# Ancient Roads and Land Division in the *Chorai* of the European Bosporos and Chersonesos on the Evidence of Air Photographs, Mapping and Surface Surveys<sup>1</sup>

Tat'jana N. Smekalova & Sergej L. Smekalov

The Greek colonization of the Kimmerian Bosporos was of a distinctly agricultural character as the vast fertile lands of the Kerch Peninsula constituted the main treasure of this region.<sup>2</sup> The rural territories were intended not only to provide the population of the Bosporos with food but also to supply trade goods that were able to compete in the overseas markets. Thus the Bosporos was provided with all the components necessary for the existence of the state and its citizens. These trade goods included grain, especially wheat, which was always in demand in the ancient world.

As shown by the literary as well as the archaeological and epigraphic evidence,<sup>3</sup> the earliest Greek *poleis* which arose in the 6th century BC in Bosporos were Pantikapaion, Theodosia, and Nymphaion. The small towns of Tyritake, Myrmekion and Porthmion were founded probably in the course of internal colonization and were part of the Pantikapaian polis. The early poleis were civil communities of landowners allotted land-plots or kleroi within a distance of a few kilometres from their settlements. Later, with the development of the commodity production of grain, the *chora* of these *poleis* started to grow and required a new demarcation of land-plots. Nevertheless, the *poleis'* basis as communities of landowners remained intact. Probably, almost all of the territory in the Bosporan state, which was suitable for agriculture, was tilled at the height of the international grain trade in the 4th century BC.<sup>4</sup> Although our written sources' information on land division in the European Bosporos is extremely scarce,<sup>5</sup> the physical traces of such a division are fortunately still preserved. This paper attempts to reconstruct the systems of land-plots in the major poleis using a combination of remote (aerial and space photography and mapping of distributions) and archaeological methods.

# Methodology

We base our assumptions on the postulate that the systems of ancient land-di-

vision must have been more or less distinctly reflected in the now existing realities: on aerial photographs, in the grid of old and modern roads recorded on maps of various years, in the boundaries of present-day fields, the positions of forest belts and land demarcations of various types. The territory of the Kerch Peninsula cannot have changed its appearance much since the ancient period as otherwise certain indications of ancient field demarcations, which still remain, would have been erased completely from its surface. Only the most urbanized, completely built-up areas and perhaps the levelled areas of aerodromes may prove to be unpromising for our researches. Most of the land, however, still preserves, or preserved until recently, information which it is possible to bring to light using a combination of techniques mentioned above.

Air photography provides the basic link in this complex. On the basis of our recent studies, we can state that within the European Bosporos, it is only possible to observe traces of ancient land-division from a considerable height and under certain conditions. Unfortunately, we have only recently been able to study the many aerial photographs, after many cartographic materials and aerial photographs were declassified and thus became available to researchers. This fact has partly impeded the studies of the *chora* of ancient states. Now these studies should be carried out with redoubled effort in order not to miss the traces of *kleroi* which are disappearing fast in areas under tillage or construction.

The land-plots revealed by means of air photography are the starting point for the entire chain of reconstruction. The indispensable prerequisite for this reconstruction is to detect the regular grid of land-plots on aerial photographs. Two of the most important indications of *kleroi* are (1) rows of straight parallel lines (mostly dark) intersected with a group of similar straight lines perpendicularly to the former, and (2) the metrological parameters of the rectangles resulting from these intersections.

The orientation of the axes of demarcation must have corresponded to the directions most "favourable" for the transportation of the crops from the fields and for communications of other kinds. In addition, it complied with the peculiarities of the terrain providing the best soil drainage. It is also known that the requirement for optimal insolation must be taken into account.<sup>6</sup>

Historical evidence and the results of studies of the *chora* of Chersonesos are our starting point concerning the metrological characteristics. Strabon mentions indirectly that the unit for measuring out areas used in the northern Black Sea region was the *plethron* (7.3.19). Although its value was not indicated by the author, it is known that one *plethron* equals 100 square feet. As shown by A.N. Ščeglov and G.M. Nikolaenko who studied the system of land-division in the *chora* of Chersonesos, a standard measure based on an Egyptian foot and equal to 0.35 metre was used there (100 feet correspondingly equalled 35 metres).<sup>7</sup> The Egyptian *plethron* must thus have equalled 1,225 m<sup>2</sup> or 0.1225 ha. Having presupposed that feet and *plethra* were also

used for land-division in the Bosporos we arrived at the confirmation of this hypothesis as demonstrated below.

There is another Greek measurement of length for the plots, *schoinos*, which is equal to 120 feet of 0.2777 m each, as recorded on the Herakleian tablets.<sup>8</sup> It is apparent that 100 Egyptian feet is almost the same as one *schoinos*. There is an approximate Roman equivalent, the *actus* of 120 Roman feet, which, assuming a standard foot, gives us a length of 35.48 m. *Actus*, or "drive", was originally an agricultural term, indicating the distance that oxen pulling a plough were driven before a turn-back. The two Roman measures of area most commonly used were *iugerum* which equals 2 square *acta* or 2,523.30 m<sup>2</sup> or 0.25233 hectares and *centuria* ("century") equal to 20 × 20 *acta*, i.e. an area of 200 *iugera*. *Iugerum* was originally an agricultural measure – the field that could be ploughed in a day.<sup>9</sup> Plinius (*NH*, 18.49) writes:

It is a fair day's work to plough one *iugerum*, for the first time, nine inches in depth; and the second time, one *iugerum* and a half – that is to say, if it is an easy soil. If this, however, is not the case, it will take a day to turn up half a *iugerum* for the first time, and a whole *iugerum* the second (transl. J. Bostock & H.T. Riley).

