as paddy rice production) and of diversification (addition of new forms of production to the regional repertoire) in the sixteenth century (Morrison 1995a). It was not expected that there would be an orderly chronological progression from dry to wet agriculture or any other single sequence and, indeed, there was not. What we found, in general, was that demographic trends tracked agricultural change relatively closely (that is, in a broad sense, periods of increased population density were associated with agricultural intensification). However, this overall picture masks a significant degree of variability and, importantly, fails to capture the way in which the diverse paths of intensification are contingent on very local histories of land-

scape modification and very local considerations such as the position of roads, temples and towns, as well as the more obvious constraints placed on agriculture itself by water, soils, slopes, etc. Further, we began to appreciate the important role of social and political power in structuring the course of intensification (Morrison in press). Given that the resources and opportunities of producers vary widely, we find that there was a complex sequence of change involving multiple forms of production. Elite investment in and manipulation of production of both agriculture and craft goods (Sinopoli 1998) can be traced through both inscriptional analysis and, indirectly, through architecture; we have found significant differences in the form and tempo of elite-financed activity through time.

To summarize, we found that the fourteenth-century intensification of agricultural production primarily took the form of expanding areas of intensive, irrigated agriculture. This was effected through the construction of river-fed canals and a large canal-fed reservoir (the Kamalapura reservoir). There are few runoff-fed reservoirs associated with the Early period, although there were clearly some areas of dry (rain-fed) agriculture. This early focus on high-cost but productive wet agriculture seems to have involved a focus on paddy rice, a highly esteemed foodstuff, viewed as essential for elite consumption and ritual (Morrison 2001a). The minimal expansion of the fifteenth century involves the construction of at least one large runoff-fed reservoir, but it was in the sixteenth century, as expected, that we saw the greatest expansion and intensification of agricultural production. This took the form, in part, of the extension of canals (intensification proper). However, sixteenth-century canal extension took place primarily in the areas north of the river, where the new canals displaced existing reservoirs, which were built in either the fourteenth or fifteenth centuries. This sequence of change follows, in large part, expected trajectories of change based on the "orthodox" Boserup-inspired model. However, sixteenth-century changes elsewhere in the survey area differed radically from those of the area north of the river. For example, the Daroji and

Dhanayakanakere valleys saw the massive expansion of both cultivation under runoff-fed reservoirs and of dry farming, a more extensive form of production that nevertheless became part of the *regional* strategy of intensification in the Late Vijayanagara period.

What this overall regional picture of changes in agricultural organization does not, however, highlight, is that the differing forms and practises of production and their associated labour demands, scheduling requirements and type and quantities of crops produced were not practised equally by farmers, labourers, landowners and consumers across the region. Intensification on a regional scale meant very different things for different groups of agriculturalists and had differing consequences for the form and tempo of their labour, for their market participation and for their consumption and even participation in temple rituals, which involved food to a significant degree (Morrison in press).

We were also able to document some changes through time within categories of agricultural production. For example, manuring is now sometimes practised on both dry and irrigated fields, though it tends to be concentrated on dry fields very close to villages (where the manure piles are prepared). The practise of manuring may be visible by tracing the distribution and density of trash (particularly low-density slag scatters) across agricultural areas. Present-day agriculturalists spread trash (plastic, sherds, metal, etc.) across manured fields each year since manure piles include household wastes and are collected from houselots. We found that manuring was practised on a much larger spatial scale during the Vijayanagara period than it is today, with manuring signatures found on fields distant from any settlement. This change may partly reflect contemporary use of chemical fertilizers, though chemical fertilizer use is still quite limited in this region, especially for dry crops, and we suspect that the larger regional population of the Vijayanagara period and consequent demands on the productive capacity of even dry lands led to attempts to increase the fertility of dry fields which may have been cultivated more often than they are today, long fallows being the current norm.

Features related to agricultural production accounted for nearly a quarter of all sites recorded; 157 of the 657 sites (24%) documented in the intensive survey area. In the eight blocks of the intensive survey, we recorded 63 reservoir embankments, varying in size from 20 m to more than 2 km in length; longer and larger reservoirs are present in the extensive survey area. Several extensive terrace systems, including VMS-133 which also integrated a small reservoir, were documented in upland regions south of the city; the largest of these extended over 15 to 20 ha. Numerous smaller agricultural features were also recorded, including check dams, erosion control walls, gravel-mulched field and wells. Wells are often associated with reservoirs, taking advantage of the raised water table thus created. In a few cases, wells were later built in the bed of silted-in reservoirs. Permanent irrigation facilities (that is, facilities with the potential to contain water year-round) included numerous canals, *anicuts* (dams that divert river water into canals), two canal-fed reservoirs and a massive sixteenth-century aqueduct that carried canal water onto a large island north of the city.

