

Devilish details – fine-tuning survey techniques for ephemeral sites

Wieke DE NEEF & Martijn VAN LEUSEN¹

Groningen Institute of Archaeology, University of Groningen, the Netherlands

Abstract

The Rural Life in Protohistoric Italy project investigates small surface scatters from the Bronze and Iron Age, found during field walking surveys in Calabria, Italy. In this article we argue that detailed, multidisciplinary investigations of such ephemeral sites are crucial for our understanding of protohistoric rural society and land use. We illustrate our methodology of integrated surface recordings, geophysical methods, small test pits and laboratory studies with the case study of the Late Bronze Age site T231. The implications of this case study for regional settlement models are discussed.

Keywords: *Archaeological methodology, rural landscapes, near-surface prospection, protohistory, data integration.*

Résumé

Le projet Rural Life in Protohistoric Italy (Vie rurale en Italie protohistorique) étudie la distribution de matériels de surface des âges du Bronze et du Fer, trouvées lors de prospections pédestres en Calabre (Italie). Dans cet article nous soutenons que les recherches détaillées et multidisciplinaires de tel sites éphémères sont cruciaux pour la compréhension de la société rurale protohistorique et l'utilisation des terres. L'étude de cas du site T231 daté du Bronze final illustre notre approche méthodologique des enregistrements intégrés en surface, des méthodes géophysiques, des petits sondages et des études de laboratoire. La discussion porte sur les implications de cette étude de cas pour des modèles d'habitat régional.

Mots clés: *Méthodologie archéologique, paysages ruraux, prospection près de la surface, protohistoire, intégration de données.*

Introduction

Ephemeral protohistoric surface sites are detected in almost all field walking surveys in Italy; they bear witness to rural land use that stretches from coastlines to marginal areas in the mountainous interior. However, our understanding of protohistoric society is hampered by a lack of studies targeted at small sites: Italian protohistoric research remains, until today, largely focused on “central places”. In this paper we will present our current investigations into small Bronze Age surface scatters in Calabria (southern Italy), and argue that a systematic, detailed, and interdisciplinary approach will result in a new level of insight, with the integration of high resolution datasets as the key to success. We will illustrate our approach with a case study: the Late Bronze Age (LBA) structure at site T231.

Protohistoric research in the Sibaritide

The Plain of Sibari and its surroundings in northern Calabria have been the subject of a long tradition of protohistoric research, yet most intensive investigations were dedicated to large, central places interpreted as the top rung of settlement hierarchy: Torre Mordillo, Broglio di Trebisacce, and Timpone della Motta (Figure 1). Although small protohistoric scatters have been recorded in the area since the 1960's (De Rossi *et al.* 1969), and the dynamics between “major” and “minor” sites were studied by the La Sapienza University research school of Renato Peroni in the 1980's and 1990's, none of the smaller sites have been studied in detail. Moreover, neither single farms nor other limited

¹ Contact: w.de.neef@rug.nl.