It is apparent that one *plethron* equals almost exactly half a *iugerum*, the two units thus having been possibly considered quite similar in terms of their use for plot measuring. It is in *iugera* that the areas of rectangular plots were measured in Valencia where they were 710 × 360 m with an area of 2,556 m<sup>2</sup> or 100 *iugera*.<sup>10</sup> Numerous traces of Roman "centuries" are found in Italy, eastern Spain and northern Africa.<sup>11</sup> After Augustus' times the value of "centuries" became so standardised that any exceptions are practically unknown.<sup>12</sup>

After determination of the traces of discernible land-plots on aerial photographs we studied maps, both old and new large-scale ones, as well as high-resolution space photographs. On these we selected linear elements, the directions of which corresponded to those of the axes of land-division while the distance between them was equal to or divisible by the size of one land-plot. All the elements found were recorded in a single computer topography base. To this, the results of the deciphering of aerial photographs, which had been obtained earlier, were added. The resulting composite map serves as the basis for the reconstruction of the system of land-plots of the *poleis* or other administrative entities.

Finally, the data obtained by the remote methods were supplemented by archaeological evidence available checked by surveying. The precise geographical coordinates of the distinctly detectable demarcation banks and walls, roads, buildings etc. were determined by means of GPS-receivers and drawn on the composite map of the area under study. Often plots were divided by small ditches. These were later filled by soil from the upper layers that were more magnetic than the subsoil medium housing them.<sup>13</sup> As shown by previ-







ignated by circles following Maslennikov 1999, 77.

ous research, these objects create fairly considerable magnetic disturbances, which can be easily detected owing to their considerable length, as well as intersections of lines at a right angle such as is uncommon in natural structures. Therefore, magnetometer surveys may be of help in revealing the layouts of rural estates, as well as in the determination of anomalies caused by silted-up ditches, buried roads and walls or banks between ancient fields.

The division of the land into equal plots according to an orthogonal system was adjusted, in particular, to natural features. The land-division was conducted within the territories adjoining the *polis* they belonged to and bounded by various natural geographical and topographic barriers: upland ridges, seashores or the banks of lakes, rivers, deep gullies, etc. The orientation of the land-demarcation axes was selected according to the predominant directions of slopes and at the same time answered to the requirement of providing the shortest and most convenient way to the *polis* (or some other economic and administrative centre nearby) for the transportation of crops or other economical needs. Along with the peculiarities of the landscape, the type of soils, their humidity and stoniness, prevailing wind directions and insolation determined the positions of ancient fields. Naturally, not only the modern features of the relief but also changes in climate and hydrology, as well as the constancy or variability of the wind, must be taken into account in any historical reconstruction.

The necessary additional information was yielded by archaeological surveys and excavations of the past years. Of special importance is the evidence for farmhouses that may have been located on each plot. If the spatial relation between the *kleroi* and the farmhouses is proved, the finds from the latter may serve as dating materials for the system of land-division.

Now, we proceed to the results of our research. Four areas of continuous orthogonal land-division have been revealed on the territory of the European Bosporos (Fig. 1):<sup>14</sup>

- 1) the south-western part of the Kerch Peninsula (I);
- 2) the middle part of the peninsula near the Strait of Kerch (II);
- the region to the north-east of the city of Kerch extending towards the Temir-Gora Mountain (III);
- 4) the region west of Pantikapaion (IV).

#### Distant chora of Theodosia

The first and the largest region is that of the southern part of the Kerch Peninsula from Cape Čauda reaching as far as the Uzunlar Lake (Uzunlarskoe). It has already recently been noted that on aerial photographs taken in 1972, the traces of at least 130 ancient land-plots are distinctly visible (Figs. 2a and 3a-b).<sup>15</sup> The *kleroi* measure about 350 m in the meridian and 388-390 m in the latitudinal directions (Fig. 2b). Thus the shorter side of the plots corresponds to 1,000 Egyptian feet and the longer one to 1,000+100 feet. We suppose that the



*Fig. 2. a)* Aerial photographs of the territory west of Cape Čauda; b) the orthogonal system of land-plots is set off on the air photographs.

a slight deviation from the north: c. 12-14° to the west. The grid of these squares is only disturbed by the steep beach and banks of the Kačik (or Kačikskoe) Lake, which probably was a sea bay in antiquity. On the plots situated to the east of the lake, additional meridian lines can be seen – possibly the result of restructuring. No traces of rural buildings have as yet been revealed either on the photographs or during limited surveys in the terrain.<sup>16</sup>

The above mentioned deviation of the axes of the land-plots 12-14° counter-clockwise from the modern northern direction perhaps deserves a more detailed consideration. Jumping ahead, we can note that we have recorded the identical direction for the land-dividing demarcations of the *kleroi* situated near Mt Temir-Gora. It is well known that the position of the magnetic pole has varied with time, so that the counter-clockwise deviation of 10-15° relative to the modern northward direction corresponds to the exact orientation of the magnetic pole during the period from c. 4th to the 1st century BC.<sup>17</sup> The coincidence of the parallel orientations of the two systems of land-division is probably not fortuitous. We suppose that ancient land-surveyors used some devices like our compass for laying the axes of the plots. It is known, that where no considerations of the relief were of importance, Roman camps, towns, monuments and country estates tend to be oriented to the four car-



*Fig. 3. a)* Enlarged detail of the aerial photograph of the territory west of Lake Kačik; b) Enlarged detail of the aerial photograph of the territory east of Lake Kačik.

dinal directions. We do not insist that the *kleroi* must have invariably been oriented to the north everywhere throughout the Bosporos. Undoubtedly, the main requisition when selecting the orientation of the axes was that of providing the shortest way to deliver crops to the *polis* or to a place from which the grain could be transported by sea. As we will see below, the direction of the axes of the land-plots of Nymphaion is different, in that it corresponds to the shortest way to the *polis*. But it is nevertheless undoubted that a compass is a very convenient tool, and therefore the northward orientation was preferred, when the direction towards the *polis* coincided approximately with a cardinal direction and where natural conditions allowed it. The northern

direction, however, was the direction towards the "ancient" magnetic north which in the 4th-3rd centuries BC deviated 14° counter-clockwise from the respective modern one. In principle, this specific declination may be used for approximate "archaeomagnetic" dating of the system of land-division albeit the dates obtained covered a very wide range. Our results, notwithstanding their extreme vagueness, do not contradict but rather corroborate the more accurate date yielded by archaeological evidence as proposed below.

