CHAPTER 2

Field methodology, recording and analytical procedures

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2.1 INTRODUCTION | P. ATTEMA

In this chapter, the various methods are discussed that were employed in the course of the Džarylgač Survey Project. Field methods ranged from intensive artefact survey in ploughed fields, aimed at documenting site and off-site patterns, to the systematic survey of large tracts of overgrown steppe landscape, recording any visible cultural features, and from extensive survey with diagnostic pottery sampling at selected sites, building reference collections for the classification of the survey pottery, to trial trenching, in order to better understand the function and chronology of sites. Equally important in the field methodology were the geophysical surveys to investigate possible subsurface features in both known archaeological sites and outside these.

In addition, environmental surveys were aimed at establishing a landscape classification based on geomorphologic characteristics and at a description of the soils to provide the landscape context for the archaeological data. Besides the surveys themselves, the various recording and analytical procedures connected with the field methodology are also discussed in this chapter. These procedures concern, for example, the way in which field data and artefacts were processed and recorded in the database and in a GIS to create the various artefact distribution maps underlying our interpretations and analyses. Finally, the way in which sites were designated as such and were classified is discussed.

The base for determining the extent of the research area was a wide diversity of cartographic materials, from nineteenth century maps to aerial photography and satellite images of Google Earth. Furthermore, these were an invaluable source of information, not only for orientation in the field, but especially for spatial analyses and understanding the changes that have taken place in the landscape through time. This chapter therefore begins with a detailed discussion of these sources before continuing with the methodology employed in the project for fieldwork and data recording, processing and analysis.

The DSP area of study comprises ca. 450 km², in which a 16 km wide N-S transect of ca. 200 km² was delineated for more intensive research. The wider area of study encompasses part of the central Uplands of the Tarchankut Peninsula and part of the coastal zone N of it, between Černomorskoe and Vodopojnoe, while the transect centres on Lake Džarylgač (Fig. 2.1).[13] The transect cross-cuts various types of landscape that are characteristic of the wider area of study and as such may be taken as representative for the archaeology found in each land type. From S to N and from high (170 m a.s.l.) to low (immediately above sea level) these land types consist of Plateaus/Uplands, Hillsides, Pediment, the Coastal Lake and Lowland Ridge. Chapter 3.3 gives a detailed description of the land types in the transect.

Fundamental to the present discussion of the survey methodologies used by the DSP team are the two contrasting forms of land use within the transect and their related potential for the detection of surface archaeology. Whereas the lower parts of the landscape (the Pediment and Lowland Ridge) are regularly under the plough, the higher areas (Hillsides, Plateaus/Uplands) are for the larger part covered in steppe vegetation. Fig. 2.1 shows how the transect can be divided into two main 'visibility zones'. The lower area is parcelled out into vast agricultural fields with a very high overall visibility when ploughed; ploughed fields, once gridded into uniform units, are exceptionally fit for standard intensive field walking and artefact collection. The higher area, however, is largely grassland. This called for a different design of a field

[13] See Chapter 1 for the motivation behind the selection area of study.

walking method suited to deal with low ground visibility and the lack of agricultural plots as survey units. The methods employed in the two visibility zones are described in Sections 2.3.1.1 (the block survey in the Pediment and Lowland Ridge) and 2.3.1.2 (the slope survey) respectively.

In order to better comprehend the cultural landscape of the wider area of study, site-oriented, extensive investigations were carried out at a number of previously known sites (and their vicinity) and kurgans both within and outside the transect. The methods employed in the site-oriented surveys are described in Section 2.3.1.3.

A number of the kurgans were targeted for more intensive three-dimensional mapping using the Total Station (see Chapter 6.5.2 and Hill 19 in the site catalogue). The aim of this was to produce a digital terrain model which can be used for more detailed analyses within the context of wider research on the funerary landscape of the NW Crimea. This approach is discussed in Section 2.3.2.

Selected areas of archaeological interest were subjected to geomagnetic survey to obtain indications of possibly preserved subsurface archaeological features. This was conducted by two teams, whose methods are discussed in Section 2.3.3.1. Manual augering was carried out at specific points across the transect to establish the nature and thickness of the soil on top of the limestone bedrock, and at specific sites to discern the presence of cultural layers below the plough zone. The methods used for this are discussed in Section 2.3.4. Certain sites were targeted for more detailed subsurface investigation through the excavation of trial trenches, in order to gain better insight into the nature and chronology of specific features discovered through the other field methods. The method and approach used for this is discussed in Section 2.3.5.

Besides the surveys themselves, the various recording and analytical procedures connected with the field methodology are also discussed in this chapter. These procedures concern, for example, the way in which field data and archaeological finds were processed and recorded in the database; this is discussed in Sections 2.4 and 2.5. Underlying the various approaches to the survey was the use of a Geographic Information System (GIS). Besides mapping finds, GIS was used together with cartographic data to target areas suitable for survey, and to prepare the groundwork for field walking ahead of time. Using this data on handheld computers (or PDA, for Personal Digital Assistant) with Global Positioning Systems (GPS) receivers made systematic survey much more efficient in the seemingly endless fields. The spatial data was linked to a database containing detailed information from each unit (on finds, field conditions etc.) allowing for specific distribution maps and further spatial analyses. This is all discussed in Section 2.5.

Finally, the distribution maps and the density of archaeological material and features have together led to the identification of sites. How these were determined and further classified is discussed in Section 2.6.

2.2 Cartographic base of the DSP | P. Guldager Bilde & T. Smekalova

Historical maps and aerial photos of the Crimea, which are preserved in Russian archives, have formed an invaluable source in the archaeological and environmental investigations of the DSP study area in the context of the wider region of Northwestern Crimea. Below, we will discuss the topographical maps that were used in the project. The use of Google Earth as a tool within the project will then be discussed.

2.2.1 Historical topographical maps | T. Smekalova

Fig. 2.2 shows a map dating from 1837 that is based on the topographic surveys of Colonel Betev as well as on triangulation measurements of the Crimea that were carried out in 1836-1938 by the Corps of Military Topographers under the direction of F.F. Schubert and D.D. Oberg. The map clearly shows the relief of various landscape features, major and minor roads and the numerous settlements present in the landscape. It also shows, for the first time, water sources and a substantial number of kurgans. The proportions of the peninsula practically coincide with those of modern maps.

On the basis of this map, a further reconnaissance of Crimea was conducted in 1865 as part of a large-scale mapping carried out between 1845-1870. During these years, Poland and 22 provinces of Central and Southern Russia, including the Tauric Province, were surveyed in the scale of one-verst (1 *verst* is 1.067 km). The resulting map depicts a larger number of roads, settlements, kurgans and wells than the previous map (emendations in red). Also the ethnic composition of the individual towns and villages are corrected.

