Systematic Transect Survey of the Jurreru Valley, Kurnool District, Andhra Pradesh

Shipton, C.B.K.[1], Janardhana, B.[2], Koshy, J.[2], Petraglia, M.D.[3], Haslam, M.[3] & Korisettar, R.[2]

[1] School of Geography and Environmental Science,
Monash University,
Clayton,
Melbourne,
Victoria,
3800,
Australia

[2]Department of History and Archaeology,
Karnatak University,
Pavate Nagar,
Dharwad,
580 003,
Karnataka,
India.

[3]Research Laboratory for Archaeology and the History of Art,
Dyson Perrins Building,
South Parks Road,
University of Oxford,
Oxford,
OX1 3QY,
United Kingdom.

Correspondence address:
ceri.shipton@cantab.net

Abstract

Here we present the methods and findings of a systematic transect survey conducted in the Jurerru valley, Kurnool District, Andhra Pradesh. Systematic protocols for locating, identifying and recording archaeological localities are detailed. The results of this transect survey are compared with those of a previous unsystematic survey to demonstrate some of the biases in the latter. The systematic data is then used to understand and compare landscape use during different periods of human occupation. The article demonstrates that systematic transect surveys can be used to rationalize landscapes of rich archaeological heritage.

Keywords

Systematic transect survey, locality identification, Jurreru valley, Kurnool District.

Introduction

Since the mid-nineteenth century surveys have revealed an abundance of archaeological sites from all periods across the Indian sub-sontinent (Foote, 1869; Clark & Sharma, 1982, Pappu, 1996, Chakrabarti, 2001). Pedestrian survey has proven to be a productive and cost-effective way to identify archaeological localities (Paddayya, 1982). Archaeological surveys conducted in conjunction with geological, geomorphological and palaeoenvironmental studies reveal how past populations adapted to different habitats (e.g. Pappu, 1974, 1985). Landscape surveys have even been used to elucidate aspects of ancient cosmologies (Boivin, 2004). However, on the whole, surveys undertaken in South Asia have been exploratory rather than systematic and may therefore bias locality distribution towards easily accessible locations, large sites, areas with high surface visibility, or particular classes of remains. In the absence of systematic data on the sizes and distributions of localities from different periods we are unable to draw firm conclusions about aspects of past behaviour such as settlement patterns and population density. Systematic transect surveys provide relatively unbiased data, so that after taking into account taphonomic factors, the actual frequency and distribution of localities can be extrapolated from the survey sample.

The Kurnool District in Andrha Pradesh has proved a rich hunting ground for archaeologists for over a century (Foote, 1884; Murty, 1974). In the Jurreru valley (Fig. 1), key sites have been discovered, providing significant information on important topics ranging from the Neolithic of South India (Allchin, 1963); through the origins of microlith technology and modern human behaviours in South Asia (Clarkson *et al*., 2009); to the impact of the Toba supervolcano eruption, 74 kya, on hominin populations (Petraglia *et al*., 2007). However as no systematic survey of the area has been undertaken the local context of these localities is not well understood. To rectify this situation we carried out a systematic transect survey of the Jurreru valley. The goal of the survey was to ascertain unbiased data on the frequency, size and distribution of localities in the Jurreru valley, to interpret the landscape use of past populations.

Geography

The Jurreru valley drains part of the limestone, shale and quartzite uplands of the Cuddapah basin (Gupta *et al.*, 2003). The Jurreru flows north-eastwards in its upper reaches, arcing round to flow due east after the first 10 km (Fig. 2). It continues eastward for approximately 30 km, flowing out of the uplands and on to the plains (Fig. 2), where it then turns south-east for 15 km before emptying into the larger southward flowing Bhundu River. The Jurreru valley is disproportionately large in comparison to the river itself, suggesting either it has experienced head water capture, or tectonic forces have widened the valley. The study area for this survey was a 4.5 km stretch of the valley around the village of Jwalapuram, just before the river flows out on to the plains. At this point the valley floor is gently sloping and approximately 250 m above sea level. On the southern side of the valley are two parallel east-west oriented hills known as Eddulakonda, which comprise limestone and shale beds capped by intrusive dolerite dykes, reaching a maximum height of c. 350 m (Fig. 3). On the northern side of the Jurreru valley is the steep limestone hill Peddakonda, which rises to a height of 480 m where it is capped by a quartzite plateau (Fig. 3). Large quartzite boulders that have detached from the plateau and litter the slope of Peddakonda, were used by humans as rockshelters (Fig. 4). Low limestone hills emanate eastwards from Peddakonda (Fig. 3). In the centre of the valley, at the western end of the survey area, there is a steep sided shale hill called Kuppakonda (Fig. 3).

Survey Method

The Jurreru survey was conducted by three archaeologists (Ceri Shipton, Janardhana B., Jinu Koshy) and a villager from Jwalapuram trained to identify artefacts (Hari Vishwanath). The area chosen to survey was a 4.5 kilometre stretch of the valley around the village of Jwalapuram in which a number previously known sites were located. The Jurreru valley is aligned east-west in the survey area; in order to get a representative cross section of archaeological remains the surveyors walked transects at regular intervals north-south across the valley, from the quartzite plateau to the furthest dolerite dyke. The north-eastern most point of the survey was the Nawab Bungalow located on a small limestone hill to the east of the village of Patapadu, while the south-western most point was a break in the dolerite dyke where a road runs between the villages of Krishnagiri and Cherlakoturu (Fig. 3). Pedestrian transect surveys were conducted by walking straight lines across the study area, and scanning the ground for artefacts. As each person is effectively able to scan just over a metre either side of them, our four-person transects were 10 m wide. Transects were spaced 200m apart, so they covered 5% of the total survey area (Fig. 5).

Much of the Jurreru valley floor was covered by rice paddies and jowar fields that the surveyors were unable to cross directly, while the hill slopes were covered in thorn bushes which sometimes reached impassable density (Fig. 4). These obstacles precluded traditional transect survey methods of walking along tape lines aligned using a compass or landscape feature. The transects were therefore guided using a Global Positioning System (GPS) handheld unit, which negated the need to string out tapes and so saved the survey a great deal of time. Following a single latitude across the entire width of the valley using a GPS, as opposed to repeatedly using a compass, also meant the transects were straighter and therefore provided more systematic data.

Archaeological localities were usually identified on the basis of artefact concentrations, which were defined as a minimum of three artefacts within a 5 m^2 area.