Very important data for the reconstruction of the system of land-plots in the southern part of the Kerch Peninsula are obtained from large-scale maps: 1:25,000, the so-called *verstovki* or *one-verst* maps (scale 1:42,000); 1:100,000, the *three-verst map* of 1866 (scale 1:126,000), Betev's map of 1842, Muchin's map of 1817 and high-resolution space photographs. These maps and photographs have enabled us to reveal the linear elements (mostly roads or boundaries of fields) corresponding to two features of the plots: their orientation at 12-14° to the west and the interval between them, which is divisible by 350 m in the latitudinal and by 385 m in the meridian direction (Fig. 4).

The preserved elements of the system of land-lots yielded by maps and space photographs allow us to reconstruct the orthogonal structure of the land-division throughout a considerable territory that exceeds several times the initial area where the plots have been revealed by air photographs. Especially noteworthy are at least three "trunk roads" leading from north to south seawards. One of the roads is discernible both on the *one-verst* map and on the 1:25,000 map almost in the centre between the group of plots situated east of the Kačik Lake. This road leads from north to south - approximately from what is now the village of Vulkanovka (formerly Džav-Tepe) to the seacoast, corresponding exactly to the boundary between the hypothetical ancient plots. At the end of this central road, on the coast, a seaport settlement may have been situated which today may be destroyed by the fast erosion of the seashore. Similar roads are also found in the western part of the peninsula leading from the former village of Sarylar and, in the eastern part, from what is now the locality of Krasnopol'e to the sea (see Fig. 4). They lie at distances of 8 and 6.5 km respectively from the central road. We may suppose that these roads were the main ones in antiquity leading from the inland steppe to the seashore.

In the western section of the territory under consideration we are able to reconstruct another meridian road, as well as two latitudinal ones, with a distance of 720 m between them, north of a small lake of Dort-Kol and south of the village of Arpač. However most of the elements of the orthogonal system of land-division have been reconstructed in the central and eastern parts of the district under consideration – from the very seacoast inland towards Vulkanovka.<sup>18</sup> Probably we are dealing here with an almost uninterrupted cultivation of the fields from antiquity to today with the same borders and roads as before.

In the northernmost area of the Black Sea gulf – west of Lake Uzunlar – two roads run latitudinally as parallel lines c. 720 m from each other. These



Fig. 4. Southern section of Kerch Peninsula from Cape Čauda up to Lake Uzunlar. Reconstruction of the orthogonal system of land-division. The structures discernible on air photographs are drawn with solid lines, shown in the map at a scale of 1:25,000 – dotted lines, in the one-verst map – dashed lines.

are crossed by at least four transverse roads, three of which are about 770 m from each other, the fourth lying at a distance of about 2,000 m east from the previous one and fairly close to Lake Uzunlar (see Fig. 4).

The directions of all the above-mentioned elements correspond exactly to the axes of the system of land-plots, the distances between them being divisible by the linear dimensions of the latter. Using the composite map (Fig. 4), it was possible to establish that the plots occupied a considerably larger territory than that traced on air photographs. This territory is bounded on the south and west by the sea, by Lake Uzunlar on the east, and on the north by a line lying slightly farther north from the northern extension of the same lake. The total area of the reconstructed system of land-plots amounts to about 350 km<sup>2</sup> or 35,000 ha, the number of the plots being at least 2,800.

The validity of the hypotheses proposed was checked in the course of surface surveys in 2004-2005 and magnetic surveys in 2005, as well as by measuring the coordinates of the traces of ancient land-division discernible on the surface. One angle of a land-plot in the westernmost system of land-division, i.e. outside the military zone, was chosen as a testing area ( $50 \times 20$  m) for magnetic surveys. The location of this angle was found on the surface by means of the calculated GPS coordinates defined by the aerial photograph

superimposed on the computer map of the district. In the magnetic field recorded, two extended anomalous structures are well distinguishable notwithstanding a considerable level of noise caused by iron objects remaining from World War II. The two structures cross each other at a right angle, their directions corresponding exactly to the axes of the land-division. The results of magnetic surveys thus corroborate the existence of traces of land-plots here. Their boundaries were probably marked by tilled ditches that later were filled with upper (more magnetic) layers thus producing extended weak positive anomalies.

In terms of natural conditions all this territory is characterized by a fairly monotonous landscape: practically level or slightly rugged plain with only rare gently sloping hills here and there. The few natural obstacles for the cultivation of these vast lands include the deep and ramified ravine of Džapar-Berdy running into the salt lake of Kačik, as well as the lake itself, Mt Djurmen and the *uročišče* of Kotlovina, which may have been a salt lake in antiquity.

The natural limits of the land-division system under consideration were the coast to the south and south-west and Lake Uzunlar to the east. In the north, the demarcated area may have been bounded by the Parpač Ridge. The latter must have been at the same time a kind of a border dividing the tilled fields from the territory to the north, where due to topographical and climatic conditions (as well perhaps as some others) another economical structure and type of everyday life dominated among the local population. We must remember that precisely this last district of the peninsula is the most abundant in barrows of different periods, which in some cases form practically uninterrupted chains marking the direction of ancient roads in particular running east to west along the crest of the aforementioned ridge. Notwithstanding the fact that in terms of its natural conditions the Crimean area of the Azov Sea has always been favourable for agriculture, it was predominantly a region of animal husbandry and semi-nomadic populations. It is true, however, that the situation varied in different historical periods even within a single epoch.

The topsoil consists here of silted solonetzic černozems, meadow and černozem-meadow soils, and solonetzs. At present, these soils are considered potentially fit for agriculture but in need of certain improvements.<sup>19</sup> In antiquity, however, these lands were probably considerably more fertile. Otherwise it is impossible to understand the well known statement of Strabon that the plain between Theodosia and Pantikapaion was rich in grain and had many settlements (7.4.4).