In the early 1870s, ordnance surveys almost completely ceased in the internal provinces of Russia, but fortunately were continued in the border regions, including the Crimea. At this time they were conducted on the half-verst scale (1:21,000) (Fig. 2.3). In the half-verst military topographic map of the Crimea issued in the late 19th-early 20th century, a vast number of kurgans is marked by out-of-scale symbols showing height specifications for the largest mounds. This specific attention for the kurgans was due to their value as strategic military points. However, water sources and wells were also recorded in detail, as well as roads and paths, including those that were no longer in use. On this map the relief of landscape features is rendered in contour lines at an interval of 2 *sažens* (about 4.3 m).

The latter map of the Crimea was extensively used in the DSP as it is an exceptionally rich source for the study of the spatial patterning of Early Modern settlements and ancient kurgans over the landscape and it can be used to detect traces of ancient land division and to locate the presence of ancient ditches and ramparts (Fig. 2.4). As the proportions of this map correspond exactly to modern cartographic renderings of Crimea, the features identified in this map can be transferred with relative ease onto new maps or air and space photographs facilitating comparison of features appearing on either of these sources. Used was also a map made in the mid-20th century at a scale of 1:25,000 and with contour lines drawn at an interval of 5 m (Fig. 2.5) as well as a more recent map at the scale of 1:100,000 (Fig. 2.6). The former map was revised in the 1980s on the basis of air photos.

2.2.2 Aerial photography | T. Smekalova

Besides historical topographical maps, aerial photos were also valuable sources of information in the DSP for revealing particular classes of archaeological objects, especially for linear structures such as land divisions and traces left by land usage. Aerial photos taken in three different years were used for analyses: 1956, 1971, and 1978. The separate images were adjusted and combined using Adobe Photoshop. This made it possible to detect long features that continued across multiple photos, mostly traces of boundaries of old and ancient fields. Individual architectural features, such as ancient houses, turned out to be better visible on Google Earth than on the aerial photographs (see Section 2.2.3).

2.2.3 Google Earth | P. Guldager Bilde

In the course of the DSP, Google Earth satellite images have been used for various purposes:

- As landscape images
- To help orientate and to select fields for survey
- To detect or verify landscape features
- To detect man-made features (buildings, kurgans, roads) (Figs. 4.148, 160, 167, 234 and 6.16, 21-23, and others)

Google Earth is a proprietary virtual globe program, which renders the earth by series of superimposed images obtained from satellite imagery, aerial photography and GIS 3D globe. In mid-2006 it was released to the public as a free tool. Since its release the resolution has been gradually improving. Most land is now covered in at least 15 m resolution. The images are not all taken at the same time, but are generally current to within three years. The internal coordinate system of Google Earth is geographic coordinates (latitude/longitude) on the World Geodetic System of 1984 (WGS84) datum. The program is a forceful research tool for any research dealing with spatial data – but equally so for persons engaged in illicit excavation activities.

During the time of the fieldwork, the Tarchankut Peninsula was covered by images of much varying resolution and the full map is based on a patchwork of images made during a number of different passes primarily in summer time and early autumn. Until recently, the very tip of the peninsula including the town of Karadža as well as the strip between latitude 32.4742 and 32.5700 covering the central part of the DSP study zone was published in a rather low resolution, whereas the section between the two mentioned strips are covered by several high resolution maps (August 2004 and October 2004 respectively). Immediately E of Lake Džarylgač is a narrow strip photographed in June 2003 in high resolution. Further E of this is a broad sector in high resolution dated in August 2007. Over the winter 2009/2010, the maps of the DSP study zone were finally updated with high resolution images shot 8 April 2009.

For a close study of the area it is necessary to employ Google Earth's feature 'historical maps', because it enables one to study the same section of the landscape through maps taken at different times. Only thus does one catch the largest number of individual features.

2.3 Field methods | P. Attema

2.3.1 Field walking | P. Attema, P. Guldager Bilde, T. de Haas, W. de Neef, C. Williamson & K. Winther-Jacobsen

2.3.1.1 Systematic survey of the Pediment and Lowland Ridge | T. de Haas & P. Attema

The land relief in the N part of the survey area (in Chapter 3 referred to as the Pediment on the S side of Lake Džarylgač) and the Lowland Ridge (on the N side of Lake Džarylgač) is gently undulating with relatively deep soils, making it suitable for cultivation. This area is divided into extensive arable plots that are ploughed in a rotating system (see Chapter 3.5 on land use). Except for a number of previously mapped kurgans, the partially excavated settlement of Panskoe, part of the Hellenistic cadastre system, and the large Bronze Age site Skalistoe 2 (see Chapter 1.3), few archaeological sites had hitherto been recorded in these extensive fields.

In May of 2006 a pilot survey was conducted (by Attema, Guldager Bilde and Stolba) around Lake Džarylgač to gain an indication of the nature of the presence and distribution of archaeological material and to determine the suitability of a standard survey approach in the cultivated areas of Tarchankut Peninsula. Four ploughed fields were extensively surveyed and were shown to yield finds in very discrete scatters (see Chapter 4.4.1 and 4.4.5). The good and regular surface visibility on the extensive ploughed fields around the lake was therefore shown to offer an excellent opportunity to map human activity in this landscape on the smallest of scales, supporting one of the primary aims of the DSP: to investigate the archaeology of the area around the lake and more specifically to discover traces of rural occupation during the Hellenistic period (see Chapter 1.1). To this end an off-site survey methodology known as the *block survey*, which has been devised by the Groningen Institute of Archaeology (GIA) for ploughed fields, was employed and further developed.

2.3.1.1.1 The block survey

The block survey was developed by the GIA from the late 1990s onwards for intensive field surveys in Central and South Italy.[14] In a block survey, agricultural fields – traditionally the most important survey unit – are further divided into a grid of regular units, in principle 50 by 50 m. Each of these units is traversed by five walker transects, 10 m apart, from which all archaeological artefacts are collected. Assuming a total pickup of artefacts from a 2 m wide swath, this would result in a 20% sampling coverage of each unit. Data recording on paper unit forms is supplemented by digital recording of spatial information using handheld computers (PDAs). Intensive block surveys thus provide systematic and detailed information on the distribution of archaeological artefacts over the ploughed areas of the landscape (e.g. Figs. 4.44-47).

The use of newly acquired GPS and PDA mapping software helped us to further optimize the survey efficiency with a pre-established grid of survey units (see Section 2.5.1 below on the application of GIS software). Each field team consisted of 5 to 7 people: 5 or 6 transect walkers, one of whom was the team leader responsible for the paper administration, and a PDA operator, who marked the grids in advance of the surveyors and measured in both natural and archaeological features (Fig. 2.7). The general lack of orientation in these vast fields made it important to flag the corners of each unit. This was done with small barbecue sticks with fluttering red-and-white plastic tape, which had been prepared in large numbers beforehand. Grids were set out per field in units of 50 or 60 m across to keep the coverage as close to 20% as possible depending on the expected number of field walkers, and were usually square.