Other types of archaeological localities were identified by the presence of rock art, structures, and/or human skeletal remains. For each locality we assigned a locality code using a three letter abbreviation for the name of the nearest village followed by a number which increased consecutively with each new locality identified (e.g. JWP 64). Each locality therefore had a unique number allowing for systematic recording and discussion. We noted the date the locality was found and recorded which transect, if any, the locality occurred on. We took latitude and longitude in the approximate centre of the locality as well as noting the approximate elevation using the GPS. At each locality we estimated the maximum artefact density, which was divided into three categories, low (<2 per m^2), medium (>2 per m^2 <5 per m^2), and high (>5 per m^2). We estimated the approximate length of each locality, to the nearest 5 m. We noted the degree of artefact rounding to assess if the artefacts had been transported far from their original point of discard. We noted if the sediment at each locality appeared to be aggrading, eroding or stable. We described the surface vegetation, such as acacia scrub or grassland, and in the case of cultivated fields we noted the crop in question, as this greatly affects surface visibility. Based on the depositional and environmental context, the artefact density, the freshness of the artefacts and the size of the locality, we also estimated the potential for finding artefacts in a buried context. Localities with a discrete, high density artefact scatter, which were uncultivated, with low vegetation cover, and had a stable land surface, were considered to have the best prospects for excavation. Each locality was photographed, and the direction and number of the photograph was documented.

Artefacts were not collected during the survey as this might bias future surface collection or result in the loss of localities altogether (Burke & Smith, 2004). Instead the archaeological remains were described in the field with each category of remains having its own description criteria. In the case of lithics we recorded whether the artefacts were large (longer than 10 cm), medium (5 to 10 cm long) or small (less than 5 cm long) and noted the raw materials present. We recorded if the lithics included cores, flakes or retouched pieces and we noted and photographed any distinctive pieces such as blades, backed artefacts, or bifaces. For ceramics we described the colour and coarseness of all the wares present, whether there was any decoration and whether they were handmade or wheel made. For rock art we photographed and described the pictures noting any identifiable species represented and the colour of the paint. For structures we measured the dimensions, noted the materials it was made of and made an assessment of its possible function. For human skeletal remains we identified the bones and the minimum number of individuals represented. All survey data was recorded with pen and paper in the field, before being entered into an Excel spreadsheet after each week's work.

During the survey we encountered many localities as we were walking around obstacles blocking the transect trajectory, or when we were walking between transects. These localities were recorded as off-transect, allowing them to be analysed separately from the transect sites because they were not identified using the same systematic criteria.

Using diagnostic artefact types we were able to assign a provisional period to the majority of localities. The periods assigned by the survey are only intended as provisional guides as most surface archaeological remains are not dateable and may become associated for reasons other than their contemporaneity. Our survey was guided by chronological information from previously excavated localities (Petraglia *et al.*, 2007; Clarkson *et al.*, 2009). The presence of Acheulean artefacts in the valley indicates human occupation extends as far back as the Middle Pleistocene. The Middle Palaeolithic in the valley is known to date from 78 to 38 thousand years ago, while the microlithic dates from 35 thousand years ago to the late Holocene. Neolithic localities were identified by the presence of Patapadu ware, coarse black ware, and hand-made red ware, ceramic styles that are known to date from the Neolithic (Fuller *et al.*, 2007). The great majority of stone structures we encountered were megalithic burials, which emerge in this region at around 1400 B.C. and continue through the Iron Age and into the Early Historic period to circa 100 A.D. (Fuller *et al*., 2007). Localities lacking diagnostic artefacts were classed as unknown.

Comparison with Previous Survey

The survey was conducted over an area of approximately 13 km^2, 5% of which was covered by our transects. We found a total of 90 localities along the transects and a further 50 were discovered off the transects. Without systematic surveys, archaeological locality distributions may be biased towards large sites, in locations that are easily accessible, with high surface visibility. Previous exploration had revealed archaeological localities on Peddakonda, the base of Eddulakonda and on the uncultivated portions of the valley floor. Our systematic survey found that archaeological localities are more widely distributed throughout the valley, both high on the hill slopes and in cultivated fields and sometimes may consist of only a handful of artefacts.

To test the utility of systematic transects we compared the results of the systematic survey with those of an unsystematic, ‘windshield’ survey carried out in 2003 (Petraglia *et al*., 2009a). Using chi-square tests in Excel we compared the proportion of localities by period (Table 1) between the two surveys. Table 1 indicates there is a very significant difference between the transect and unsystematic surveys in terms of archaeological periods, such that Iron Age sites are overrepresented and Neolithic sites are underrepresented in the unsystematic survey. This result may be attributed to the fact that Iron Age sites consist of highly visible Megalithic structures. We then compared the proportion of localities found in fields versus those found in uncultivated areas (Table 2) and found there was a highly significant bias in the unsystematic survey towards uncultivated areas. This may be explained by the greater surface visibility making it easier to identify sites in the absence of crop coverage. The intensity of the transect survey ensured that even in low visibility situations we were still able to identify sites. We also compared the proportion of localities found on hillsides versus those on the valley floor (Table 3). The results show a significant bias towards localities on the hillsides in the 2003 survey, which we attribute to the targeting of large quartzite rock shelters during this survey. Lastly we compared the number of localities representing each artefact locality between the surveys (Table 4). The results show that in 2003 there was a significant bias towards sites with structures, rock art and human remains and against sites with lithics. Again we attribute this to the greater visibility of structures and the targeting of rock shelters during the 2003 survey. These tests all show that there are significant biases in unsystematic survey which means their results cannot reliably be used to determine human landscape use.

Surveys are constrained by the amount of time, money and people available. For future research we determined the minimum number of 10 m wide transects that it is necessary to walk to get a representative sample of the archaeology in the valley. A chi-square test compared the distribution of localities by period between our survey, with transects every 200 m, and the results obtained if we had walked transects every 400 m and every 800 m. The chi-square p-values in table 6 show that while the distribution of sites does not differ when transects are walked every 200 m versus every 400 m there is a significant difference in distribution between transects walked every 200 m and every 800 m. We therefore conclude that in order to get a representative sample of archaeology with limited resources the optimal spacing between 10 m wide transects is between 400 and 800 m.

Discussion

With a rigorous assessment of the location, frequency and size of archaeological localities we are able to make some assertions about the taphonomic processes that have resulted in the present day locality distribution and about human settlement patterns. At no surface locality did we observe a substantial degree of artefact rounding, suggesting that all artefacts occur at or near their primary discard location. The small size and low energy of the Jurreru river ensures that it is unable to create secondary context sites by transporting large quantities of artefacts from their original locations.