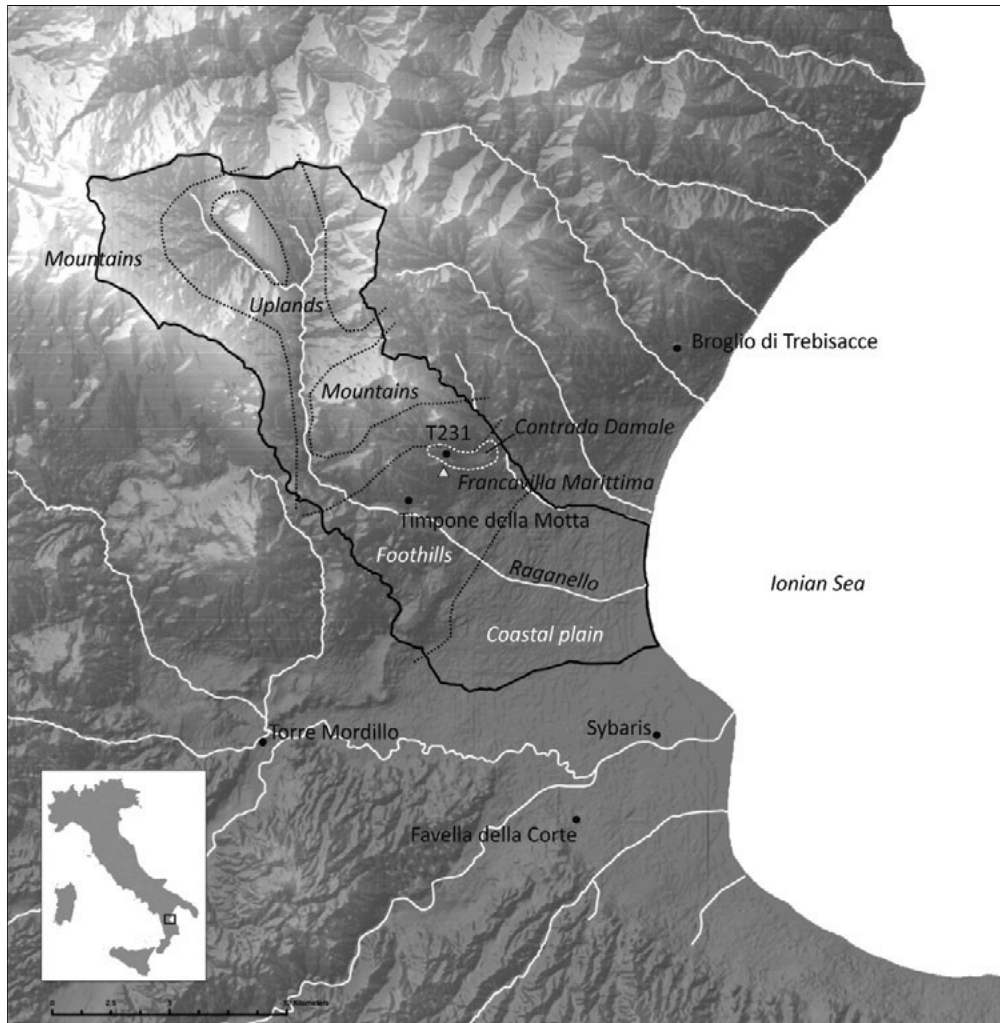


FIGURE 1. THE SIBARITIDE IN NORTHERN CALABRIA (ITALY), WITH ARCHAEOLOGICAL SITES MENTIONED IN THE TEXT. THE RESEARCH AREA OF THE RAP AND RLPI PROJECTS IS OUTLINED IN BLACK. THE FOUR LANDSCAPE ZONES USED IN THE SITE CLASSIFICATION ARE INDICATED WITH DASHED LINES (MAP W. DE NEEF/GIA).

activity locations feature at all in Peroni's model of protohistoric settlement dynamics and increasing social complexity in the Sibaritide (Peroni & Trucco 1994: 832-879, Vanzetti 2013). In fact, Peroni's theory is based on the unsystematic topographical recording of a mere 36 sites, occupied during at least one sub-phase of the 800-year span between the Middle Bronze Age and Early Iron Age (1700-900 BC).

Studies by the Groningen Institute of Archaeology (GIA) in the Raganello basin add a significant dimension to this existing framework. Originally a side project to explore the surroundings of the GIA excavations on the Timpone della Motta near Francavilla Marittima, the surveys grew into a large independent research project mapping diachronic settlement remains between the coastal plain and the inland mountains of the Pollino range (Attema *et al.* 2010: 6-7). More than 10 years of systematic field walking by the Raganello Archaeological Project (RAP, 2000-2010) resulted in the mapping of 255 surface scatters in this river basin in the northern part of the Sibaritide, dating from the Bronze Age to sub-recent threshing floors. The majority of these remains, 160 sites, date to the protohistoric period. Since they are typically only a few meters in diameter, we assume that we have



recorded the base of the settlement hierarchy consisting of short-lived, rural activity foci. They occur throughout the research area, and testify to protohistoric presence in all landscape components, from the gently rolling foothills to slopes in the uplands and mountains. The coastal plain, formally part of the research area, remains uninvestigated due to the heavy alluvial sedimentation, covering antique land surfaces under several meters of soil. Archaeological remains outside our research area, such as the Neolithic village Favella della Corte and the Archaic Greek colony of Sybaris, indicate that the coastal plain was occupied as well.

Our present research project, the Rural Life in Protohistoric Italy project (RLPI, 2010-2015), is aimed at a better understanding of the protohistoric record presented by the RAP and other Mediterranean survey projects. The interpretation of ephemeral protohistoric remains encounters several problems. First, most of the scatters are small and they often consist of poorly preserved handmade ceramics which cannot be dated closely. This means that it is difficult to assess what they represent in terms of function, chronology, and possible structural remains. Moreover, since they are located in an area which was until recently under intensive agricultural exploitation, covering diverse geological zones characterized by pronounced relief, natural and anthropogenic post-depositional processes deeply influence their preservation and detection. And finally, we are aware of the fact that their detection may have been subject to several research biases, caused by the survey strategy, accessibility, and visibility.