To expedite the fieldwork, two teams of field walkers were deployed as long as conditions allowed. In the large fields, the teams typically began at opposite ends and worked towards each other, going back and forth across the shorter sides of the fields. Separate numbering ranges for the units were used by each team to facilitate record keeping. In 2007, one team used numbers beginning with 1000, while the other used 2000 numbers; in 2008 the series of 6000, 7000, and 8000 were used for the block survey units. The 3000 series was used for the samples taken outside the block surveys from the entire campaign in both years (see below).

[14] This method was developed in the course of the *Regional Pathways to Complexity Project* of the Groningen Institute of Archaeology (GIA) and the Archaeological Centre of the Free University of Amsterdam (ACVU). This multi-disciplinary project started in late 1997 and was published as Attema, Burgers & van Leusen 2010. Articles focusing on the field surveys carried out in the RPC-project and which made use of the field methodology practiced in the DSP are Burgers, Attema & van Leusen 1998, Attema, van Joolen & van Leusen 2001, and Van Leusen & Attema 2003. See of recent also Attema & de Haas 2008.

Finds from each unit were collected in bags marked with the project code, the date, unit number and bag number with sample type, quantified and summarily described, and then recorded on the unit forms (Fig. 2.8). These forms were filled out by the team leaders during and/or after the transect walking of each unit. Besides finds data, the unit forms also contain a sketch of the unit showing any possible archaeological features, as well as sampled areas and concentrations, and notes on field properties and visibility conditions.[15] Additional notes were kept in each team's field notebook, including general information on survey conditions and observations of the field or situation.

In certain circumstances, e.g. with relatively high amounts of finds or conspicuous features such as kurgans, additional sampling took place. This typically involved the collection of artefacts from a limited area, the so-called *Total Sample*: in this case field walkers were 2 m apart, implying a 100% coverage. This close inspection was also more readily applied when handmade wares were found, since they are generally more difficult to discern in the field. *Grab Samples*, for finds randomly collected, were also taken in a few instances.[16] Finds from the incidental samples were kept separate from the standard samples so as not to distort the overall density maps, which are drawn from the regular unit surveys based on 20% coverage. All of the samples were registered on the unit forms and are recognizable by their unique Bag-ID, a combination of the unit number and an individual bag number. Concentrations and sampling areas were subsequently measured in with the GPS mapping software on the PDA.

2.3.1.1.2 Data processing

The information gathered from the surveys and during material processing (see Section 2.5) was digitized on a daily basis. This consisted of data entry from the unit forms into an MS Access relational database and uploading the spatial features recorded with GPS and the handheld computers to the central desktop GIS environment (see Section 2.5.1). Doing this on a daily basis not only allowed for control and accuracy checks, but also for provisional analyses as work progressed. Furthermore, the daily reports from each team, drawn from observations made in the field notebooks, were recorded by the team leaders in text files (MS Word).

2.3.1.2 Systematic survey of the slopes | K. Winther-Jacobsen

The S part of the survey area consists of a series of Hillsides, incised by erosive ravines of varying depths, which gently descend from the Plateau down towards Lake Džarylgač and the Black Sea in the NW. In this area, a large number of kurgans had already been mapped (Chapter 6.5), but no other archaeological evidence had previously been recorded. The initial aim of the Hillside survey in 2007 was therefore to test the presumed dearth of material culture and to work out a method to investigate the archaeology of this specific landscape type and its role within the regional settlement system. More specifically, the survey aimed at tracing remains of Hellenistic settlements in relation to the groups of kurgans on the slopes.

Although there are numerous traces of previous agricultural episodes, the slopes are currently largely uncultivated and are covered by steppe vegetation. This accounts for the low visibility, making the slopes unsuitable for block survey aimed at mapping artefact scatters. Consequently, survey in this area in 2007 was largely experimental. However, although very few artefacts were found during the 2007 season, the survey did reveal the presence of several clearly visible stone structures, enough to warrant a full and systematic investigation of this uncharted area. Furthermore, by the end of the 2007 season it became apparent that the area would soon be inaccessible due to the construction of a large wind power plant scheduled to start in 2008 (see the Foreword). As a result, for the 2008 season the methodology was adapted to investigate as much of the area as possible within the time permitted.

2.3.1.2.1 Methods

In 2007, a start was made with the survey of the Hillsides for which Hill 2 was targeted. This resulted in the observation of several interesting features (stone structures, surface pottery) that were recorded with GPS coordinates. The results of this investigation led to an intensive survey of four further Hillsides. The targeted hills had in common that all were located next to slopes where groups of kurgans had already been mapped, while not featuring kurgans themselves, this

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15 Factors that can affect visibility include the degree of shade, dust, vegetation, modern material, stoniness, and the level to which the field has been ploughed; these factors are discussed in detail in Van Leusen 2002.

16 Grab samples within the unit boundaries followed the unit number; grab samples taken outside the unit boundaries were given a number starting with 3000, and the coordinates were taken.

in order to detect a possible functional differentiation between hills. For the intensive survey, walkers were spaced at an interval similar to that used in the block survey (10 m). However, for orientation and data recording, the survey relied entirely on the PDAs, using GPS and ArcPad mapping software (see Section 2.5), since cartographic features are scarce in the area. The outer (and sometimes central) field walkers were equipped with a PDA to guide the team in the designated direction and to record their tracks. All artefacts were recorded as spatial points in the PDA and collected as grab samples (numbered in the 3000 series, see above Section 2.3.1.1.1). In case of poor visibility, the immediate contexts of the finds were surveyed more intensively. Finds were most often recorded in relation to animal holes, where the burrowing exposed some of the soil. Features were also recorded with the PDA: small structures such as small concentrations of stones were recorded as points, while larger structures such as ditches and linear elevations and stone structures were recorded as lines in the GIS (see Section 2.5.1), giving a rough indication of their size and shape. In addition to the digital data recording, team leaders kept written notes in their field notebooks.

Based on the results of the 2007 season and the challenge of a tight schedule, some changes had to be made to the methodology for the 2008 season. A map showing the locations of the 102 mills of the wind power plant provided us with a basis for designating the trajectories of surveys in advance using GIS software (Section 2.5.1). The primary features on the map consisted of the foundations for the mills and the cable lines and roads connecting them. The secondary features consisted of archaeological sites identified from the investigations in 2007 (see below). We chose to lay out the survey units along the cable lines and roads, using the planned foundations as starting and ending points. The actual coordinates of these foundations were not made available, but were only roughly indicated on a low resolution map (Fig. 0.4). This also made these guiding survey lines especially instrumental in orientation.

The survey line formed the base for a trajectory which typically passed first from N to S along the W side of the line, and then returning from S to N again down the E side of the line: each pass was recorded as a separate 'unit' in a numbering system starting from 20000 (so as not to interfere with the block survey numbering system). Following this survey line, which could be up to two km long, was crucial to orientation. A consistent team of five members walked at 10 m intervals, with one team member following the line as indicated by the GPS position on the PDA, and guiding the remaining team who were spaced out to the right of the line. On the return pass, the member with the PDA remained on the line, both for the sake of orientation and to compensate for his or her having to follow the GPS signal while surveying. Thus a path of 45 m wide was covered in each direction; in this way a total path of 90 m wide was surveyed along the axis of each line.