The area around the village of Jwalapuram has been a focus for human activity from the Acheulean to the present day. The densest distribution of localities was west of Jwalapuram and east of the Jurreru dam (Fig. 6). This pattern may in part be taphonomic as this is the least cultivated area of the valley, so localities will not have been destroyed by irrigation and ploughing. Nonetheless localities reach a high frequency in this area which requires some behavioural explanation; we propose three complementary pull factors bringing hominins to this section of the Jurreru valley. Firstly there is the availability of permanent water sources including the Jurreru river and its tributary the Kukkalaganticheruvu (which joins the Jurreru from the south near the village of Jwalapuram). A large travertine formation containing Acheulean artefacts near the west bank of the Kukkalaganticheruvu also indicates spring activity in the Pleistocene, while palaeoenvironmental data indicates the existence of a palaeo-lake in the Pleistocene (Petraglia *et al*., 2009a). Secondly, this section of the valley is at the juncture between the hilly regions to the west and the plains to the east. The valley is the largest running through the uplands for tens of kilometres north and south (Fig 3.) and may have been used as a corridor for animal movements in the past. Thirdly there is a rich variety of raw materials suitable for lithic manufacture in this part of the valley, including a dark blue siliceous limestone, chert and chalcedony, a fine grained quartzite, quartz, serpentine and dolerite, the latter may have been used as both a substrate and as hammerstones. The combination of permanent water sources, a corridor for animal movements and an abundance of lithic raw materials would drawn hominins to this part of the Jurreru valley since the Lower Palaeolithic.

Systematic survey not only allows identification of where past human activity took place but also of areas where conspicuous activity is absent. Figure 6 shows some interesting empty spots in terms of archaeological localities which may be explained by both taphonomic and behavioural factors. The area upstream of the dam has filled up with sediment since the dam's construction in the mid-twentieth century, burying any archaeology. Conversely the low limestone hills on the northern side of the valley are being extensively quarried and any archaeology will have been destroyed in the process. In the cultivated areas adjacent to the road and south of Jwalapuram archaeological localities are rare due to the difficulties of spotting remains among the most common crops: jowar and rice paddies. Archaeological remains are entirely absent from the hill sides except where they occur in rock shelters, on flat promontories or in one instance in a cave. This is unlikely to be explained by taphonomy as there is little sediment accumulation on these slopes so artefacts have not been buried, and bushes and trees prevent slope wash movement. Steep ground is unsuitable for habitation and other human activities which leave an archaeological signature.

The survey encountered a range of localities both in terms of their size and their location on the floor and hill slopes of the valley (Fig. 7). Locality length ranges from 1 to 400 m, while locality elevation ranges from 233 to 495 m above sea level. Figure 6 shows that while most localities are under 65 m in length and situated on the valley floor or the lower slopes, there were also a few very large localities on the valley floor and a few small localities high on the hill slopes. The large valley floor sites are mostly ceramic bearing localities and probably represent settled agricultural villages. The smaller localities on the valley floor are from all different periods and represent a variety of different activities and occupations. The very small localities high on the hill slopes are mostly rock art localities, painted on large quartzite boulders. Their small size suggests they were either occupied by small groups, or were only used sporadically, perhaps for ritual activities.

Each period appears to have a particular distribution of localities across the landscape. We encountered only one Acheulean locality, at the gap in the dolerite dyke, although we did encounter a couple of isolated bifaces at the base of Eddulakonda and Kuppakonda. The Middle Palaeolithic localities were numerous (Fig. 4) and some were extremely large and dense lithic concentrations. On several transects west of the gap in the dolerite dyke we found Late Palaeolithic artefacts running from the base of Eddulakonda out on to the valley floor for up to 100 m. Excavations have revealed that more Acheulean and Middle Palaeolithic sites are likely to occur further out on to the valley floor, but these have been buried over time. The principal raw material used by Middle Palaeolithic hominins was the dark blue siliceous limestone that occurs as a stratum within Eddulakonda, so hominins appear to have been extensively exploiting this material at, or close to, the source. In addition to these localities on the southern side of valley, were several Middle Palaeolithic localities of varying size and density across the valley floor. Despite the high frequency and often high artefact density of Middle Palaeolithic localities, they were geographically restricted, with no localities found on the hill slopes or the quartzite plateau. The lack of sediment accumulation on the slopes and the plateau means we cannot ascribe this pattern to artefacts being buried. Middle Palaeolithic hominins were apparently based close to their raw material sources and were not exploiting the uplands to a significant degree. In this resource rich section of the valley Middle Palaeolithic groups may have had no need to heavily exploit the more inaccessible areas of the landscape.

In contrast to the Middle Palaeolithic localities, microlithic localities were encountered throughout the landscape. Microliths and rock art had previously been identified on the lower quartzite boulder rock shelters, such as Jwalapuram 9. As a result of transect sampling we found three more rock shelters with rock art and microliths in association, on boulders high up the slope of Peddakonda (JWP 27, JWP 134 and JWP 135). Many of the artefact localities found across the valley floor included microliths, although some also included other types of lithics and ceramics and probably represent the conflation of multiple periods on an eroding surface. On the southern side of the valley we found several discrete microlith localities on the hill slopes. JWP 112 and JWP 113 in particular stand out for their high density (over 5 artefact per m^2), and their location on flat promontories on hillsides suggesting they were living areas. On the northern side of the valley two microlith localities were identified on the tops of the low limestone hills which extend eastwards from Peddakonda (JWP 101 and PTP 22). Another microlith locality was discovered on the quartzite plateau itself (PNM 18). This increased landscape use in comparison to the Middle Palaeolithic may be due to increased population pressure (Petraglia *et al*., 2009b) resulting in the need to forage more widely. Alternatively, microlith producing populations may have continued to occupy the Juerru valley during the Holocene and may have been forced into the more marginal areas of the valley by encroaching agricultural populations.

South-west of Patapadu, we found a large Neolithic artefact locality (PTP 2) which stretches for over 150 m with a medium to high density of lithics and ceramics, including the Neolithic Patapadu ware. This locality is assumed to be the location of a former village. Several rock art localities on the quartzite boulders and cliffs are associated with Neolithic pottery (JWP 34, JWP 61 and JWP 131). These are particularly interesting because they indicate continuity with the preceding microlithic period or interaction between Neolithic populations inhabiting the plains and hunter-gatherers occupying the hills. A small cave (Fig. 4) was discovered containing a Neolithic burial with grave goods (JWP 133); fragments of human long bones and some handmade and finger pinched pottery sherds were observed.

During the survey four Megalithic burial complexes were encountered, two on transects and two off transects. The smallest of these comprised two cist burials at the eastern end of Kuppakonda (JWP 45). The second burial complex (JWP 101) was located on the low limestone hill running eastwards from the eastern corner of Peddakonda. This consisted of at least 4 cist burials with human remains and grave goods in evidence. The third burial complex (JWP 31) was located at the base of Peddakonda. This comprised five large cairns each containing multiple cist burials, with the largest cairn measuring 14 x 7 metres. The fourth burial complex (PTP 26) was found south of the village of Patapadu near the base of Eddulakonda. This complex comprised several large cairns made of dolerite cobbles within an elliptical arrangement of dolerite boulders. During our field season we also encountered a very large megalithic burial ground (YAG 1) just outside the range of our survey, close to the Yaganti temple. Here we counted over 50 separate burial monuments conforming to a pattern of a rectangular cist made of limestone slabs, surrounded by a circular arrangement of stones. Within the survey area we also saw a modern cist burial, which appeared to contain more than one individual. We found one rock art locality with sherds of black and red ware (JWP 136), a pottery style that has been linked to the early Iron Age (Fuller *et al*., 2007). Iron slag and pottery were discovered at locality JWP 38 at the eastern end of Kuppakonda. This locality is probably part of a large adjacent lithic and ceramic bearing site, and may well be an Iron Age village.