To tackle these problems, the project aims are threefold. Firstly, we focus on establishing whether buried remains produce the materials on the surface. Secondly, we map the natural and anthropogenic processes that influence the preservation and detection of these remains, so that we can assess which parts of the landscape are likely to produce surface scatters, where they may have been destroyed, and where they may be buried beyond the reach of the plough. For this we build on a previous research project directed by Van Leusen, the Hidden Landscapes Project (HLP, 2005-2009), in which landscape classifications at different scales and an erosion model were developed for the Raganello basin (Feiken 2014). Finally, we test, evaluate, and combine survey and prospection methods, in order to mitigate detection biases. Now, with the fieldwork phase of the project closed, we can present preliminary results of our efforts and propose strategies that may clarify ephemeral protohistoric presence in similar Mediterranean landscapes.

Methodology

Our field research follows a stratified sampling approach guided by a classification of the 160 protohistoric scatters in the Raganello basin. This site classification is emphatically not based on any preconceived site types known from other research, but is based on unambiguous properties of local topography and material assemblage (De Neef, forthcoming). In order to prevent the classification from becoming too detailed, a broad division in four general landscape zones was used: the coastal plain, foothills, upland valley, and mountains (Figure 2). The site classification allows us to study land use and settlement dynamics on a regional scale by extrapolating from detailed investigations of representative examples from each class. With the fieldwork phase of the project finished, we can conclude that the proposed site typology “works”, albeit with a few corrections.²

The selected protohistoric sites were investigated with a range of methods: a close (re-)study of the material assemblage, high coverage repeated surveys, geophysical surveys, manual augering, and test pits (De Neef & Van Leusen forthcoming). In continuation of geophysical pilots conducted in the HLP (Van Leusen *et al.* 2014), a number of geophysical techniques were tested, including total field magnetometry, magnetic gradiometry, magnetic susceptibility (MS), electromagnetic surveys, ground penetrating radar (GPR), and electrical resistivity. Of these, the magnetism-based techniques gave the best results under the specific geo-pedological circumstances; we applied magnetic gradiometry and MS measurements on all selected case studies and total field magnetometry on a

² Not all site classes could be studied due to fieldwork permissions or other logistical reasons.



		A S S E M B L A G E				
		Simple impasto		„Rich“	Storage	Funereal
L A N D S C A P E	Plain	-		-	-	-
	Foothills	Small scatter in foothills (44)		Rich foothill sites (4)	Storage vessel sites (24)	Funereal sites (3)
				Rich assemblage with storage vessel (4)		
	Uplands	Small scatter in uplands (20)		Rich upland sites (2)	-	
	Mountains	Scatter in restricted areas (10)	Cave sites (10)	-	-	
			<i>A-typical sites (8)</i>			

FIGURE 2. THE CLASSIFICATION OF PROTOHISTORIC SITES.

subset of these. Aside from these site oriented measurements we also applied a non-site, landscape prospection approach to test how many magnetic features occur without an associated archaeological surface manifestation (Armstrong & Van Leusen forthcoming). Nevertheless, we are aware of the “non-response bias” of archaeological remains not detectable by magnetic contrast, and argue that more research is needed in this field. In addition to the on-site measurements, information about the geological and soil background was obtained by manual augering and soil pits. Augering was also applied to map soils and slope processes on both landscape and site scale, to explain the presence or absence of archaeological remains on the surface (Sevink *et al.* forthcoming). Finally, we were able to investigate the associations between surface material, geophysical features, soils, and archaeological stratigraphy by excavating small targeted test pits. Full excavations were beyond the scope of the project, and not allowed by the fieldwork permit issued by the archaeological authorities.

Our interpretations and research conclusions are highly dependent on the accurate integration of these various invasive and non-invasive datasets, which implies that reliable positioning in the centimeter range is of the utmost importance. This is especially critical for invasive research targeted at single geophysical anomalies, but also for the association between surface and subsurface remains. Maintaining measurement systems in diverse locations, across different research teams, over a number of years proved not to be without problems. Yet in spite of the practical problems of field research in the mountainous inlands of Calabria, we are confident that our approach contributes to a more complete picture of the archaeological record of the Bronze Age. That this is underpinned by the detailed integration of high resolution datasets will be illustrated below with the case study of site T231.