In terms of archaeology, the territory described is the least well known, possibly due to the fact that almost the entire coastal zone, up to 5 km in width, has been off limits since the pre-World-War-II period. On the map presented in I.T. Kruglikova's monograph,<sup>20</sup> only one Hellenistic settlement (Karasevka), together with the port settlement of Kazeka known from written sources and perhaps situated near Cape Čauda, is specified in the northern section of the district under consideration. As far as Kazeka itself, little of it

remains preserved. V.V. Veselov's surveys<sup>21</sup> have not dealt with this region at all. Neither have the recent explorations by A.V. Gavrilov, who is of opinion that it could not belong to the *chora* of Theodosia being too far away from the city nor have our few brief trips to the region of Cape Čauda succeeded in supplementing the information available.<sup>22</sup>

In our opinion, the land-plots found here did nevertheless belong to the distant *chora* of Theodosia. Although their distance from the city is fairly far by land (c. 50 km), we must not forget that the Greeks preferred seaways. The route via the gulf was shorter (c. 32 km), more convenient and safer, lying within direct sight of both Kazeka and Theodosia.

Unfortunately, at the present stage of our studies we can say almost nothing concerning the dating of the land-division system under consideration. The reason is that no farmhouses have as yet been found here, partly because the southern areas have been inaccessible for reconnaissance on foot and partly because until recently the ideas on what this intended research should include have been fairly vague. Now it becomes clear that the search for rural houses must be carried out throughout the entire reconstructed territory, in particular in the vast area south of Vulkanovka. On the basis of a strong resemblance between this land-division and that of Nymphaion, as discussed below, we can probably assume that both are dated to the same period – the 4th century BC.

## Distant chora of Nymphaion

Another hypothetical area of continuous land-division occupies the centre of the eastern section of the peninsula - a few dozen kilometres approximately from the village of Tasunovo (on the north) towards the Strait of Kerch (fig. 1.II). The studies of this area started with B.G. Peters' deciphering of air photographs covering for the region north of v. Michajlovka.<sup>23</sup> He identified over 100 land-plots formed by straight, parallel lines crossed by other similar ones at right angles (Fig. 5). The dimensions of the plots, as established by Peters, were 300 × 340 m. However, after careful examination of the scale of the plan published by this author and studies of aerial photographs of 1972, it became clear that these figures are wrong. In reality the plots measured 350-380 by 380-400 m, i.e. they were equal to those in the distant chora of Theodosia mentioned above. The orientation of one side of this system of land-plots is c. 20-23° clockwise from the geographical north direction (or 16-19° clockwise from magnetic north). On the photographs taken in 1972 shot from a greater height than those on which the land-plots of Theodosia have been identified by Peters, only single elements of the entire orthogonal grid discovered by him are discernible. Only certain parallel dark lines running approximately 390 m from each other can be detected in the northern section of the area under consideration. The shot examined by Peters encompassed a smaller territory than did our images. Moreover, his



*Fig. 5.* The orthogonal system of land-division revealed by B.G. Peters near v. Michajlovka. *After Peters 1978; a) plot boundaries; b) tumuli; c) stone enclosures of ancient times; d) stone enclosures of Medieval period; e) terrace walls; f) outcrops of limestone rock.* 

photograph was probably taken during a more favourable season when the dark lines of the plot boundaries were quite clearly discernible, thus ensuring that the researcher could be certain that he really had seen land-plots. During his surface reconnaissance, Peters was able to observe the boundaries of the *kleroi* visually by marks of darker vegetation and certain elevations.<sup>24</sup> In addition, excavations of kurgans situated within the divided territory have even enabled the scholar to establish the chronological interval between the land-division and the raising of the kurgan mounds.<sup>25</sup>

Thus at the first stage of our studies it was possible to identify the immediate features of the system of land-division discovered north of v. Michajlovka. The land-plots are oriented with their axes 20-23° clockwise from the geographical north, measuring 360 × 390 m or approximately 1,000 × 1,000+100 feet. The area of each plot is thus equal to 100 *plethra*. Meridianally they are longer than in the latitudinal direction, probably corresponding to the positions of former demarcation marks. We are dealing here with exactly the same practice of allotting land as is the case in the distant *chora* of Theodosia. The predominant direction of the hill slopes and of potential communication routes here was towards Lake Čurubaš, therefore the "additional" 100 feet were reserved on the respective sides of the plots so that the roads then in existence led to the lake and the strait.

At the second stage of these studies, i.e. in the course of examining detailed maps of the territory, we were able to identify numerous linear elements directly marking the land-plots (Fig. 6). These elements included first the earth roads running at a transverse to each other from the northern angle of v. Tasunovo, and second, the forest belts and earth roads, which cross the Kerch-Feodosija highway in the direction from Michajlovka towards Kerch, as well as the earth roads and a forest belt south and south-east of Michajlovka (see Figs. 1 and 6).

But the most noteworthy linear element is a rectangular block of present-day fields measuring over  $3 \times 3.5$  km and its surroundings visible on almost every topographical map within a vast flatland south-west of Lake Čurubaš. The direction of its axes and the dimensions of the separate fields into which this area is divided correspond almost perfectly to the immediate signs of the already identified *kleroi* (Fig. 6). We suppose that this square structure is the remains and direct continuation of the same system of land-plots that was found near the village of Michajlovka.<sup>26</sup> It is thus possible to reconstruct the ancient system of land-division throughout a fairly large territory from the costal zone between lakes Čurubaš and Tobečik westwards and north-westwards as far as Michajlovka and further west and north-west to the areas slightly west of Tasunovo (Fig. 6).

The placement of this system of land-plots leaves no doubts that we are dealing here with the distant *chora* of Nymphaion. This system does seem to have belonged to Nymphaion, although until now the border of the *chora* of that *polis*, even at its peak, had been considered to be slightly further east, the *chora* itself confined to the area between Lakes Čurubaš and Tobečik.<sup>27</sup> The main argument in support of a considerable enlargement of the supposed rural surroundings of Nymphaion is this uninterrupted continuation of the single system of orthogonal land-division throughout the entire area described above.

Here, as well as within the undoubted territory of the Nymphaian *chora* (the area between Lakes Čurubaš and Tobečik), the predominant direction of the demarcating of the land was determined by the natural slopes of the vast elevated plateau. This direction coincided with the longer axes of the lakes and the general seaward inclination of the terrain.