In order to assess chronological trends in settlement patterns we compared artefact density across the periods. Table 6 shows there are trends for increasing artefact density throughout the ages. A Kruskall-Wallis test showed this pattern to be highly significant. One possibility is that this trend results from the winnowing of artefacts over time, although there is little evidence for substantial artefact transport and sorting. Alternatively this may reflect a trend towards increasing sedentism from the microlithic onwards, so that as people were repeatedly using the same localities this caused a build up of higher artefact densities. These comparisons were done using both on and off transect localities in order to increase sample size; when only transect localities were compared the statistical results were the same.

Conclusion

This article has demonstrated that unsystematic survey can result in significant bias in the periods, environment, location and types of material observed. Transect surveys provide a robust method for determining the true spatial distribution of archaeological localities within a given area. With this information we can begin to make assertions about the landscape use of past populations, thus situating excavated localities in their local context and enhancing our understanding of human behaviour. In the Jurreru valley systematic survey data has illustrated that occupation of the valley begins in the Acheulean period; there was intense, but spatially restricted occupation of the valley in the Middle Palaeolithic; microlith producing populations occupied a broader range of habitats in the valley; and there was a general trend for an increase in artefact density over time, which may reflect increasing sedentism. We hope that systematic transect surveys will be employed to rationalise existing areas of archaeological heritage in India, enabling rigorous analysis of the landscape use of past populations.

Acknowledgements

We wish to thank the Archaeological Survey of India for permission to conduct this research. We gratefully acknowledge the American Institute of Indian Studies for logistical support. The survey was supported by the British Academy, the Leverhulme Trust and Karnatak University. We thank the villagers of the Jurreru valley for allowing us to conduct this work, and we wish to note a special thanks to Hari Vishwanath for his assistance on the survey.

References

Allchin, F.R. 1963. *Neolithic cattle keepers of South India: a study of the Deccan Ashmounds*. Cambridge: Cambridge University Press.

Blinkhorn, J. 2008. In which context does symbolic behaviour first become manifest in the archaeological record: a case study from Kurnool District, India. Unpublished M.Phil thesis. University of Cambridge.

Boivin, N. 2004. Landscape and Cosmology in the South Indian Neolithic: new perspectives on the Deccan Ashmounds. *Cambridge Archaeological Journal* 14: 235-257

Burke & Smith 2004. *The Archaeologist's Field Handbook*. Crows Nest: Allen & Unwin

Clarkson, C., Petraglia, M., Korisettar, R., Haslam, M., Boivin, N., Crowther, A., Ditchfield, P., Fuller, D., Miracle, P., Harris, C., Connell, K., James, H. & Koshy, J. 2009. The oldest and longest enduring microlithic sequence in India: 35,000 years of modern human occupation and change at the Jwalapuram Locality 9 rockshelter. *Antiquity* 83: 326-348.

Clark, J.D. & Sharma, G.R. (Eds.) 1983. *Palaeoenvironment and Prehistory in the Middle Son Valley, Madhya Pradesh, north central India*. Allahabad: Abinash Prakashan.

Charkrabarti, D.K. 2001. *Archaeological Geography of the Ganga Plain: The Lower and the Middle Ganga.* Permanent Black: Delhi

Foote, R.B. 1869. On quartzite implements of Palaeolithic types from the laterite formations of the east coast of southern India. In: *International Congress of Prehistoric Archaeoilogy: Transactions of the Third Session, Norwich, 1869*. Longmans Green and Co. London pp.224-239

Foote, RB, 1884b, "Rough notes on Billa Surgam and other caves in the Kurnool District", *Records of the Geological Survey of India* 17, pp. 27-34.

Fuller D. Q., N. Boivin & R. Korisettar, 2007. Dating the Neolithic of South India: new radiometric evidence for key economic, social and ritual transformations. *Antiquity* 81, 755-778.

Gupta, S., Rai, S.S., Prakasam, K.S., Srinagesh, D., Bansal, B.K., Chadha, R.K., Priestley, K. and Gaur, V.K. 2003. The nature of the crust in southern India. Implications for Precambrian crustal evolution. *Geophysical Research Letters* 30: 141-1419.

Murty, M.L.K. 1974. A Late Pleistocene Cave Site in Southern India. *Proceedings of the American Philosophical Society* 118: 196-230

Paddayya, K. 1982. *The Acheulian culture of the Hunsgi Valley (Peninsular India): a settlement system perspective*. Deccan College, Pune.

Pappu, R.S. 1974. *Pleistocene studies in the upper Krishna Basin*. Deccan College, Pune.

Pappu, R.S. 1985. The geomorphic setting of Acheulian sites in peninsula India. In (Misra, V.N. & Bellwood, P. (eds.) *Recent advances in Indo-Pacific Prehistory* pp. 9-12. Delhi: India Book House

Pappu, S. (1996) Reinvestigation of the prehistoric archaeological record in the Kortallyar basin, Tamil Nadu. *Man and Environment* 21:1-23

Petraglia, M., R. Korisettar, N. Boivin, C. Clarkson, P. Ditchfield, S. Jones, J. Koshy, M. M. Lahr, C. Oppenheimer, D. Pyle, R. Roberts, J-L. Schwenninger, L. Arnold & K. White (2007). Middle Palaeolithic Assemblages from the Indian subcontinent before and after the Toba Super-eruption. *Science* 317, 114-116.

Petraglia, M.D., Korisettar, R., Bai, M.K., Boivin, N., Janardhana, B., Clarkson, C., Cunningham, K., Ditchfield, P., Fuller, D., Hampson, J., Haslam, M., Jones, S., Koshy, J., Miracle, P., Oppenheimer, C., Roberts, R., & White, K. (2009a). Pleistocene and Holocene occupations of the Kurnool District India: Cave and rockshelter records, the Toba super-eruption and forager farmer interactions. *Journal of Eurasian Prehistory* 6: 119-166

Petraglia, M.D., C. Clarkson, N. Boivin, M. Haslam, R. Korisettar, G. Chaubey, P. Ditchfield, D. Fuller, H. James, S. Jones, T. Kivisild, J. Koshy, M.M. Lahr, M. Metsupalu, R. Roberts and L. Arnold (2009b). Population increase and environmental deterioration correspond with microlithic innovations in South Asia ca. 35,000 years ago. *Proceedings of the National Academy of Sciences USA* 106: 12261-12266

Tables

Period	**Transect**	**Unsystematic**
Acheulean	1 (1.1%)	1 (8.3%)
Middle Palaeolithic	33 (36.7%)	5 (41.7%)
microlithic	27 (30%)	3 (25%)
Neolithic	4 (4.4%)	0 (0)
Iron Age	3 (3.3%)	3 (25%)
Total	68 (100%)	12 (100%)
Chi-square p-value		<0.001

Table 1. Locality count by period and survey. Localities of unknown period are not included.