In the field, the foundation areas were marked with sticks and the coordinates of these were registered wherever possible, since these were the base for survey trajectory. The sticks, however, were often up to 200 m away from where they were indicated on the map.

Features were recorded in the same manner as in 2007; sherds collected outside the line-units were recorded in the PDA and given grab sample numbers starting with 3200. All archaeological observations and observations concerning the conditions of the survey, such as weather and vegetation, were recorded in narrative form by the team leader in the field notebook, rather than on unit forms, which are tailored to the block survey. Consequently, the level of topographical recording is on a lower resolution compared to the ploughed zone (Table 2.1). Furthermore, the units in the individual

Unit 20019					
Administrator	Walkers	Date	Time	Weather	Average visibility
KWJ	5	16.5.	12:25	Sunny	4
Line starts at foundation 47 and goes S towards foundation 46 on the W side, measuring in both foundations. Three cores taken at stick 47 each 10 m from the stick. I photograph them all: Photos 16.05.08.2-4. They prove that although the soil looks deeper it is in fact in this place no more than 0.2 m deep. Topography: Areas of shallow and deeper soils alternating. Features: 20019/01: flint (45.529050/32.90681). According to the map there should be five kurgans W of the line, but none are visible; however, there is a cultivated field approximately 70 m W of the line. Three cores have also been drilled at foundation 46, but only two of them were left on the surface. I photograph them: Photos 16.05.08.5-6. Just past foundation 46 we reach an approximately 12 m long, slight elevation oriented NS, which is marked with a question mark on the map. We take a polyline along its top. Line stops 95 m S of foundation 46.					

Table 2.1 Example of a short unit record.

lower fields in the ploughed zone are all within the same geomorphologic type, whereas the unit-lines on the slopes, although within the same macro-geomorphologic type, exhibited a much higher degree of micro-variation in terms of changes in soil and vegetation (see also Chapter 3). It soon became obvious that some of these changes reflect different human activities, and it would have been useful to investigate this aspect more fully.

The 2008 Hillside survey worked alongside a team of geophysicists from Eastern Atlas, Berlin, surveying the same areas as the team of Tatiana Smekalova (see Section 2.3.3.1). Consequently, we have correlating archaeological and geophysical data sets from the Hillsides investigated in 2008, although the spatial accuracy of the data is affected by the low resolution of the wind power plant map. Because of this wind power plant project, the Crimean Branch of the Institute of Archaeology required that we produce a prioritized list of areas for survey (Table 2.2). This map also included preliminary identifications of archaeological features based on the 2007 season results and investigations continued by T. Smekalova, S.B. Lancov and S.D. Koltuchov in June, and further work done by Lancov and Koltuchov in the autumn of 2007 (Fig. 0.4).

Despite the urgency, our work on the slopes in 2008 was constrained by the agreement to only work in those areas with known archaeological features, and to survey larger coherent areas rather than focus on the mill foundations. We therefore prioritized coherent areas where several preliminarily identified sites would be affected by projected foundations and/or infrastructure. Therefore, much time was spent re-examining known phenomena such as kurgans, and the 'stone circles' which were natural rather than manmade (see Chapter 3.3.2.6). Although the strategy forced upon us was detrimental to finding new sites, we were, nevertheless, able to record two new large settlements and two diffused scatters of pottery, besides making several surveys of complete sites.

Preliminary site no.	Preliminary identity	Windmill Park Project feature (nos. refer to foundations)
34, 36 and 43-44	Bronze age and Tatarian settlement, kurgans	31, 32, 34 and cables between them
21-22	Stone circles	41, 40, 39 and cables between them
47, 26, 27 and 28	Settlement and stone circles	42, 43, 44 and cables between them
No numbers	Kurgan group	47, 46 and cables between them
No numbers	Kurgan group	48, 49, road to and cables between them
48, 30 and 59	Settlements, stone circles, kurgan group	(49), 54, 59 cables and roads between them
		(54), 55, cables and roads between them
No numbers and Hill 7.3	Kurgans, settlement	60, 62, 63, cables and roads between them
Hill 1 and no number	Two large settlements	64, 65, 66, cables and roads between them
No numbers	Kurgan groups	68, 69, 70, 71, cables and roads between them
49	Kurgan group, stone circles	75, 76, 77, 78, cables and roads between them
17-1	Stone circles	79, 80, 81, 82, cables and roads between them
14	Stone circles	86, 87, cables and roads between them
10	Stone circles and kurgan group	92, 93, 94 cables and roads between them
15 (Hill 13)	Settlement	
Hill 12	Settlement	71
A total of 36 foundations of 1000 m^2 and 17.3 km cables and roads between them		

Table 2.2 Prioritized list of areas surveyed.

2.3.1.3 Extensive site survey | P. Guldager Bilde

In 2007, as a supplement to the systematic surveys described above, brief visits to previously known sites in the DSP area were carried out in the company of S.B. Lancov and S.D. Koltuchov (Attema, Guldager Bilde, Smekalova, Stolba). The purpose of these visits was to become familiar with the region, to build an archaeological reference context for the systematic surveys within the transect, and to document any new observations of these sites.

The targeted sites for extensive survey range in period from Bronze Age to Early Modern, and include the areas (Fig. 2.9):

- Along the coast between Masliny and Černomorskoe
- Along part of the N shore of Lake Džarylgač
- In the ravine E of Vodopojnoe

These site visits led to non-systematic sampling (grab samples) of 11 known sites as well as to the localisation of 12 more sites hitherto unknown, which (with one exception) were also sampled by means of grab samples (see below Chapter 4.2).

GPS coordinates of the sites were taken with the PDAs and registered in the central GIS environment. Grab samples from all sites were processed, classified and entered in the database. Apart from serving as dating tools for the sites themselves, the pottery functioned as a reference collection for pottery from the intensive survey.

2.3.2 Total Station surveys | P. Attema

During the 2007 and 2008 campaign, part of the DSP team was involved in the mapping and documenting of kurgans within the DSP study area. Methods employed to document the kurgans consisted of recording their geographical position and exact dimensions by means of GPS and Total Station. This was done in order to obtain the necessary spatial data to create digital terrain models that could further be elaborated in AutoCAD software. As a rule, the digital terrain models comprised groups of kurgans rather than single specimens. Geomagnetic surveys were aimed at revealing details on the internal structure of individual kurgans and to detect possible subsurface features in between kurgans relating to cultic activities or *fossa* graves (see for the method Section 2.3.3.1). On the basis of the acquired data a catalogue was compiled containing standard descriptions of each kurgan, photographs, a schematic plan and cross-sections (see Appendix 1, DSP07-H19 and DSP08-H19 listings). Of kurgan groups where geomagnetic surveys were carried out, maps and interpretation of the results were added to the catalogue entries. In two campaigns a total of 31 kurgans were recorded using Total Station, of these nine were also surveyed by magnetometer. Besides the selected kurgans, the Total Station was also used to map architectural remains in the area of study especially of Panskoe I (see Chapter 4.3.2.1) and of a Hellenistic house on Hill 10 (DSP07-H10-01).