The orthogonal system of plots surrounding Michajlovka was limited to the west by the Uzunlar Rampart – a combination of a natural (hills) and an





artificial barrier. The proper *chora* of Nymphaion were bordered to the west and south-west by the Glubokaja Ravine which joins a system of ravines united under a single name of the "*uročišče* of Plavni" (Ičkil-Džilga) the latter running in their turn into Lake Tobečik. The soils vary throughout this region offering in places the most fertile černozems on the peninsula.<sup>28</sup>

To the north and north-east, the *chora* of Nymphaion were probably bounded by the banks of Lake Čurubaš. To the north-west, judging by the area occupied by the orthogonal system of land-plots, the boundary was the elevated southern edge of the vale-depression in which further to the north the village of Andreevka Južnaja is situated. Probably, along this boundary lay a section of an ancient road which is marked now by a chain of at least 11 kurgans. This road, traceable also further west by a continuous row of kurgans, must have crossed the entire Kerch Peninsula from Cape Ak-Burun to what is now the city of Staryj Krym thus following the line of the Parpač Ridge (Fig. 1).

Useful information on the system of ancient land-plots has been yielded by reconnaissance expeditions and excavations including, in particular, Peters' works north of Michajlovka. These allowed the statement that the demarcation of the land-plots was carried out synchronously according to a single plan and was almost contemporary with the construction of the barrows dated to the end of the 4th to the 3rd century BC.29 A number of monographs<sup>30</sup> present us with information on the settlements discovered in the chora of Nymphaion and provide their exact positions. Those of the settlements which arose or continued to exist in the 4th-3rd century BC have been marked on the map of the reconstructed system of land-division (Fig. 6). The map shows clearly that many of the settlements (nos. 25-31, 34-36, 97-100; the numeration given after Zin'ko 2003, 160) adjoined the limits of the supposed land-plots and were probably farmhouses or "agglomerations" of houses built on the plots. Of special interest are the data published by Scholl and Zin'ko concerning the settlement of Ogon'ki-4 (no. 27 in Fig. 6) where the directions of the walls of the house and the fence around the plot coincide with the axes of the land-division system. The settlements of the 4th-3rd century BC also extended continuously to the north-west from Michajlovka (Fig. 6). We cannot rule out that their number is greater than that given by Kruglikova.<sup>31</sup> In our opinion, these territories certainly require further investigation.

If the spatial relation between the farmhouses and land-plots remains to be proved by future studies, the finds from the houses would be helpful in dating the given system of land-tenure. Already now we may suppose that it should be dated to the 4th century BC since a rapid increase in the number of settlements in the territory under consideration is characteristic of this same period, whereas in the 5th century BC the settlements of the Nymphaian *chora* were concentrated mainly along the seashores and lake banks (nos. 1-12 in Fig. 6), while in the 3rd-1st centuries BC only single sites (nos. 1, 6, 9, and 21) continued to exist.



Fig. 7. Aerial photograph of the territory north of v. Glazovka.

Further study of the land-division system of Nymphaion should aim at a more detailed identification of its plan, defining the boundaries of each plot as well as the existence of farmhouses, fences, ancient roads, etc., and, naturally, establishing the entire area of its distribution.

#### Distant chora of Pantikapaion

The third orthogonal system of land demarcation was revealed during the examination of aerial photographs from the region of Mt Temir-Gora (Fig. 1.III). Here, the demarcation occurs as a system of absolutely straight parallel and transverse lines as if soaring above the fairly uneven surface of the locality. These lines are best discernible on the shrub-overgrown northern slope of the famous mount of Temir-Gora (Fig. 7). That here distinct traces of both the outer boundaries and the internal demarcation of the plots are still preserved is owed to the fact that these lands have been excluded from present-day cultivation. Only recently, some garden-and-dacha cooperatives absent on the photos of 1972 have arisen in the western part of this *uročišče*.

The boundaries of the plots and the lines of their inner demarcation are distinctly visible on aerial photographs of the area from north-west of the



Fig. 8. North-eastern part of Kerch Peninsula. Reconstruction of the orthogonal system of land-division. The structures discernible on air photographs are drawn with solid lines, shown in the map at a scale of 1:25,000 - dotted lines, in the one-verst map – dashed lines. Settlements of the Hellenistic time are rendered by dots, those of the 1st-3rd cent. AD – by triangles. 1 - Pantikapaion, 2 - Myrmekion.

Temir-Gora as far towards the sea as Cape Tarchan in the north, and as far as the territories north-west of the village of Vojkovo in the west. The system of field demarcation thus ignores the Tyritake Rampart, and, accordingly, must be earlier than the rampart.

Air photography revealed indications of land-plots in this district: the direction of the axes was 14-15° west of the magnetic northern direction (see above on the peculiarities of this direction coinciding with that of the land-plots near Theodosia). The orientation of the land-division system was determined by the need for the easiest possible transportation of crops to Pantikapaion, i.e. mainly southwards.

The distance between the boundaries of the land-plots is 370 m in the meridian direction and 355 m in the latitudinal one. Thus the area of a land-plot equals c. 100 *plethra* as in the cases described above.

From large-scale maps and space photographs, all linear elements corresponding to the immediate indications of ancient land-plots were identified. These elements were registered on a composite computer map (Fig. 8). The mapping showed that the system of land demarcation stretches throughout almost the entire north-western tip of the Kerch Peninsula. Natural limits of the demarcated territory are in fact the coastline to the north and south, the line running northwards from the eastern edge of the village of Vojkovo in the west, and the slopes of the coast from Cape Fonar' as far as the village of Osoviny in the east. The total demarcated area thus amounts to at least 10,000 hectares while the number of land-plots is about 800. The top-soils here are fairly fertile černozem and dark chestnut-coloured soils.<sup>32</sup>