	Transect	**Unsystematic**
Fields	33 (36.7%)	1 (7.1%)
Uncultivated	57 (63.3%)	13 (92.9%)
Total	90 (100%)	14 (100%)
Chi-square p-value		<0.001

Table 2. Localities found in fields versus uncultivated areas by survey type.

	Transect	**Unsystematic**
Hillside	5 (5.6%)	2 (14.3%)
Valley Floor	85 (94.4%)	12 (85.7%)
Total	90 (100%)	14 (100%)
Chi-square p-value		<0.001

Table 3. Localities found on hillsides versus the valley floor by survey type.

Artefact Categories	**Transect**	**Unsystematic**
Lithics	87 (74.4%)	11 (40.7%)
Ceramics	20 (17.1%)	5 (18.5%)
Structures	4 (3.4%)	3 (11.1%)
Rock Art	4 (3.4%)	6 (22.2%)
Human Remains	2 (1.7%)	2 (7.4%)
Chi-square p-value		<0.001

Table 4. Number of localities containing each artefact category by survey type.

	Spacing Between Transects		
Period	**200 m**	**400 m**	**800 m**
Acheulean	1 (1.1%)	1 (2.1%)	1 (3.9%)
Middle Palaeolithic	33 (36.7%)	23 (47.9%)	11 (42.3%)
microlithic	27 (30%)	14 (29.2%)	7 (26.9%)
Neolithic	4 (4.4%)	3 (6.25%)	2 (7.7%)
Iron Age	3 (3.3%)	1 (2.1%)	1 (3.9%)
Chi-square p-value		0.112	0.002

Table 5. Locality types by period for different transect densities. Chi-squared p-values compare 400 and 800 m spaced transects with 200 m spaced transects. N.B. sites of unknown period are not included. Chi-squared based on doubling the figures for the 400 m transects and quadrupling the figures for the 800 m transects.

	Acheulean	**Middle Palaeolithic**	**microlithic**	**Neolithic**	**Iron Age**
Mean artefact density category	1.2	1.302	1.688	1.818	2.429
Kruskall-Wallis p-value					0.002

Table 6. Kruskall-Wallis test comparing ordinal categories of artefact density across periods.

1 = low density, 2 = medium density, 3 = high density.