Changing patterns of production and land use are also reflected in the regional vegetation record. Not only are periods of forest clearance and vegetation disturbance evident, but different broad categories of production (wet crops, dry crops, arboriculture) as indicated by constellations of ecologically specific taxa can also be discerned in pollen profiles (Morrison 2004 and this volume). The analysis of plant microfossils (pollen, spores and microscopic charcoal) and macrofossils from stratified sediment cores has provided important information on the impact of Vijayanagara settlement and agriculture on regional vegetation that complements archaeological evidence of land use. In general, the pollen data indicate that even by the very early part of the Vijayanagara period, the regional vegetation was highly modified, very open, and that production near the city was oriented toward wet rice. The Vijayanagara period saw massive deforestation, on a scale even greater than the present, when forests are almost non-existent. The existence of Vijayanagara-period

coconut plantations is now well established, as is the production of edible oils, especially castor oil and ornamentals such as jasmine flowers. New World cultigens are *not* clearly present in the sixteenth century, although chillies (*Capsicum*), maize (*Zea mays*) and several other novel cultigens were introduced to South Asia sometime in this period. New World weeds do, however, appear in the pollen record around the time of or shortly after the decrease in regional population density following the fall of the city in 1565; some of these weeds have since become serious challenges to agriculture.

Fire histories also reflect the intensity of settlement, field clearance and burning for craft production (charcoal for kilns, etc.). Quantitative analyses of microscopic and macroscopic charcoal from reservoir cores (Morrison 1994) reflect the history of burning in the area, burning that may be related to agriculture, craft production and domestic activities. We have documented significant change in fire histories through time, with charcoal particle concentrations tracking vegetation changes documented by pollen analysis in a fairly direct way. Another significant result of this analysis related to a change in post-Vijayanagara fire regimes, beginning around the British period. At this time, particle ubiquity and size distributions indicate that industrial-scale sugarcane production, as is practised in this area today, was first established, replacing, in large part, paddy rice production. Fire histories near the city, such as this one, should reflect a different trajectory of settlement growth, field clearing, etc., than those further way from the city where expansion and intensification came later and took a different course; quantitative charcoal analysis of five more distant reservoir cores has been carried out; these data are still being analysed.

Regional Landscapes: War and Devotion

Other dimensions of regional land use and settlement studied by the VMS include aspects of defense and militarism and ritual and religious features and structures. Clearly, labelling a structure as being primarily military,

agricultural, religious, etc., tends to elide the fact that many of these had (and often continue to have) multiple components, functions and signification. For example, many sites classified for preliminary analysis as being associated with transport were also important to military infrastructures and were key to agricultural production and the movement of resources; settlement sites were often fortified and contained temples and other religious architecture; agricultural features often had religious significance, and so on.

Throughout Vijayanagara history, militarism and warfare played prominent roles in creating and shaping the empire and the Vijayanagara Metropolitan Region. Although the widespread belief that the city of Vijayanagara was enclosed within seven concentric rings of fortifications, a notion based on conventional descriptions in the travel literature, is incorrect, the capital was heavily fortified. We recorded 62 defensive sites in the intensive survey area, and the outermost fortifications documented extend nearly 30 km from the city core (Brubaker 2000 and see this volume), creating a large area of semi-enclosed agricultural land. Sites classified as defensive include fortification walls, hilltop forts, isolated bastions and horse-stones (see below).

The impressive dry stone masonry walls of the Vijayanagara Urban Core, with their core and veneer construction, are well known and were probably largely completed by the early fifteenth century. At this time there may have been extensive open areas, perhaps with gardens and fields, inside the city – these clearly became crowded out by denser settlement. By the early sixteenth century, this locus of dense settlement had expanded through the addition of an outer fortification wall that encompassed the pre-existing walled town of Kamalapura the new settlement of Varadevi-ammana-pattana and the area between them. Extensive archaeological remains of walls, temples and other structures as well as of dense scatters of artefacts documented in the 1990 and 1991 seasons attest to the intensity of settlement in this area during the early sixteenth century.