Surveys of Veselov and Kruglikova revealed numerous settlements here all dated to the 4th-3rd century BC. Their mapping gives grounds to suppose that the settlements may have been adjacent to the boundaries of the ancient land-plots (Fig. 8).<sup>33</sup> Some of them, however, might be farmhouses on the plots so that the land-division possibly also dates to the 4th century BC. A few of those settlements continued to exist in the early centuries AD. Here too, as in the chora of Nymphaion, changes in the scale of land-tenure and the character of agricultural production undoubtedly took place in the 3rd century BC: in particular the transition from marketable production to one oriented towards the demands of the local market. These abrupt changes can probably be explained by disturbances in the natural equilibrium of the region.<sup>34</sup> Indeed, in the 4th-3rd centuries BC, virgin lands were ploughed, and trees and bushes were cut down after the land-division was carried out. In addition, the fairly moist climate which had dominated here in the 6th-4th centuries BC was superseded by a dry and hot one in the 3rd century BC. Apparently, the combination of climatic changes and the removal of upper fertile topsoil throughout large areas resulted in ecological troubles or even a catastrophe with rising probability of drought, dust-storms and deterioration in the fertile top-soils on the arable fields.<sup>35</sup>

The central area of the last territory under consideration is mostly level plain. Nevertheless it is here that Mt Temir-Gora and Mt Chroni and, in addition, the deep and ramified Bulganakskaja Ravine are situated. Only the upper rocky mountain-ridges were exempt from cultivation. It is well known that hill-slopes are the best place for vineyards. Therefore these territories probably constituted the most valuable part of the available lands and, correspondingly, were subjected to a very careful land demarcation.<sup>36</sup>

It is noteworthy that many present-day roads and field-demarcations north of the village of Glazovka coincide in terms of their direction with the axes of ancient land-plots while the distances between the borders of some modern fields are divisible by the size of the *kleroi*. Both parameters correspond exactly to those surveyed on the northern slope of the Temir-Gora.

Taking into account the position of these plots we must ascribe them either to Pantikapaion itself or to Myrmekion. However, the fairly vast territory subjected to land-division as well as certain features which characterize this land division as an extremely important public measure suggest that the demarcated area belonged to Pantikapaion rather than to the smaller town of Myrmekion which itself was probably part of the Pantikapaian *polis*.

It is remarkable that the territory occupied by land-plots is contiguous

to the eastern limits of the so-called "royal chora". Last-mentioned probably occupied an extensive part of the littoral of the Azov Sea from a settlement in the area in the middle of the Bay of Reefs and the northern tip of the so-called "Third Tyritake Rampart"<sup>37</sup> to the east of the village of Zolotoe to the west. To the south, this territory is approximately bounded by the latter village. The problem of the "royal chora" we have discussed elsewhere;<sup>38</sup> here, one should only note the absence of any traces of orthogonal land-division which this particular territory features. Instead, the gentle, fertile slopes and dry even areas here are divided into bands of so-called "long fields". Geomorphologically, this region constitutes a closed area. It belongs to the anticline system of Čegene-Enikale. Its relief is composed of a system of sloping terraces formed by rocky ridges. Almost all of the ridges are steeper on one side, viz. that formed by a cut of the rocky bed, than on the other gently sloping one.<sup>39</sup> The ancient arable fields must have occupied these gentler slopes. As is typical, the long-term cultivation of the hill slopes resulted here in the formation of earthen banks. These are found not only in the Azov Sea region but also in every locality where agriculture developed in a hilly terrain.<sup>40</sup> Paradoxically enough, the earthen banks that undoubtedly resulted from cultivating the land on the hill slopes cannot be considered fruits of human labour. The immediate cause of their formation was the washing-out of the eroded topsoil which was gradually deposited on the boundaries of adjoining plots or between the fields and uncultivated areas. The banks bordered the long parallel bands which once were tilled with heavy bull-driven ploughs.<sup>41</sup> These banks provide information about the extent of the development of agriculture and even about the technique of tillage. The "long fields" extending in some cases over considerable distances probably reflect not landownership but rather the specifics of the agricultural use of the plots. We may suppose that these lands belonged to a single owner, probably the supreme ruler of the Bosporos, cultivation of the "long fields" being carried out by farmers from the local tribes. The settlements of the latter are found nearby and their inhabitants probably were united into communities. The cemeteries of the local population were also situated nearby. The tombs are of the stone-cist type sunk below the ancient topsoil surface and covered with low mounds.

#### Home chora of Pantikapaion

Finally, the fourth orthogonal system comprised, in our opinion, the lands immediately west of Pantikapaion (Fig. 1.IV). The entire valley between two hilly ranges, with Mt Mithridates on one side and the famous kurgan of Kara-Oba on the other, bears traces of land-division in the form of the boundaries of present-day fields. The boundaries deviate 5° to the east from the modern meridian here. The orientation of the plots seems to have been determined by the direction of the major road to Pantikapaion which is the continuation of the Parpač high-road. On the modern 1:25,000 map two parallel roads are still traceable running via neighbouring hill slopes as far as the latter extend. It is exactly this direction that seems to have been chosen as the basic one for the land-division.

This territory divided into plots is bounded on the south by a chain of kurgans marking the road which led to Nymphaion and which, as mentioned above, was the northern limit of the distant *chora* of Nymphaion. The frontier settlement here was that of Andreevka Južnaja where in the 4th century BC a monumental farmhouse with a stone wall around its land-plot was built in place of an earlier settlement.<sup>42</sup> The orientation of the walls of the house and of the wall itself conforms exactly to the directions of the hill slopes and of the supposed road to Pantikapaion and, correspondingly, to the orientation of the land-division axes. The immediate traces of the ancient field demarcations are preserved in the northern section of this area. Here, north of the Mt Turkmen, straight parallel lines are visible on air photographs running at the angle stated above and crossed by transverse streaks. To the north, the lands seem to have been demarcated as far as the Čokrak-Babčinskaja depression and the Karalar Anticline thus adjoining the territory of the hypothetical "royal chora". The borders of modern fields and the country roads traceable on the maps at scales of 1:25,000 (surveys of 1954) and 1:42,000 (late 19th century) still conform to the dominating direction determined by the ancient land-division. To the west, the limits of the territory under consideration have not as yet been established. They probably extended up to the Uzunlar Rampart; at least their traces have been found south of the village of Čistopol'e. If this supposition holds, the area occupied by ancient land-plots must have amounted to at least 20 × 8 km or 16,000 hectares, corresponding thus to c. 1,300 plots of 100 plethra each.