Figures

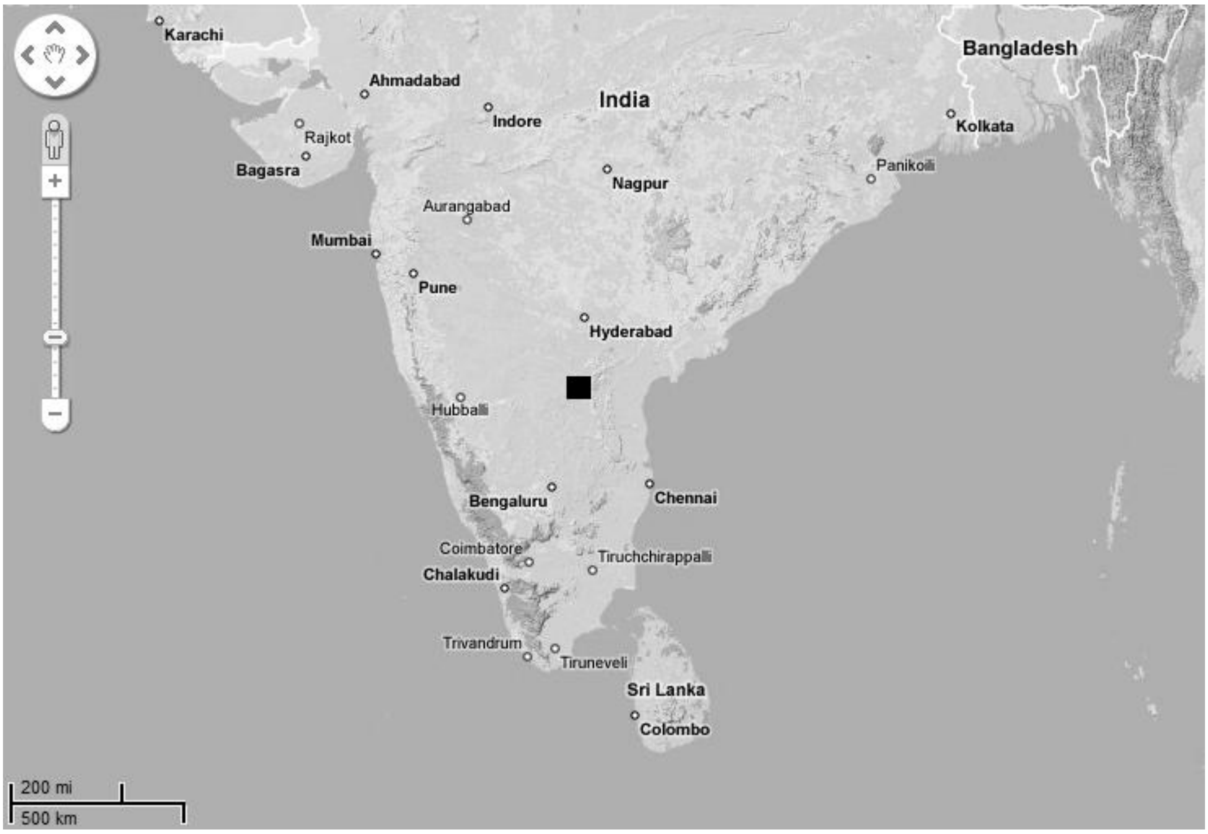

Figure 1. The Jurreru valley, marked by the black square, in peninsula India

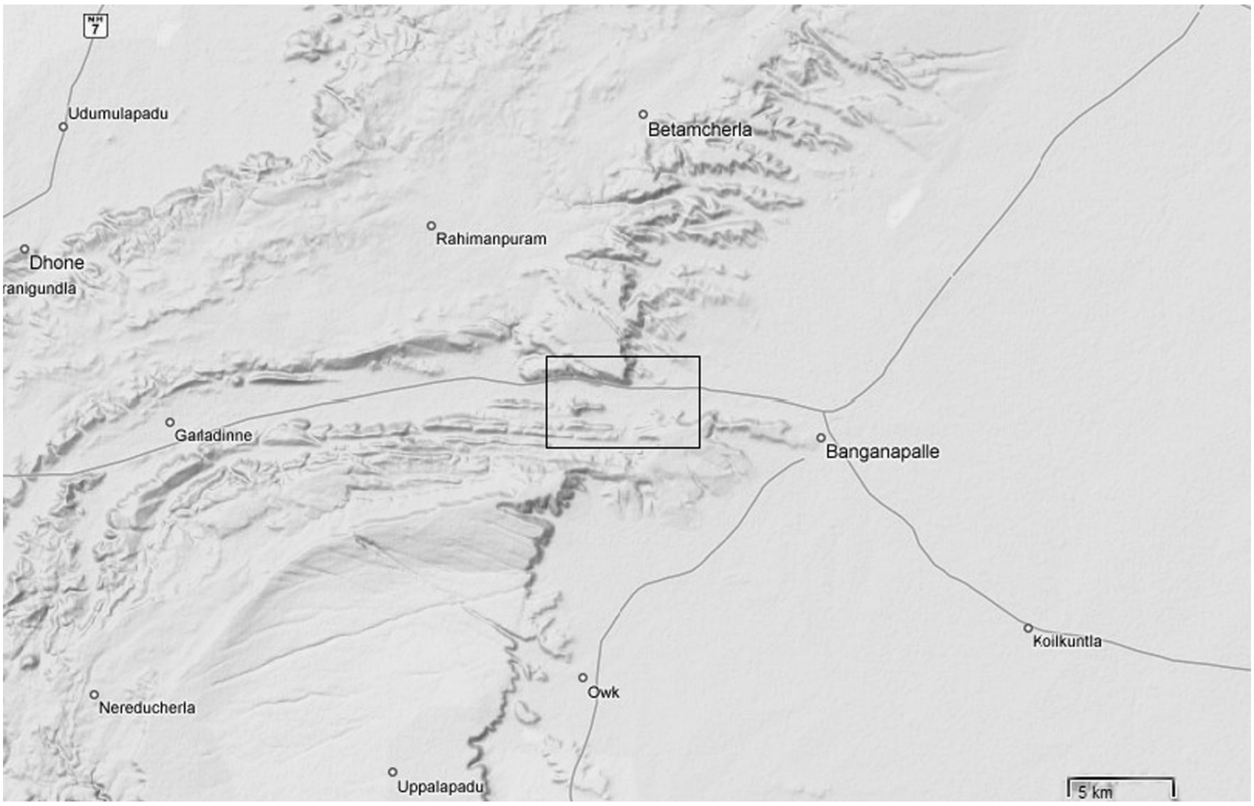

Figure 2. The Jurreru valley and surrounding terrain. The survey area is within the rectangle.

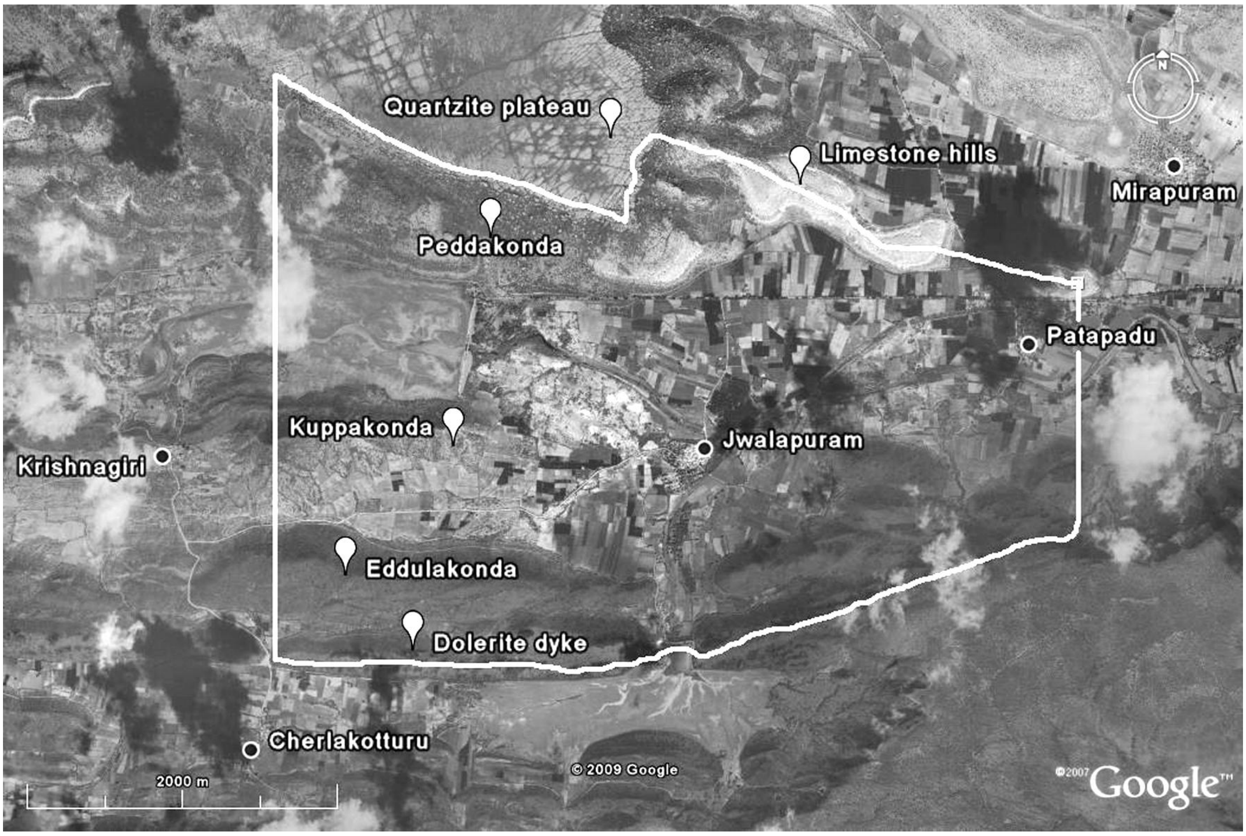

Figure 3. Geography of the Jurreru valley. Survey area outlined in white.