However, travellers to Vijayanagara encountered the capital's defensive infrastructure

long before reaching either the fifteenth- or the sixteenth-century city centre. Merchants, ambassadors, pilgrims and potential invaders alike entered into a highly structured landscape from the moment they arrived in the Vijayanagara Metropolitan Region (Sinopoli and Morrison 2004a and this volume), passing through series of disconnected fortified places ranging from walled passes to walled towns and overseen by elevated forts and bastions. Although only some of the city's walls were plastered and painted, all made use of the naturally hilly terrain and both these defensive features and the troops stationed near them would have provided a powerful reminder of the military power of the city and empire. Along the northern edges of the Vijayanagara Metropolitan Region lay a string of hilltop forts, each with excellent visibility of the others and of the Urban Core and low-lying regions south of the river (see Brubaker this volume). Similar forts are found in strategic locations throughout the region, including the Daroji Valley to the south of the city and the high Sandur Hills that define the southern edge of that valley. Many of these southern forts have long occupational histories, pre-dating the city itself, a fact which points to the multiplicity of factors affecting the locations and forms of forts, walls and other such features.

Throughout the region, fortification walls spanned strategic passes and potential access routes. The builders of these walls were clearly concerned with both utility and visual impact. While all the walls in the Vijayanagara Metropolitan Region were constructed of locally available granite or basalt, not all are similarly constructed. In outlying areas and especially along wall segments located atop remote hills and far from roads, construction is often less formal, with no attempt to shape the constituent boulders making up these massive walls. Elsewhere, more formal dry stone masonry consisting of quarried blocks or split boulders is found only on the exterior face of the wall, with the interior side either unfinished or else having a built-up ledge of earth for defenders to stand on. However, along major roads, walls and gates were often faced with quarried and even dressed stones; many of these were both massive and ornate, designed to impress and intimidate as well as

defend (Sinopoli and Morrison 2004a and this volume). Other defensive features included watch posts and bastions located along roads and near gates. More unusual features are the rows of boulders known as "horse-stones", features often associated with gateways and passes. Horse-stones are alignments of many closely laid parallel rows of large boulders, each usually at least a metre high and a metre across. These features were placed in low-lying areas where they served to slow down or impede movement, particularly by mounted armies.

Control of movement in the Vijayanagara Metropolitan Region was intimately related to defense, as well as to the flow of resources and of people into and out of the capital. Nearly 80 transport related sites were documented in the intensive survey area. These include several broad roads, 30 to 60 m wide, that were the major routes of movement into the city core, as well as numerous smaller routes leading to temples, settlements and agricultural regions. Both topography and cultural features (such as boundary walls) channeled large-scale movement along major roadways; most of the contemporary roads in the area follow older routes. Often such routes are marked by alignments of gateways, bastions, wells, platforms, shrines and what may have been administrative structures. Boundary walls, cobbled road surfaces and worn areas of sheet-rock mark the location of roads. Linear distributions of structures and other features were particularly important for identifying the major routes into the capital, many of which lie underneath or adjacent to modern paved roads. Rock-cut stairways defined routes of movement across steep outcrop areas, and elevated roadbeds skirted the edges of outcrops above low-lying irrigated fields. Gates in fortification walls ranged from large monumental entries to small passages wide enough only for a single person to pass through. In many cases, roads ran along the tops of reservoir embankments, a practical necessity when crops or muddy fields lay below. The embankment of the massive, canal-fed Kamalapur reservoir not only supported a major road leading into the city but also itself constituted part of the outer city wall, even supporting several bastions.

It is also possible to see the Vijayanagara

Metropolitan Region in terms of a complex and shifting sacred geography. Although many landscape features and structures certainly had religious significance, we categorized 143 sites as being primarily religious in function, the second most common site category after agricultural sites. These locations primarily index formal, institutionalized religious practise; in this same category we could also count many additional sacred images and structures found in residential sites and elsewhere. Sacred sites in the Vijayanagara Metropolitan Region include large Hindu temple complexes, most of these associated with more substantial settlements. The sixteenth-century Pattabhirama temple, for example, is one of the largest in the region; it lies just outside the village of Kamalapura but inside the outer circuit of city walls in an area that became densely packed with houses and shops in this century. The Pattabhirama temple and several other large complexes in the survey area enclose multiple shrines within a bounding (*prakara*) wall; their towering gateways or *gopuras* are often visible at great distances. Many of these large complexes were elite-sponsored, as is clear from associated inscriptions and, interestingly, many are associated with Vaishnavite deities while a somewhat larger number of small shrines are associated with Shaivism or Goddess worship.