2.3.3 Geophysical surveys | C. Meyer, D. Pilz, T. Smekalova & B. Ullrich

2.3.3.1 Geomagnetic prospection

In the DSP, extensive use was made of geomagnetic prospection to determine the physical characteristics of the soils, and allow for the visualization of buried man-made structures. Below we will first discuss some general principles of this technology and will then focus on the specific methods that were applied by two teams that participated in the DSP. These were a Russian team headed by T. Smekalova of DNRFCBSS and a German team of the company Eastern Atlas Geophysikalische Prospektion (Berlin).

2.3.3.1.1 General principles

Buried archaeological features can be detected as long as there is a significant contrast in one or more geophysical parameters. Each geophysical method varies in depth range, is sensitive to a specific physical attribute and is influenced by certain environmental and soil conditions. Geophysical methods for the investigation of buried features were initially developed for studying geological structures, but during recent years they have become more and more important for archaeology. Of all the geophysical methods, magnetic survey is one of the most effective and universal ones used in archaeology, because many archaeological objects have specific magnetic properties, which allow them to be detected through the surface of the site by the magnetic anomalies they create.

To carry out magnetic prospecting, one measures the Earth's magnetic field within a small area done very close to the surface, and at many points within a fixed grid. For archaeological features to show up on the magnetic map they must contain magnetic material that differs from those in their surroundings, thus producing 'anomalies' in the retrieved recordings. Geomagnetic anomalies are caused by changes in the complex magnetic properties of the soil that may be induced by human activities. The amplitude of the magnetic anomalies is determined by the contrast of magnetic susceptibility between archaeological structures and the surrounding unaffected soil. Iron oxides like haematite, magnetite or maghaemite are carriers of magnetization. Those minerals occur ubiquitously in the soil, forming microscopically small grains. Usually magnetic anomalies are very small. For that reason, highly sensitive probes are required.

2.3.3.1.2 The 2007 and 2008 campaigns

In the 2007 campaign, geomagnetic prospection was undertaken by T. Smekalova assisted by A. Čudin. Prospection was aimed at complementing the results of the field walking survey, especially on the Hillsides (Hill01, Hill02 and Hill06 to Hill11) where various settlement structures were detected on the surface, like walls, pits and ditches, and the 'stone circles', that were later identified as natural features (see Chapter 3.3.2.6).

In 2008 the geomagnetic prospection was extended to two teams. The Russian team continued to focus on sites with high archaeological potential, and a German team, Eastern Atlas from Berlin, was invited to conduct geomagnetic survey on the slopes S of Lake Džarylgač in the areas to be affected by the construction of the projected wind park (see also Section 2.3.1.2). The Eastern Atlas investigations were directed by B. Ullrich and C. Meyer assisted by L. Keller, R. Kniess, R. Meyer, D. Pilz, E. Schönherr and H. Zöllner.

In order to check the consistency of the data yielded by the two different teams, a control check was performed by using the Fluxgate array to resurvey site DSP07-H01-01, and comparing the data with that produced by T. Smekalova using the Overhauser gradiometer in 2007. Both systems yielded the same result.

2.3.3.1.3 Methodology of T. Smekalova

During the 2007 campaign the magnetic survey by the Russian team was carried out with an Overhauser gradiometer (Fig. 2.10). This is a magnetometer with two sensors produced by Gem systems (Ontario, Canada). The measurements were made along straight parallel lines with an intermediary space of 0.5 m. The magnetometer was operated in so-called 'walking mode' measuring every 0.2 seconds. The intermediary distance between measurements along the lines did not exceed 0.2-0.3 m. The height of the sensor above the surface of the ground was ca. 0.3 m. Two Gem magnetometers were used, one serving as a main instrument that was moved on the plot to measure the magnetic field along the lines of a coordinate system. The other was placed at a fixed point where it automatically measured the temporal daily variations of the Earth's magnetic field every 15 seconds. The combined data from the two magnetometers was used to obtain the measurements of the magnetic field on the plot. With the help of a special program, the necessary corrections were made to remove the temporal changes of the global magnetic field.

In the 2008 campaign, a four-sensor device was used; the sensors of the Overhauser magnetometer GSM-19 of Gem Systems were mounted on a cart with an intermediary distance of 0.5 m between each sensor. This increased the speed of the magnetic survey by several times.

System	Overhauser GSM-19WG magnetometer with 4 sensors
Sensors	One, two or four
Measurement category	Total field in nT
Configuration	1, 2 or 4 channels, mounted on cart
Sensor separation	0.5 m
Sensor height	0.25-0.35 m
Distance measurement	GPS coordinates of the corners of investigation area
Investigated area	250,000 m² = 25 ha
Data format	Data export in standard X, Y, Z (line-oriented to facilitate software compatibility)
Grid	0.5 x 0.3 m
Processing and filters	Corrections for daily variations of the Earth's magnetic field

Table 2.3 Summary of geomagnetic prospection parameters of the Smekalova team using the Overhauser magnetometer.

To localize the surveyed areas, GPS coordinates were taken of the corner points of each plot using the same GPS hardware and software and coordinate system as the intensive survey (see Section 2.5.1). This data was later incorporated into the central GIS environment.

As a rule, plots were 50 m long (or less) and as wide as necessary for the magnetic survey to cover the investigated area. Two long measuring tapes were set out along the two opposite sides of the plot, with shorter (50 m or less) measuring tapes used to mark the intervals along which the parallel lines had to be walked.

As for the elaboration of the data, two different presentations of the magnetic data were prepared with the help of Surfer software (Golden, Colorado): coloured contour maps and grey-scale maps. On the contour maps, positive anomalies are shown in blue, and the negative ones in red. On the grey-scale maps the positive anomalies appear dark colour, and the negative ones light. The contour interval was usually 2 or 5 nT (Nanotesla).

2.3.3.1.4 Methodology of Eastern Atlas

The Eastern Atlas team used for their investigations an array of 5 and 6 Fluxgate Gradiometer probes respectively, mounted on a cart (see Fig. 2.11). The two sensors of each probe measured the vertical component of the earth's magnetic field with an accuracy of 0.1 nT. The measured gradient is insensitive to the typical large fluctuations of the earth's magnetic field and is determined only by the magnetization of the ground. The technical details concerning the investigation are summarized in Table 2.4. The grid images shown in the maps were produced by transforming the measured values to a scale of 256 grey levels. The geomagnetic maps in this case are displayed in dynamic scales of ±6 nT.

System	Array of five or six Foerster fluxgate gradiometers
Sensors	3 Foerster 4.021, 3 Foerster 4.032
Data logger	heslog DLAD62001
Measurement category	Vertical gradient in nT/m
Configuration	6 channels, mounted on cart
Sensor separation	0.5 m/0.8 m/1 m
Sensor height	0.35 m
Distance measurement	Odometer (survey wheel), coordinates of investigation area by GPS Mobile Mapper
Investigated area	1,300,000 m² = 130 ha
Data format	MRC, MDT (MARPLOT), images as PNG
Resampling (images)	0.25 m x 0.25 m/0.2 m x 0.2 m
Processing and filters	–

Table 2.4 Summary of geomagnetic prospection parameters of Eastern Atlas using the Foerster Fluxgate gradiometer.