Investigations at T231

Surface scatter T231 is an example of how the combined effort of intensive archaeological re-survey and magnetometry can result in the detection and assessment of previously unknown sites. In the summer of 2011 we produced a new distribution map of protohistoric surface material around the near-by LBA site T94, reaching the highest spatial resolution by recording each individual artefact with a Total Station. This re-survey was accompanied by magnetometer survey using a Bartington Grad601 dual sensor array, conducted in rectangular grids tied into the local measurement system. The magnetometer survey recorded a rectangular, strongly positive anomaly of approximately 8 x 4 m, some 100 m SE of site T94. The distribution map of surface artefacts revealed a diffuse scatter of Bronze Age material, fanning out downslope from this anomaly (Figure 3). This scatter had not been detected in the original RAP survey of the field, conducted with crew members walking at 10m intervals. Like T94, the new scatter was classified as a “protohistoric site with LBA storage vessel in the foothills” on the basis of its material assemblage and location, and named T231.

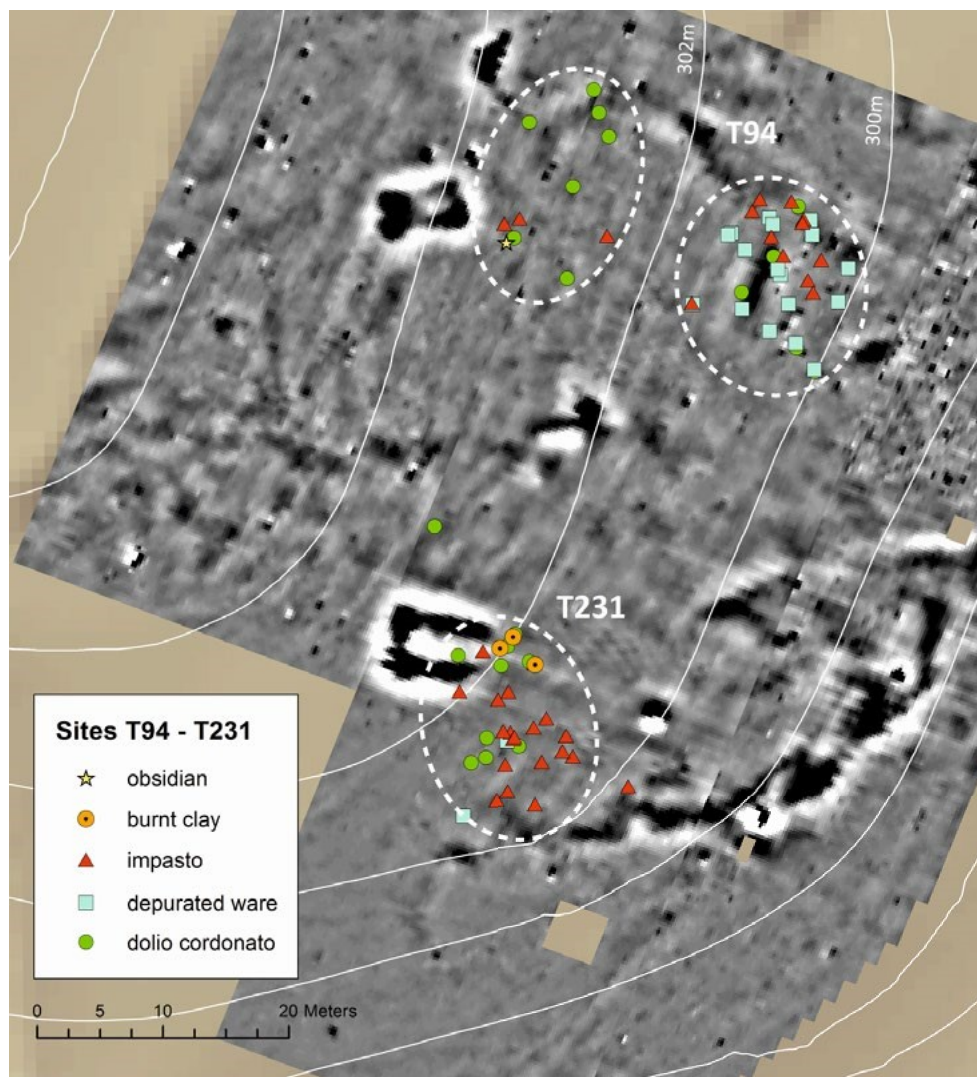


FIGURE 3. SITES T94 AND T231, CONTRADA DAMALE (CALABRIA, ITALY). RESULTS OF THE MAGNETIC GRADIOMETER SURVEY ($\pm 10\text{NT}$) AND THE DISTRIBUTION OF SINGLE ARTEFACTS RECORDED BY TOTAL STATION (MAP W. DE NEEF/GIA).