In addition to the large, formal temples complexes, we documented a large number of smaller temple complexes ranging in date from the Early (Sinopoli 1996a) to Late Vijayanagara periods. Even these small complexes follow consistent architectural formats and layouts, though they are also often carefully sited with reference to either natural features such as rockshelters or hilltops, or face roads or settlements. Only one example of a Harihara shrine (a deity incorporating aspects of both Shiva and Vishnu) was recorded, in the village of Kamalapura. Most shrines are identifiable as either Shaivite, Vaishnavite or Goddess-related, although there is also a wide range of more local deities and "folk" images such as the ubiquitous *naga* stones. In addition to formal shrines, we have also documented a large number of isolated images of deities carved on boulders or slabs. One interesting

example is a large rock whose natural shape evokes a coiled cobra with rearing head and extended hood; this likeness was enhanced with a small amount of carving, creating a large and rather alarming figure guarding a narrow paved passage through the outer city wall.

The range of locations with religious sites is immense. Temples, shrines and sculptures are found along roads and in settlements, near gates and bastions, on isolated hilltops, in fields, in the bed of the river and in association with reservoirs and canals. In some cases, we can link their locations to associations in local sacred geography. For example, the small temple complex VMS-83 is located near one of the seven sacred gateways to the capital that is noted in Sanskrit texts (Sinopoli and Morrison in press b, and Morrison in preparation). Images of a heroic form of Hanuman carved on slabs and boulders are extremely common in the survey area and are particularly associated with gateways and entrances. The popularity of Hanuman may be due to his local connections: this region is widely believed to be ancient Kishkindha, the monkey kingdom ruled by Sugriva (whose throne was restored with the help of the god Rama, a form of Vishnu) with the assistance of his loyal lieutenant Hanuman. Kishkindha and its inhabitants figure importantly in the great epic, the *Ramayana*.

The city of Vijayanagara was a cosmopolitan, multi-religious place and so, it seems, was the region surrounding it. Several places near the city were once home to significant numbers of Muslims; in these locations we have documented fifteenth- and sixteenth-century tombs; a mosque and *idgah* (outdoor place of prayer with a wall and niche indicating the direction of Mecca) were also documented in the extensive survey area, indicating the multi-religious nature of the rural as well as urban population. Jainism developed around the same time as Buddhism but although Buddhism largely disappeared from India in the second millennium, Jainism remained important, especially in Karnataka. Interestingly, Jain temples seem to be restricted to the city itself, suggesting that in this region, Jainism was practised primarily by urban dwellers. Even today, many Jains are involved in trade and

business and agricultural practice is prohibited to observant Jains.

Before Vijayanagara: Longer-Term Records

Finally, the VMS documented more than 40 previously unknown pre-Vijayanagara sites, ranging from the Neolithic through the Early Historic, enabling us to reconstruct in a general way the occupation and land use history of the study area from about 2400 BC to the present, elucidating for this area a history that was previously entirely absent. Isolated finds of prehistoric artefacts and temporally non-diagnostic lithics were also made throughout the survey region. A small number of the pre-Vijayanagara sites had been previously reported, such as the Neolithic ash mound locally known as Wali Ghat (VMS-26), presumed to be the funeral pyre of Vali (the brother of Sugriva who was killed by Rama). A few others were noted by British officer and antiquarian Robert Bruce Foote in the late nineteenth century; however, the vast majority of these sites have not previously been documented.