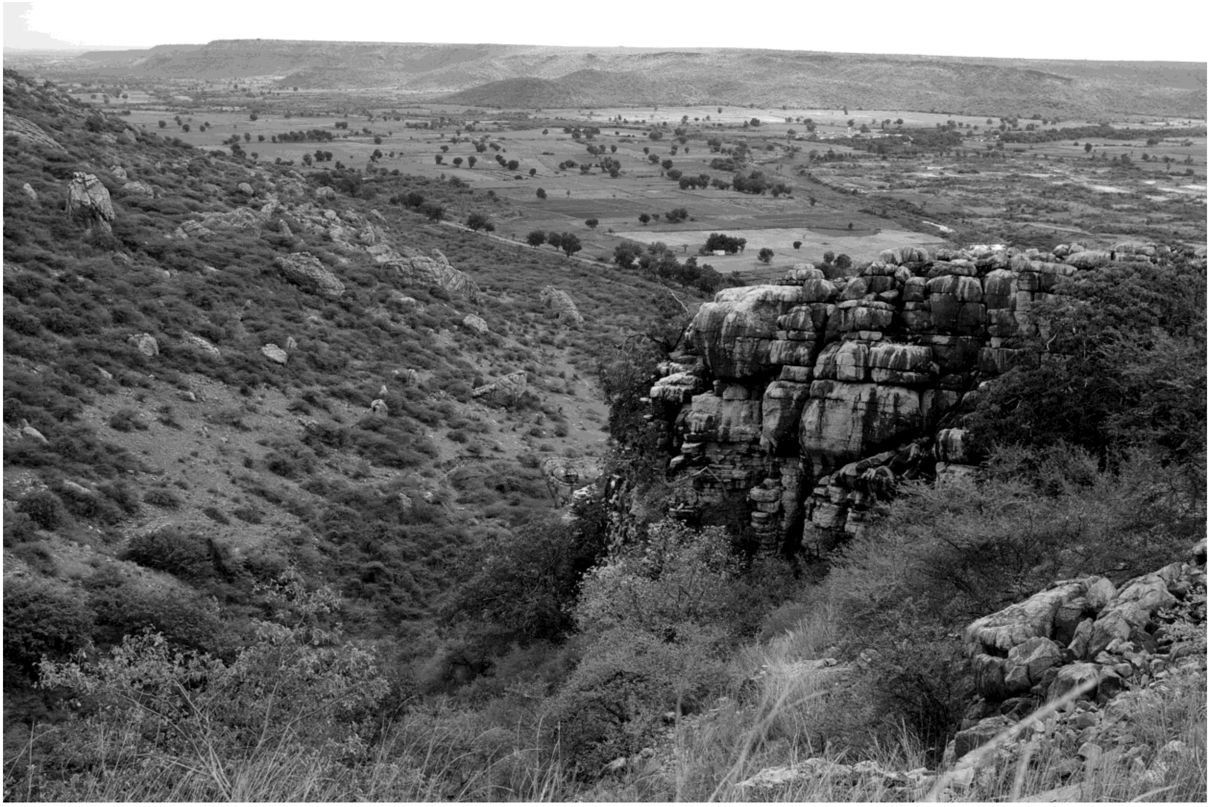

Figure 5. View of the Jurreru valley from Peddakonda looking eastwards towards Patapadu. Quartzite boulders that were sometimes used as rockshelters are visible on the left of the picture. Note that much of the valley floor is under cultivation and that thorny scrub covers the hillsides. The cave in which a Neolithic burial was discovered is situated in the cliff on the right of the picture.

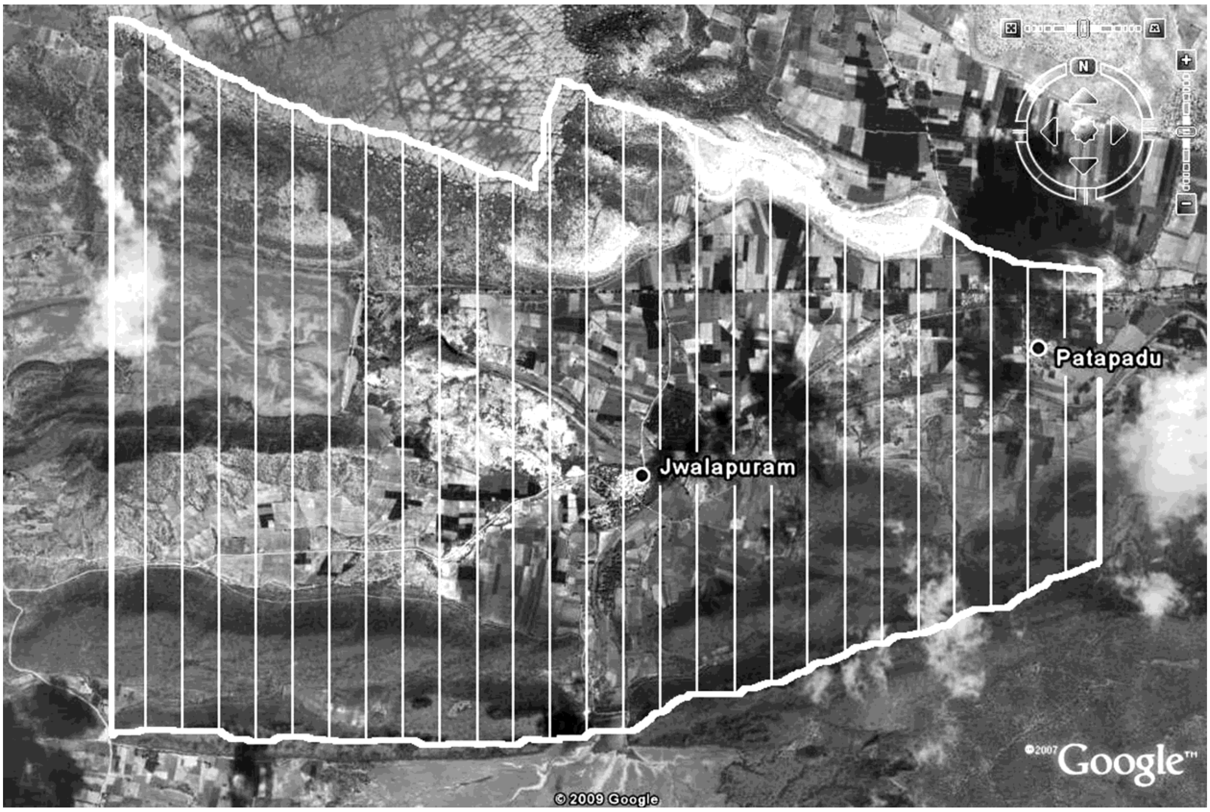

Figure 4. Transects walked across the survey area.