If all stated above is correct, then the grandiose works carried out by ancient surveyors were so careful and well adjusted, while the directions of the axes of the plots corresponded so exactly to the major communicational needs of the population and to the relief, that it has been impossible to surpass these works ever since. Nor, perhaps, was any re-demarcation necessary since nothing hindered the cultivation of the fields within their previous limits first by medieval farmers<sup>43</sup> (who were not numerous though, while the pastures of cattle-breeders did not disturb the borders of the fields) and then by more recent ones. New fields were here laid within the previous boundaries as dictated by the grid of old roads wherever the former and latter were preserved. Such long existence of ancient systems of land-division is not an extraordinary phenomenon but rather a normal one. Something similar is found both in Greece – not far from Athens in Attica – and in Etruria where changes in the landscape began only after the 1920s. Modern large-scale grain production began slightly later on the Kerch Peninsula.

The main ancient roads running along the borders of land-plots were so well thought-out that they still continue to be actively exploited.<sup>44</sup> As to





the technique of making the field boundaries that simultaneously served as a grid of roads, the remarkable preciseness and parallelism of the straight "latitudinal" lines is remarkable as is their strict orthogonality relative to the "meridian" borders of the plots. This fact suggests that the entire land-division campaign was a serious public endeavour and of a distinctly Greek character. Thought-out in details, it was conducted by experienced experts who possessed a highly developed surveying culture. These experts were helped by ploughmen with bulls for tilling-up the demarcation lines and many other assistants.<sup>45</sup> Without such a cardinal change in farming, it would have been impossible even to think of growing the immense quantities of grain exported by the Bosporan Kingdom in the 4th century BC.

# Mapping Greeks and barbarians

A major question is concerned with the character of ownership and the sources of labour. To solve these problems we must return to a more detailed study of the relation between the settlements (and their related cemeteries) and the land-tenure structures within the given territory. It is noteworthy that many barbarian villages with (their?) neighbouring kurgan burial grounds of the 4th-3rd century BC are concentrated *outside* the main regions of "demarcation" (see Fig. 1 and the map of the distribution of the best studied settlements of the 4th-3rd centuries BC in the Kerch Peninsula published by Maslennikov<sup>46</sup>).

The farmland needed reliable protection not only from military threats but



*Fig.* 10. Detail from Hablitz's "Map of the Tauric Peninsula and Nearby Places Composed on the Basis of the Evidence of Greek Writers of the Ancient and Middle Periods", 1803.

also from nomadic neighbours damaging the fields by pasturing, etc. Therefore the plots had to be defended by banks and ditches from the other territory of Taurica inhabited by local tribes. As mentioned above, the land-plots of Nymphaion and Pantikapaion were defended by the Uzunlar Rampart (Fig. 1). Are we not justified in supposing that those of Theodosia were shielded by the so-called Parpač Rampart? The distinct traces of the latter were still observed by Academician P.S. Pallas<sup>47</sup> and recorded by A.V. Gavrilov near the deserted settlement of Šiban and what is now the village of Jačmennoe.<sup>48</sup>

Essential new information on this problem has been obtained by examination of the *one-verst* map of the surveys of 1896 and the map at a scale of 1:25,000 of 1955-1965. Each kurgan marked on these maps has been registered on the composite computer map (Fig. 9).<sup>49</sup> It has been noted that the *one-verst* map contained considerably more kurgans because each, sometimes even fairly small, elevation was documented on it. But the height marks for these elevations are mostly absent. On the 1:25,000 map, only quite noticeable barrows with a height exceeding 1 m and only in rare cases no higher than 0.5 m are shown. But the heights of the mounds are marked on this map.

The number of kurgans thus revealed is over 3,000. They are distributed rather monotonously throughout the western steppe zone of the Crimea adjoining Sivaš Sound. However, the repetitiveness is completely changed as soon as we enter the limits of the Kerch Peninsula this difference being the first that catches our attention when we examine the composite map.

Remarkable on the latter is a lengthy chain of kurgans or some local elevations following each other closely. This chain extends from the north-eastern outskirts of the town of Staryj Krym along the Čuruk-Su River, then turns abruptly to the east near v. Novopokrovka and runs along the Parpač Ridge to the Uzunlar Rampart. Here the chain splits, one branch of it running to Nymphaion, the other to Cape Ak-Burun.

Now we will present a more detailed consideration of this line beginning with its western section. The kurgan chain runs here via the eastern bank of the Čuruk-Su River complying almost exactly in its southern half with the "bank made by Scythian slaves" marked on K. Hablitz's "Map of the Tauric Peninsula and Nearby Places Composed on the Basis of the Evidence of Greek Writers of the Ancient and Middle Periods", 1803 (Fig. 10).<sup>50</sup>

Then the line of the kurgans turns, as mentioned above, to the east near the village of Novopokrovka. Here a number of settlement-sites from the 5th-3rd centuries BC are found. Their situation at the intersection of the roads from Pantikapaion and Theodosia to the Perekop Isthmus must once have been very favourable.<sup>51</sup>

The chain of kurgans then continues via the summit of the Parpač Ridge which runs latitudinally through the middle of the peninsula dividing the latter into two almost equal parts. The Parpač Ridge begins near v. Vladislavovka. There is a small ledge on the surface here which becomes more and more distinct the further east it reaches transforming at last into a ridge. Its



*Fig.* 11. *Aerial photograph of the territory between the ruins of v. Šiban and Lake Ači. The arrows designate elevations on the rampart.* 



*Fig.* 12. Detail of the 1:25,000 map of the territory between the ruins of v. Šiban and Lake Ači. The kurgans and elevations marked on the map are seen distinctly.

formation was called forth by the presence of a bed of Čokrak limestone lying between some looser rocks.<sup>52</sup> From Mt Uglovaja, which is situated on the line of the Uzunlar Rampart, the Parpač Ridge turns first to the east-south-east,



Fig. 13. Detail of the "Map of the Northern Coast of the Black Sea from Cape Chersones up to the Taman' Peninsula" drawn by captain-lieutenant Manganari, 1836.

then to the south reaching Lake Uzunlar. The southern section of the Uzunlar Rampart, which is the best known Bosporan bank, runs via the summit of the ridge. The geological structure of this extensive feature (the output of the bed of Čokrak limestone) precludes the formation of any natural hill-like elevations that are so characteristic of bryozoa limestones and can be mistaken for kurgans. Hence all hill-like mounds marked on maps as chaining via the Parpač Ridge are probably artificial.