The majority of pre-Vijayanagara cultural features date to the late Iron Age and Early Historic periods; we link these periods together intentionally because of the problematic chronology in this region, where it is clear that megalith construction continued well into historic times. The sites typically lie within 1 to 2 km of the Tungabhadra River, most often on the slopes or upper terraces of high outcrops. We expect that many more such sites once existed in the region, particularly in areas south of the river, where many prehistoric remains were probably destroyed by the Vijayanagara-period building boom. Some 33 sites were documented in the intensive survey area. Outside the intensive survey area in the Daroji Valley is VMS-110, a large iron-smelting and settlement site occupied during the Neolithic and then again in the Early Historic period, finally being modified into a reservoir in the Vijayanagara period. In this same general area are megaliths, rock art, artefact scatters and four now largely destroyed Neolithic ash mounds. In many cases, we found Neolithic material (ceramics, ash mounds) in

association with later Iron Age or Early Historic deposits, although the pattern in the Daroji Valley suggests less continuity in occupation than that near the river.

Pre-Vijayanagara site types identified include seven megalith mortuary complexes, the largest of which (VMS-643, 645 and 647) may have covered as much as 20 to 30 ha. Features at these complexes included linear cairn megaliths, as well as circular and other stone alignments, petroglyphs and enigmatic features that we have tentatively termed crack features, in which large boulders (some of them chipped) were deliberately placed in fissures in outcrops. Clearly not all of these features are associated with burials; in fact most of them probably are not (many features are built over sheet-rock) and we prefer to refer to these impressive complexes as "commemorative" locations rather than cemeteries (Lycett and Morrison in preparation). Substantial reservoirs are also found at some of these sites; these differ morphologically from Vijayanagara-period facilities and do not seem to be associated with agriculture.

Nine sites contained isolated cairn megaliths. These were typically located on the edges of high outcrops in areas of high visibility. In several instances, a larger cemetery was found within 100 to 200 m of these isolated cairns. Five rock art sites were recorded. These were rock shelters or faces containing painted (red and white) and pecked motifs. In addition, cemetery and settlement sites often contained rock art (rock bruising) as well as lines of small cupules pecked into sheet-rock, sometimes in intersecting patterns. Several isolated rock art sites were also located and described.

Among our most significant Iron Age/Early Historic discoveries was the identification of seven settlement sites. Although late prehistoric and early historic period settlements are almost certainly under-reported relative to mortuary/commemorative (megalithic) complexes, our systematic survey located settlement sites at about the same frequency as large megalithic complexes. The identification of settlements may be hampered by their lack of standing architecture, a feature which makes them less evident to local inhabitants. Survey work of the village-to-village

variety is critically dependent on local understanding of archaeological distributions, and sites that are small, less obtrusive or simply not adequately described by visiting archaeologists may be missed in this kind of research. Iron Age and Early Historic settlements in the survey area were typically located atop high outcrops and on their slopes though small artifact scatters in low-lying areas suggests that a more complete picture of regional land use is probably obscured by later modifications, especially intensive agriculture. In several cases, settlements were paired with mortuary/commemorative complexes such as settlement VMS-541, located on the northern slope of the outcrop containing VMS-543. The majority of settlements were small, about 1 to 2 ha. Others, however, were significantly larger, with one of 20 ha and another of 40 ha; these larger settlements show signs of internal spatial differentiation, which we are still in the process of analysing.

Settlements were identified by high surface densities of artefacts as well as remains of structures, including rubble wall alignments and brick fragments. Artefacts include Black and Red Ware (BRW), polished and unpolished Red and Black wares, as well as Russet-Coated Painted Ware (RCPW) and a small number of Rouletted Ware (RW) sherds (the latter coming from far-off Bengal, according to recent XRF work by Gogte). Other

materials found on the surface and in test excavations of VMS-110 include stone and ivory beads, lapis lazuli beads and shell ornaments as well as chipped and ground stone artefacts, iron slag and faunal remains. Unfortunately, botanical preservation was poor and we can as yet say little about agricultural practice or food ways. VMS-110 also contained a well-preserved Neolithic component, with a distinctive lithic assemblage and micaceous grey and pink ceramics. Six AMS radiocarbon dates from our test excavations date the Early Historic materials from 175 BC to AD 75 and the Neolithic materials to 2465-2035 BC (two sigma ranges, calibrated; Morrison and Johansen in preparation).

Discussion

Although much work of analysis and synthesis remains to be done, the work of the VMS has opened up a heretofore unknown history of land use; vegetation, fire and occupational history; landscape modification; and sets of long-term associations and disjunctions of sacred places in northern Karnataka. We have been able to track human use of and human impact on the Vijayanagara area landscape over the past four thousand years and have been able to shed light on processes of imperial expansion, urbanization, agricultural intensification and the changing organization of craft production.