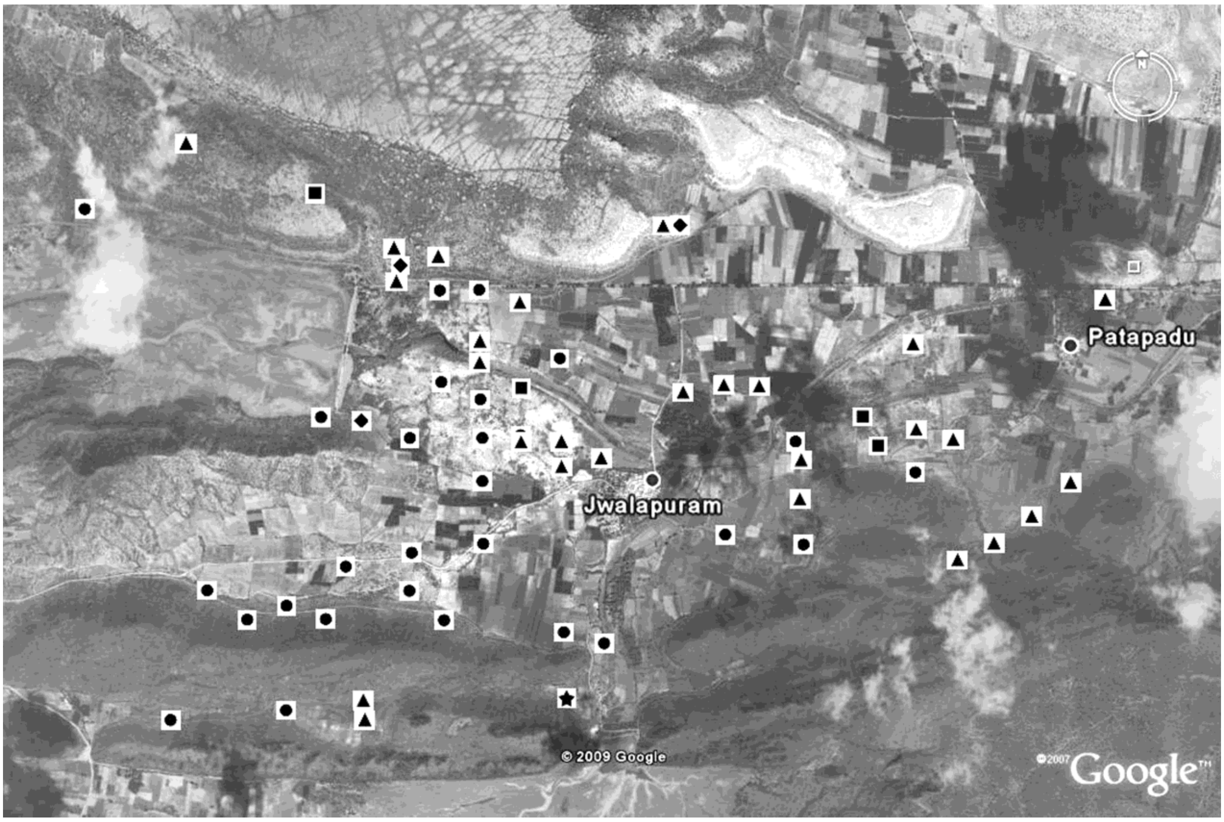

Figure 6. Sites found on transects in the Jurreru valley. The star denotes the Acheulean locality, circles indicate Middle Palaeolithic localities, triangles indicate microlithic localities, squares denote Neolithic localities and diamonds denote Iron Age localities.

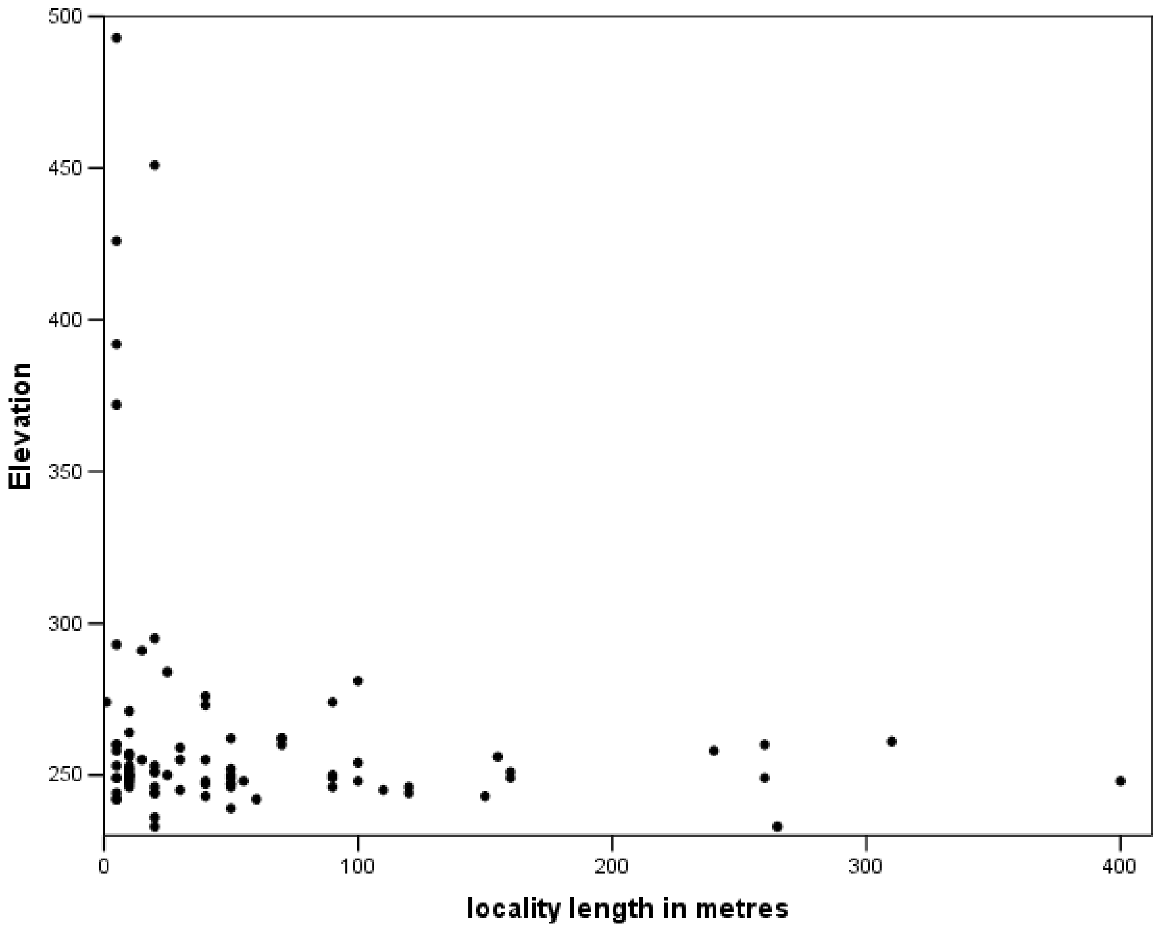

Figure 7. Locality length by elevation above sea level in metres.