The investigated sites were localized using a handheld GPS receiver (Thales Mobile Mapper) with an accuracy of within 0.5 m; additional GPS coordinates were taken when necessary to compare topographic features with geomagnetic anomalies. These coordinates were later incorporated into the central GIS environment.

On two selected archaeological sites, aerial photographs were also taken by the Eastern Atlas team using a kite which was set up with a digital camera PENTAX Optio A20 (see Fig. 2.12). To rectify the pictures, GPS points were defined and marked in the field and were used to set spatial reference points on the picture. Fig. 4.301 shows the aerial photography of Hill 12 which is a composition of several rectified and referenced pictures. The obtained image facilitates easy comparison of visible surface features and geomagnetic anomalies.

2.3.4 Soil surveys and augering | W. de Neef

In the 2008 campaign, manual augerings were conducted to gain more information on the landscape of the Lake Džarylgač research area (Fig. 2.13). Augerings were conducted for two reasons. The first was to gather information on soil properties, consistency and profiles in order to better understand the geology, hydrology and soils of the area of study (see Chapter 3). The second reason was to study the soil profile and to check the degree of disturbance of the soil at specific site locations, reflecting the degree to which the archaeological layers are still intact (see Chapter 4). The individual augering profiles are presented in Appendix 3, whereas the augering profiles made in DSP sites are included in Appendix 1.

2.3.4.1 Studying soil, sites and landscape

The study of soils in a landscape can reveal natural and human-induced changes in the landscape, such as erosion or deforestation, which may have influenced human occupation and activity as well as the deposition and preservation of archaeological remains. As the underlying factors and processes can differ greatly from area to area, it is necessary to observe the soils at different locations. Prior to the start of the project, little was known of the soils in the area of study apart from the 1967 soil chart of the Crimea (scale 1:250,000; Fig. 3.1). A greater level of detail was required to produce the necessary landscape description for the specific research area.

In 2008, systematic observations and manual augerings were conducted in the area to collect this detailed information. Although intended as the initial phase of observation, to acquire a first impression of the different land types in the area, these soil studies could not be continued due to the termination of the project after the 2008 campaign. Therefore, the collected data as presented in Chapter 3 is rather summary.

One method to obtain a first impression of the soils in a landscape is to describe their variations. In the DSP research area, a total of 29 soil augerings were carried out in a transect between the Black Sea coast to the N and the Hillsides to the S. This made it possible to draw a section of the landscape showing the relationship between topography and soil types. These samples were taken at approximately 100 m intervals.

To collect detailed information on the soil material, soil horizons, and the degree of disturbance of the soil profile at specific locations, an additional 31 augerings were conducted at seven sites throughout the area. The purpose of these site-oriented augerings was to gain information about the relationship between the archaeological remains on the surface, the soil underneath, and possible strata.

At each augering location data were collected to answer the following questions:

- What type of soil is present at the augering location?
- Is the soil profile undisturbed, or is it disturbed by, for instance, ploughing?
- Can we detect archaeological indicators, such as pottery fragments, bone, charcoal and flint, in the soil profile?
- How deep is the bedrock?

Augerings were conducted with an Edelman auger, a manually operated device with a drilling head of 8 cm in diameter. The drilling head is a hollow cylindrical tube with a length of 25 cm. The Edelman auger used in the 2008 season could be extended to a length of 2 m. At most augering locations, bedrock was reached before that, except for augerings 15 and 16 on the S and N shores of Lake Džarylgač. The drilling head is brought into the ground in a turning motion, the inserted bits at the bottom of the drilling head cutting the soil and filling the cylinder, whereby the soil structure is slightly disturbed. Cores are then brought up and laid out in the same sequence as the soil in the ground, after which the soil profile can be described.

Of each augering, the following information was recorded:

- Thickness of soil horizons in cm below the surface
- Texture and texture changes of the soil horizons
- Colour of the soil horizons (Munsell values)
- Mottles of different colour
- Humidity of the soil
- Effervescence of the soil material
- Types of natural inclusions (e.g. stones, plant remains)
- Types of archaeological inclusions (pottery fragments, charcoal, flint)
- Depth of bedrock below the surface

Where necessary, the amount of stones on the surface surrounding the augering location was recorded, as well as vegetation, land use, and humus content of the layers. The coordinates and elevation of each augering location were taken with the same PDA-GPS system used by the field survey teams, so they could easily be plotted into the central ArcGIS environment.

2.3.5 Trial trenches | V. Stolba

As a final step in the methodological sequel, trial trenches were made at selected sites discovered in the field walking and geomagnetic surveys and during the revisit of known coastal sites. All of the soundings were aimed at producing additional data for the cultural and chronological attribution of these sites, when this could not be established based on the exposed features and/or surface finds.

The geophysical prospection, which produced detailed geomagnetic maps of sites prior to excavation, proved very valuable for picking out an optimal location for the trenches. The orientation of the latter generally depended on the features detected on the geomagnetic map. In other cases it followed the four main cardinal points or the grid of the magnetic map. The standard trench size used was 2 x 2 m, but in two cases (the trial trenches dug in DSP07-H08-01 Feature 2 and DSP07-H10-01 Feature 5) this was exceeded in order to completely expose the objects (storage pits) or to provide an extent that allowed a better understanding of their basic purpose and outline. All of the trenches were excavated and recorded down to the bedrock, with layer-wise clearing of the fill; finds from each layer were recorded in separate find lists.

2.4 Finds processing and analysis | S. Handberg

Finds collected in the DSP were washed, dried and subsequently processed on a daily basis. The actual recording of the finds was limited to one person (S. Handberg) in order to secure consistency in the use of terminology as well as taxonomy. Basically, all of the finds were classified per bag into functional groups (Architecture, Handmade Ware, Transport Amphora, Tableware, Utilities, Bone, Lithics and Indeterminable) and then subdivided by shape, fabric, type and date (see Chapter 5.3 for more on the classification).

An MS Access database, which could be integrated with ArcGIS, was used for the recording. All of the finds were first recorded in a FINDS table. This table formed the basis for the creation of the distribution maps (see also Section 2.5.3). All diagnostic fragments were selected for numbering, more detailed description, drawing and photographing. They were then entered into a separate DIAGNOSTICS table. The information for the finds catalogue pertaining to the individual sites was later extracted from this table.

Finds were acquired in various ways; systematic collection during field walking of the ploughed zone and the slopes, diagnostic sampling during extensive surveys, random sampling during the geomagnetic and soils surveys and total collection from trial trenches. A more detailed treatment of artefact classification is given in the introductions to the site catalogue (Appendix 1) and the finds database (Appendix 2).