Although associations between magnetic anomalies and surface scatters may seem obvious by sheer spatial proximity, we insist that invasive research is necessary to establish whether scatter and anomaly are produced by the same subsurface deposit. Moreover, invasive investigations contribute to understanding site formation, post-depositional history, and the precise origin of geophysical anomalies. In the case of T231, we were allowed to strip away the plough layer over an area of 10 x 10 m covering both the rectangular anomaly and the surface scatter, and to excavate two narrow trenches. These immediately confirmed that the magnetic feature is caused by structural remains dating to the LBA. Thus we can confirm a spatial and temporal link between surface material, buried features, and geophysical response.

Stripping away the plough zone yielded the outline of a rectangular structure with a straight short back wall, slightly in-curving side walls, and an open end facing downslope (Figure 4). The walls coincide with lumps of hard, red clay, which were visible primarily near the open end of the structure. It appears that the building was progressively damaged by ploughing on the downslope end, whereas the strong magnetic signal at the rear end suggests that this part of the structure is buried more deeply and therefore better preserved. This was supported by repeated magnetometry and MS measurements on the stripped surface. The MS measurements, conducted with a portable Bartington MS2D loop sensor, showed high values on the exposed clay lumps but not on the rear end of the building, whereas the repeated magnetometry measurements showed the opposite effect.

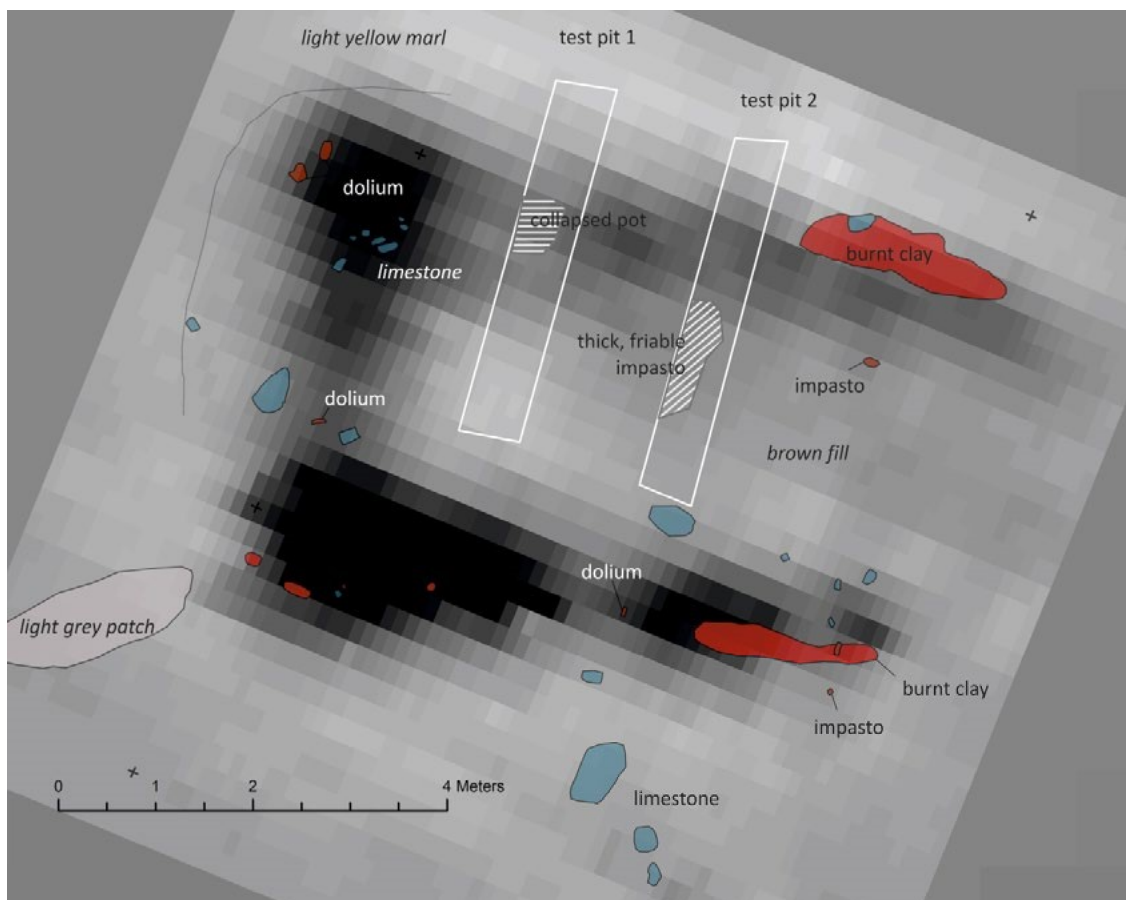


FIGURE 4. SITE T231. RESULTS OF REPEATED MAGNETIC GRADIOMETER SURVEY ON THE EXPOSED SURFACE AFTER TOPSOIL STRIPPING. THE TWO TEST PITS ARE OUTLINED IN WHITE. LOCATIONS OF BURNT CLAY AND CERAMIC FRAGMENTS ON THE STRIPPED SURFACE ARE INDICATED, AS WELL AS THE COLLAPSED POT AND THE FRIABLE THICK IMPASTO IN THE TEST PITS (MAP W. DE NEEF/GIA).

In the end, the cause of the magnetic signal could be established by excavating two parallel slot trenches across the northern long wall. These were placed on either end of a profile baulk which was left standing to document the full soil stratigraphy from the plough layer down. The preserved part of the wall does indeed consist of the hard, orange-red clay seen on the stripped surface. At a depth of approximately 80 cm, a hardened floor was encountered on which large fragments of charcoal and lumps of very thick, friable ceramics were preserved. The pieces of ceramics consist of typical handmade protohistoric pottery, *impasto*, and may be parts of the sort of food ovens known from other nearby Bronze Age settlements such as Torre Mordillo. In one of the slot trenches, we also found piled-up fragments of a large *impasto* vessel which probably collapsed *in situ*. Diagnostic rim fragments place this vessel in the LBA, which coincides with the ceramics found in the surface scatter. Both the hardened floor and the red clay wall were dug into the natural, light-coloured marl, so that we can conclude that the structure had a lowered floor and adobe walls. The lowered part of the building was covered with a fill of brown soil mixed with small charcoal fragments and occasional ceramic sherds. This fill most likely formed after the building's collapse.

Magnetic susceptibility measurements taken on sections in both trenches reveal that the walls in red clay produce high values, in contrast to the relatively low values recorded in the brown fill and the topsoil. MS values of the hardened floor are elevated, but less so than those of the clay wall. Therefore the strongly magnetically enhanced properties of the red clay deposits cause the rectangular feature in the gradiometry data, overpowering the enhancement of the floor and the brown fill.

Intentional fire?

Geophysical analysis of soil samples taken from the slot trenches yielded additional information for the reconstruction of the building's history. The samples were processed and analysed by dr. K. Armstrong in the soil laboratory of Johann-Gutenberg University in Mainz (Germany), with support of the archaeological prospection research group directed by dr. D. Jordan. The MS properties of the samples, established with fractional conversion tests using a hysteresis loop, suggest that the red clay in the wall of the building was heated to exceptionally high temperatures over a sustained period (Armstrong & Van Leusen forthcoming; Crowther 2003). Experimental fires in reconstructed Iron Age huts in Lejre (Denmark) and Butser Hill (UK) indicate that such long duration fires can only be reached by controlled, intentional action, in contrast to intense but short accidental fires (Rasmussen 2007; Harrison 2013). This suggests that the walls of the building at T231 were fired on purpose, and possibly repeatedly.

As to the reasons *why* the building was fired we can only speculate. Intentional firing after abandonment is a tradition which has been suggested for Neolithic and Early Bronze Age dwellings in Calabria (Schaffer 1993; Robb 2007). However, although large charcoal fragments were found on the hardened floor, further burning traces such as ashes or collapsed building components are absent in the interior. An alternative option is the firing of the clay found *in situ* as a foundation for adobe or wattle-and-daub walls, but we have no excavated parallels for this: at nearby Broglio di Trebisacce rectangular store huts dating to the LBA have been found, but these have stone foundations. So far we do not have evidence for stone foundations at T231.

The spatial offset between the rectangular structure and the surface artefact scatter still needs to be clarified. We see such offsets between magnetic anomaly and surface distribution in many other LBA sites. Although we are confident that both manifestations belong together, the test pits have not established how the buried building remains produce the surface scatter. The scatter may be caused by the gradual exposure of buried deposits along the slope by mechanical ploughing, by which the open end of the rectangular structure is progressively damaged. Yet the distance between the magnetic anomaly and the surface ceramics is several meters, and no ceramics occur over the anomaly itself. Several studies of artefact movement in plough soils were conducted when archaeological field walking was a relatively new phenomenon (Cavanagh & Mee 2007: 11-12); now that artefact



survey is an established method, experiments and discussion of artefact displacement seem to have died away without coming to a satisfactory conclusion. Experiments in the 1980's have shown that artefact displacement depends on category, size and slope angle: small ceramic fragments and lithics can move several meters along slopes and plough furrows, whereas larger sherds have been reported to travel up to 20 m. Keeping in mind that the mechanical plough was introduced in this part of Calabria in the 1980's, it is conceivable that finds have been displaced several meters. An alternative explanation for the offset at T231 would be that the surface scatter is not produced by the structure at all, but by an external feature such as a midden, pit, or hearth. In any case, further invasive research to make statements about this was beyond the scope of the project.