2.5 GIS and database application | T. de Haas

GIS and database applications were used in every part of the DSP. This section discusses first the use of mobile and desktop GIS applications in the preparation, execution and processing of the different types of fieldwork. Following this, the structure of the database that was used to store the non-spatial data of the surveys and pottery studies is given. The final part of this section describes how the database was integrated with GIS in order to create the distribution maps that form the base for site identification and further analyses, as given in Chapters 4 and 6.

2.5.1 GIS usage

GIS software, both desktop and mobile (combined with Global Positioning Systems [GPS] receivers), was a central component of the surveys. This section first discusses the actual hardware used in the field for the field walking surveys, as well as the mapping software employed to prepare, conduct, and register survey data. Following this is a description of the way in which this equipment was used in each of the methods of field research in the DSP.

2.5.1.1 Hardware and software

The central GIS environment used by the GIA team for this facet of the project is ESRI ArcGIS 9. In principle, the GIS environment was set up similar to that used in previous fieldwork in Italy, and will be briefly described below. As the choice for intensive survey methods both on the slopes and in the ploughed zone was expected to lead to large amounts of data, spatial information was digitally recorded in the field in order to limit data processing afterwards. Collection of specific geographical coordinates was done using handheld computers (PDA) with digital maps, connected to external GPS receivers.[17] The software used on the PDA was ESRI ArcPAD 7.0 package for mobile devices, since it is well integrated with ArcGIS. Each field team was equipped with at least one such PDA set. Although ArcPAD was a new program for the GIA team, a one-day trial in the field proved it to be sufficiently stable, efficient, and user-friendly to allow it to be further modified according to the specific needs of the DSP. All GIS data as well as the database, daily reports, Total Station and geophysical data will be made available online.[18]

2.5.1.2 GIS-use in the block surveys

The block survey depended on the use of desktop and mobile GIS applications (Section 2.3.1.1). As field boundaries could not reliably be copied from topographic maps, they were measured in before survey using the PDA. These field boundaries were then uploaded to the desktop GIS and used to create the survey grids that were subsequently loaded onto the PDAs again. Creating the grids beforehand proved very efficient, as experience from other surveys showed that doing this while surveying is time-consuming and prone to inaccuracies, especially in large fields.

The grid in the PDA was used to mark the individual unit boundaries in the field with small flags (Section 2.3.1.1.1). During the survey, any potentially relevant feature (points, lines and polygons) was measured. Such features include the extent of artefact scatters, soil discolouration or elevations, sample points and areas, and various other features.

Unit IDs as recorded in the field and on unit forms were later added to the shapefile (spatial file in ArcGIS) that contained the survey grids. The field data gathered on the PDAs was uploaded on a daily basis to the desktop GIS and subsequently edited to create the following separate files:[19]

- Fields and units (polygons)
- Features (points and polygons)
- Site extents (polygons)
- Site centroid (points)
- Sample areas (points and polygons)

2.5.1.3 GIS-use in the slope survey

The slope survey relied heavily on the use of the PDA, as topographic maps contain very few features of reference in this area (Section 2.3.1.2). In general, during the survey the PDAs were used to map both the transects, that were actually walked on the slopes, by means of a tracklog, and specific observations, both (individual) artefacts and structures. After the survey, the field data was uploaded and edited to create the following separate files:

- Hills and units (polygons)
- Features (points, lines and polygons)
- Site centroids (points)
- Samples (points)

2.5.1.4 GIS-use in the extensive survey

In 2006 the coordinates of sites and fields were registered using a Garmin GPS receiver; the data were later manually entered into the desktop GIS.

The PDAs were used in the extensive survey mainly to map sample and site locations (Section 2.3.1.3). After the survey, the field data was uploaded and edited to create the following separate files:

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17 The devices are standard HP ipaq machines (of the h2200 an hx2490 series). The devices communicate via bluetooth connections with GPS receivers (Royaltek STAR3 and Socket D1598).

18 The archive is deposited at DANS, the Dutch Data Archiving and Networked Services. The data as well as the terms and conditions for use can be found via www.edna.nl or directly at http://persistent-identifier.nl/?identifier=urn:nbn:nl:ui:13-0mg-hmc.

19 All GIS files use the coordinate system WGS 1984 UTM zone 36N.

- Samples (points)
- Site centroids (points)

2.5.1.5 GIS-use in the Total Station survey

The PDAs were used in the Total Station survey in order to connect the Total Station measurements to a real world-coordinate system (Section 2.3.2). For this, the coordinates of various grid points used during this survey were measured with the PDA. After the survey, the coordinates of these control points were used to import the Autocad data into the desktop GIS.[20]

2.5.1.6 GIS-use in the magnetometer survey

The PDAs were also used in the magnetometer survey to connect the magnetometer measurements to a real world-coordinate system (Section 2.3.3.1). As with the Total Station method, the points of the grid used during this survey were measured with the PDA. After the survey, the coordinates of these control points were used to georeference the Tiff maps of the magnetometer survey data into the desktop GIS.[21]

2.5.1.7 GIS-use in the soil surveys and augerings

The PDA was used to map various observations during the soil surveys as well as the locations of the augerings (Section 2.3.4). After the survey, the field data was uploaded and edited to create the following separate files:

- Quarries (lines)
- Augering locations (points)

2.5.1.8 GIS-use in the test trench excavations

The coordinates of some of the test trenches were taken with the PDA; the remaining trenches were measured with a separate GPS device.[22] After fieldwork, the PDA data and the coordinates recorded with GPS devices were used to create a file with the locations of the test trenches (points).

2.5.1.9 GIS and cartography

For reference in the field, the 1:21,000 half-verst maps were used (see above Section 2.1). Unfortunately the digital versions of these maps that were spatially referenced proved to have some distortions, so that in certain cases there is a slight deviance between locations as measured in the field and their location on the map. This deviation can be up to ca. 100 m.[23]

The following topographical features were digitized from these maps:

- Roads (lines)
- Settlements, fishing stations, ruins and saltworks (polygons)

The location of kurgans and springs had previously been digitized by T. Smekalova in Mapinfo and were imported into the desktop GIS.

A shaded relief model is used as background for the visual representation of the area surveyed based on data provided in the ESRI ArcGIS 9 kit of data and maps. This model is based on the world elevation model of the US Geological Service, at a resolution of 90 m; this shaded relief model is used for the larger overview maps as background, while the more detailed maps use the half-verst map.

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[20] The extent of each kurgan was added to the polygon features file of the slope survey.

[21] The interpretations from these maps (i.e. all subsurface features) were digitized and added to the (line and polygon) features files of the slope survey.

[22] Three trenches were measured in detail with the Total Station.

[23] The deviations may partly be explained by the scale of mapping, but could also be due to slight distortions in the map that arose during the process of scanning and-or copying of the original maps.