Site monitoring and settlement models

Zooming out from the single site to the whole site class, it becomes evident that T231 is not unique: neither in its detection history nor in its preserved remains. This previously unknown site was classified as a "LBA foothill storage vessel site" by its location and finds assemblage, of which class we have now investigated 15 examples by integrated non-invasive and invasive research. Re-surveys of RAP field units and additional surveys in previously non-investigated areas have increased the number of storage vessel sites from 40 to 63. Furthermore, the positioning procedures for our current dataset are much more precise, so that we can effectively monitor changes to the known scatters and test anecdotal theses like Barker's remark that surface sites "can come on and off like traffic lights" (Barker 1995: 49). One of the conclusions of our methodology evaluation therefore is that even the intensive survey strategy of the RAP, with a 20% surface coverage in 50 x 50 m units aimed at mapping diachronic settlement remains, is not suitable for detecting the smallest protohistoric remains.

More-over, our understanding of the concept "site" has changed by consistently integrating different datasets. In the RAP surveys, we used the word for local increases in finds density relative to a background "noise". After four years of intensive non-invasive and invasive research in the RLPI project, we now see a variety of "site" manifestations: pottery scatters of different densities without apparent geophysical signal, scatters associated with a rectangular magnetic anomaly, scatters associated with an undefined magnetic anomaly, but also strong (rectangular) magnetic anomalies and buried archaeological deposits without a surface manifestation. One unintended consequence of our work is thus that we have become aware of the problematic use of the concept "site" in landscape archaeology.

So far, we have detected 16 rectangular magnetic anomalies, of which 9 can be associated with a ceramic scatter containing storage vessel fragments of a specific type, the LBA *dolio cordonato a fasce* (Figure 5). Based on their magnetic intensities, we can assume that most of the detected rectangular structures have a similar formation process involving firing at high temperatures. Both the rectangular anomalies and the storage vessel site class occur non-clustered and only in a specific part of the foothills, a gently undulating agricultural area of 1.7 km² called Contrada Damale, located the foot of a limestone mountain and boasting wide views over the coastal plain (Figure 6).³ Since the *dolii cordonati* are well datable by typo-chronology, we can now postulate that the Contrada Damale features a true settlement boom of small, dispersed habitations in the last phase of the LBA (the Final Bronze Age, ca. 1100-950 BC). We tentatively propose a model of an "open, non-clustered village" consisting of separate farmsteads, the inhabitants of which nevertheless maintain a stable social cohesion – much like the Contrada Damale was some 50 years ago.

This remarkable development has gone unnoticed by traditional scholarship focusing on "central" places and landmark locations. Apart from a few stray observations without clear context, the *dolio cordonato* storage vessels are known primarily from such large, centralized settlements – a research

³ The Contrada Damale is part of the municipality of Cerchiara di Calabria (province of Cosenza).





FIGURE 5. TWO COMPLETE LATE BRONZE AGE STORAGE VESSELS OF THE DOLIO CORDONATO O A FASCE TYPE, EXCAVATED IN BROGLIO DI TREBISACCE (ON DISPLAY IN THE ARCHAEOLOGICAL MUSEUM OF SIBARI). THE VESSEL ON THE LEFT IS APPROXIMATELY 1.3 M HIGH (PHOTO R. FREIBOTHE).



FIGURE 6. VIEW OVER THE CONTRADA DAMALE, THE TOWN OF FRANCAVILLA MARITTIMA AND THE PLAIN OF SIBARI (CALABRIA, ITALY), TOWARDS THE SOUTH-EAST. THE LOCATION OF SITE T231 IS INDICATED WITH A WHITE STAR. THE IONIAN COAST CAN BE SEEN ON THE LEFT; THE BROAD VALLEY OF RIVER RAGANELLO IS ON THE RIGHT (PHOTO W. DE NEEF).

bias which features prominently in Peroni's model of increasing social complexity in which craft specialization and produce redistribution play a large role. The occurrence of this specialized product class in a rural setting, in small dispersed structures such as T231, not only shows that the idea of a strong polarization between major, long-lived centres and minor, short-lived settlements should be reduced, but also that the inhabitants of small LBA rural sites had access to, and a need for, containers with large storage capacity. What was stored in these vessels remains largely un-investigated; residue analysis at Broglio di Trebisacce points to hazelnut or olive oil, but other produce cannot be excluded. The relationships between the inhabitants of large settlements such as Broglio di Trebisacce and Torre Mordillo and those of sites such as T231 remain obscure, but the rural population in the Sibaritide must have been a considerable component in the LBA economy.