2.5.2 Database structure

All non-spatial data from the block survey as well as the results of all pottery studies were stored in an MS Access database. This database was modified after those used for the GIA's surveys in Italy.[24] For the DSP survey, the database initially consisted of four tables, related to each other by their unique IDs for units and samples. These four tables include:

- The UNIT table, that contains data on the individual units (i.e. info from the Unit forms);
- The BAGS table, containing data on the samples (info from Unit forms and from the finds processor;
- The FINDS table, that contains records for each find class per sample (see also Section 2.4 and Chapter 5.3);
- The DIAGNOSTICS table, recording data on individual selected finds (see also Section 2.4 and Chapter 5.3).

After the completion of the survey, two more tables were added to the database:

- A FIELDS table with summary data (number of units, size, unit size) on the surveyed fields;
- A SITES table, with summary data on the sites that were identified after the survey, based on the distribution maps (see below).

2.5.3 GIS and database integration for distribution maps

In order to come to an analysis of the research results, the data stored in both the GIS and the database were integrated into distribution maps. The following section describes how this was done for the block survey and the slope survey; the maps of the slopes include data from the magnetometer survey, the excavations, and the Total Station survey.

2.5.3.1 The block survey maps

The analysis of the survey data as presented in Chapter 4.4 presents data for each field and for each individual site. The distribution maps are all based on the finds collected during standard sampling and present densities per grid unit. The densities have been corrected for coverage and indicated by graded colour values.[25] It was decided not to correct these densities for visibility for two reasons: on the one hand, the level of visibility was roughly consistent (all the fields were ploughed, and almost all were surveyed under moderate to excellent conditions, excepting the weather at times); on the other hand, considering the very low sherd count we fear that applying additional correction factors may 'create' patterns based in reality only on single finds.[26]

Thus, for each field an overview map was made that displays all finds, as well as period maps for all of the relevant periods: Bronze Age, Late Classical to Early Hellenistic, Byzantine, Medieval, or Early Modern, and Modern. After a description of these distribution patterns, the areas with relevant artefact scatters are analyzed, forming the basis for the identification of (possible) sites (see Appendix 1). For these areas we present more detailed distribution maps for each relevant period that also show the absolute number of finds per unit (black, italics), the scatter/site extent as well as the location of additional samples and the number of finds from these additional samples (indicated by white circles).

2.5.3.2 The slope survey maps

The slope survey data are presented in maps for both entire hills/units and for individual sites.[27] Two overview maps are presented for entire hills or, where applied, survey units (Chapter 4.5): the one presents the outline of the hill/unit

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[24] Cf. Van Leusen 2002, chapter 8, paragraphs 3.1 and 3.2.

[25] Units were normally surveyed with a 20% coverage; this means that all absolute artefact counts are multiplied by a factor 5 (raw count x 5 = 100/% coverage). These figures are subsequently normalised to densities per hectare.

[26] See further Section 2.3.1.1 on the application of visibility factors.

[27] We note here that in some cases the margin of error in positioning the topographic background map causes displacement of this background; in some cases hill outlines appear to run on across ravines. Similarly, the location of kurgans as indicated on the topographic maps sometimes differs from the location as measured with PDA and/or Total Station. The kurgans measured in during the Total Station survey on Hill 19 are up to 40 m W of their location on the topographical map.

together with the magnetometer survey results and the location of sites, the other displays the outline of the hill/unit together with the samples, the features recorded and again the site locations.

The site maps zoom in on site areas, displaying all relevant site data (magnetometer survey data, samples, features, excavation trenches).

2.5.3.3 The extensive survey maps
For the extensive survey maps, all sample locations and sites are displayed, including the digitized topographical features such as roads and villages (Chapter 4.2-3).

2.6 Site determination and classification | P. Attema

2.6.1 Site and off-site definition

In the surveys of the DSP, the term site is used to denote all artefact scatters and structural features that are indicative of past human activity at circumscribed locations in the landscape, provided these remains are detected 'in situ'. Sites encountered in the DSP can be subdivided into various types: artefact scatters, stone structures, artificial elevations and other interventions in the landscape (such as pits, quarries, and kilns). Single lithics and potsherds as a rule are considered as off-site finds unless clearly related to an archaeological feature, e.g. a burial mound (kurgan). Off-site artefacts, especially pottery, are in the context of the DSP valued as indicators of past land use and were therefore consistently recorded and analysed.

Lithics and potsherds appear on the surface foremost in the cultivated zone (i.e. Pediment and Lowland Ridge in the land type classification presented in Chapter 3.3.1), due to the regular ploughing that takes place there. The definition of a site on the basis of artefact distribution in this study depends on a combination of a high finds density relative to its surroundings and/or spatial discreteness of the artefacts and chronological coherence (see Chapter 4.3). In the non-cultivated zone (i.e. the Hillside and Plateaus/Uplands in the land type classification presented in Chapter 3.3.1), artefact scatters are rare, and site definition here, as a rule, is dependent on the surfacing remains of stone structures, artificial elevations and other visible interventions in the landscape as well as subsurface features that were detected through geophysical techniques.

2.6.2 Site classification

In order to interpret the different kinds of sites mentioned above, several classes of sites are defined in Chapter 6.1, using the data provided in Chapters 4 and 5 and in the site catalogue (Appendix 1). These site classes are provisory functional categories, and are based on the presence of such indicators as individual artefacts or artefact scatters, structures in stone, or features such as elevations, and discussed in relation to the land types in which they occur.[28] Sites consisting of artefact scatters can substantially differ in scatter size, density, artefact assemblage and chronology, and these variables help in establishing hypotheses on site function. For instance, while some of the larger Bronze Age scatters are certainly the remains of permanent nucleated settlements, the often very small Hellenistic scatters may represent small settlements, or even non-settlements, such as temporary or seasonal facilities.

Depending on their shape, the main stone structures found in the DSP area of study are interpreted as encircling walls of animal pens or as house foundations of different sizes. So far these pens and foundations have been found exclusively on the hillside. Although isolated examples occur, they are typically found together and are thus interpreted as (complex) settlements. In the Lowland Ridge there is evidence of large fortified farmhouses[29], while the elevated parts of the landscape gave no indication of this class of farmstead, but rather of modest to primitive rural housing.

Most of the artificial elevations in the landscape are burial mounds (kurgans) from various periods from the Bronze

28 See also Attema et al. 2009.

29 As large fortified farmhouses were not encountered in the survey, they do not figure as a class in the site classification presented in Chapter 6.1 that was exclusively based on sites defined within the transect. Of course they are incorporated in the concluding analysis on settlement development in the wider study area.

Age onward, belonging thus to the site class of funerary area. They appear both in the elevated parts of the landscape and in the lower zones. Many have been looted, while in the cultivated zone a substantial number has been ploughed away. Other elevations in the landscape pertain to ash heaps or dams, mainly from the Early Modern period; land divisions were also noted in the field, however their origin was uncertain. Other past interventions in the landscape are pits dug into the soil that in most cases can be related to houses, and kilns and quarries, the latter of course related to specific geological situations (see Chapter 3 passim).

The site classes and their correspondence with land types will then be used for the wider interpretation of the settlement history of the DSP area of study that is presented in Chapter 6.