Conclusions

Contrary to a persistent belief seen in many survey projects in Italy, we argue that intensive, interdisciplinary investigations into ephemeral protohistoric surface scatters do yield new insights in rural settlement and economy. Even very diffuse ceramic concentrations such as T231, which are regularly found in field walking surveys, can yield new information with the integration of different high-resolution datasets – in this case of surface recording, magnetic gradiometry, magnetic susceptibility, small test pits and laboratory analysis. On a regional scale, investigations of settlement dynamics and land use are enabled by a systematic approach based on extrapolation from site classes.

Although we still do not understand the use of the storage vessel sites and their interdependence, it is evident that the Contrada Damale was intensively used in the last phase of the Bronze Age. We also know now that the inhabitants of sites like T231 had access to a vessel class which was very likely produced by specialized craftsmen; a material category which until now has appeared to be reserved for the emerging elites of the LBA. Looking beyond the individual site, our investigations of the rural landscape contribute to the unraveling of a biased view on protohistoric societies.

References

- ARMSTRONG, K. L.; VAN LEUSEN, P. M. (forthcoming), Report on geophysical research in the Raganello basin. Groningen: Barkhuis (Groningen Archaeological Series).
- ATTEMA, P. A. J.; BURGERS, G.-J.; VAN LEUSEN, P. M. 2010. Regional Pathways to Complexity: Settlement and Land-Use dynamics in Early Italy from the Bronze Age to the Republican Period. Amsterdam: Amsterdam University Press (Amsterdam Archaeological Studies).
- BARKER, G. 1995. A Mediterranean Valley. London: Leicester University Press.
- CAVANAGH, W.; MEE, C. 2007. Functional Analysis of Survey Sites. In: Building Communities; House, Settlement and Society in the Aegean and beyond. Athens: British School at Athens, p. 11-17. (British School at Athens Studies, Vol. 15).
- CROWTHER, J. 2003. Potential Magnetic Susceptibility and Fractional Conversion Studies of Archaeological Soils and Sediments. *Archaeometry* 45: 4, p. 685-701.
- DE NEEF, W. (forthcoming), Rural Life in Protohistoric Italy: Relating Surface and Subsurface Archaeological Remains. PhD thesis, University of Groningen, Groningen.
- DE NEEF, W.; VAN LEUSEN, P. M. (forthcoming), Report on archaeological research in the Raganello basin. Groningen: Barkhuis (Groningen Archaeological Series).
- DE ROSSI, G. M.; PALA, L.; QUILICI, L.; QUILICI-GIGLI, S. 1969. Carta Archeologica della piana di Sibari. Roma: Società Magna Grecia.
- FEIKEN, H. 2014. Dealing with Biases: Three Geo-archaeological Approaches to the Hidden Landscapes of Italy. PhD Thesis, University of Groningen, Groningen.
- HARRISON, K. 2013. The Application of forensic fire investigations in the archaeological record. *Journal of Archaeological Science*. 40: 2, p. 955-959.
- PERONI, R.; TRUCCO, F., eds. 1994. Enotri e Micenei nella Sibaritide. Taranto: Istituto per la Storia e l'Archeologia della Magna Grecia.



- RASMUSSEN, M. 2007. Iron Age Houses in Flames: testing house reconstructions at Lejre. Lejre: Lejre Historical-Archaeological and Experimental Centre (Studies in Technology and Culture 3).
- ROBB, J. 2007. The Early Mediterranean Village: Agency, material culture, and social change in Neolithic Italy. New York: Cambridge University Press.
- SCHAFFER, G. 1993. An archaeomagnetic study of wattle and daub building collapse. *Journal of Field Archaeology*. 20: p. 59-75.
- SEVINK, J.; DEN HAAN, M.; VAN LEUSEN, P. M. (forthcoming), The Soils and Soil landscapes of the Raganello river catchment, Calabria, Italy. Groningen: Barkhuis (Groningen Archaeological Series).
- VAN LEUSEN, P. M.; KATTENBERG, A.; ARMSTRONG, K. L. 2014. Magnetic Susceptibility Detection of Small Protohistoric Sites in the Raganello Basin, Calabria (Italy). *Archaeological Prospection*. 21:4, p 245-253.
- VANZETTI, A. 2013. Sibari Protostorica. In: Delia, G.; Masneri, T., eds, Sibari. *Archeologia, Storia, Metafora*. Castrovillari: Il Coscile. p. 11-34.