In 1793-1794 Pallas visited this locality and left a detailed and valuable description of "a line of ruins forming a number of low elevations". Near the village of Šiban (now Frontovoe), the heaps of stones seen by Pallas lay according to his evidence 180 steps from each other. On the aerial photos of 1972 and the map at a scale of 1:25,000, the crest of the Parpač Ridge is distinctly seen in the north-east. South-west from the ridge there is a narrow elevation – a bank straight as an arrow, on which a row of mounds is discernible. Their

number exceeds 11 over a section about 2-2.5 km long (Figs. 11-12). Possibly these are the remains of a wall and the ruins of towers observed by Pallas, at least the distance between the supposed "towers" is close to that stated by the traveller.

Beyond the village of Frontovoe the chain of kurgans continues further east. The elevations are spaced most densely throughout the area from what is now the village of Batal'noe to v. Kirovo (see Fig. 9). A few really grandiose kurgans are situated here. Nearer to the Uzunlar Rampart the chain of kurgans bifurcates, its northern branches leading to Nymphaion and Cape Ak-Burun. There are also large accumulations of kurgans north of Myrmekion and near Porthmion. All three groups possibly indicate routes to the Asiatic side of the strait. These crossings may have been used under various climatic conditions.

The most distinct is the kurgan chain extended towards Cape Ak-Burun. Probably it is here that the crossing of the strait was the most active. The range of kurgans continues also on the Asiatic coast opposite Ak-Burun. In the sailing directions composed by captain-lieutenant E. Manganari in 1836 it is seen very distinctly that the shortest way to cross the deeper parts of the strait between its shallower areas is that from Cape Ak-Burun to the Southern Spit (or what is now the Tuzla Spit) (Fig. 13). This section of the strait has continuously changed its outline, the spit now becoming an island, now joining the Asiatic coast again.<sup>53</sup> In any case, it is here that the deeper fairway is so narrow that it must have been fairly easy to cross during winter. Another narrow place is situated opposite Porthmion. As we may see on maps of depths, an underwater ledge sprouts here towards another shoal which surrounds the Northern Taman' Spit (now the Čuška Spit). Possibly, the low depth and weak salinity caused by the flowing of the Kuban' River into this area of the strait facilitated its freezing. This is why a second passage to the other coast was located here. And finally, there were passages in the vicinity of Nymphaion as indicated by the kurgan chain leading to it. Although the distance to the shallow water and land is greater here than in the two previous cases, the north-south current is weaker and may have favoured the formation of strong ice layers.

Now, what was the nature of the described linear range of kurgans extending from Staryj Krym as far as the Uzunlar Rampart to the Strait of Kerch and the Taman' Peninsula? Can it have marked an ancient defensive line with a road leading along it from the central Crimea to the passages across the strait? There undoubtedly was a road here, since it is an established fact that chains of kurgans were constructed along ancient roads. It is intriguing that the barrows on the Juz-Oba, as well as other kurgan groups not far from Pantikapaion, were erected in some cases in a chess-board pattern, each visible between the others.<sup>54</sup> The kurgans possibly served as a good guiding line for travellers. They also may have marked the frontiers. The line of kurgans revealed possibly corresponded to the limits of the migration routes of nomadic tribes from the central Crimea to passages across the Kimmerian Bosporos. Indeed, in the northern half of the Akmonaj Isthmus, the kurgans are much more numerous than in the southern and south-eastern parts of the peninsula. The northern section of the isthmus is a plain, convenient for the movement of great masses of people with their wagons and herds. It is possibly that the main ancient routes leading from the Strait of Kerch to the Perekop Isthmus were situated here. In different historic periods, the movements of nomadic peoples must have followed these routes and it was probably impossible to prevent them by simply barring the isthmus. At least, it is from this side that the attack of a supposed enemy was expected by the builders of the bank on the Parpač Ridge.<sup>55</sup>

The system of ramparts on the western frontiers of the Bosporos must have been meant to defend its possessions and also protect the *chora* of Theodosia from attacks.<sup>56</sup> As described above, the expansive agricultural territory of that city, including the area with traces of an orthogonal land-division, occupied the southern section of the Kerch Peninsula. It is thus quite probable that a "latitudinal" bank was necessary to protect this territory. Its length from the Uzunlar Rampart to the village of Novopokrovka is 68 km. The latter value is fairly close to the length of the Asander's rampart (360 stades or 64 km) specified by Strabon (7.4.6). That rampart was constructed "on the isthmus of Chersonesos near Maiotis". Indeed, the ancient geographer left no statement that the rampart barred the way *across* the isthmus. Future explorations, including those using remote and geophysical methods, along the preserved sections of this line, which is important for an understanding of Bosporan history, will possibly elucidate many of the problems raised.

Studies of the arrangement of kurgans on the Kerch Peninsula are a very promising subject and we will discuss them elsewhere. Here we will limit ourselves to a few slight notes concerning the arrangement of kurgans in other parts of the peninsula. Firstly, a chain of kurgans in the north-eastern area probably indicates the presence of a road leading from the northern coast of the Strait of Kerch near Myrmekion towards Cape Tarchan on the north. The direction of this line complies with that of the system of land-division within the territory under consideration (cf. Fig. 8).

Within the territory of the so-called "royal *chora*" extended throughout the littoral of the Azov Sea from what is now the village of Zolotoe to Cape Tarchan, only very small barrows have been revealed. These probably contain burials of the local population who inhabited and cultivated these lands. No larger nomadic kurgans are known here.

Possibly, there is a rectilinear chain of kurgans situated along the northern border of the distant *chora* of Nymphaion (see Figs. 6 and 9). A road leading to Cape Ak-Burun may have been located here.

Comparing all four orthogonal systems considered above, the absolute equality of the areas of the plots situated in different parts of the peninsula is striking. This suggests that a single system of measures and a single technique of measuring land-plots existed in the Bosporos. Moreover, it is to be noted that on the Asiatic coast of the Bosporos, near Patrasys, a vast "external" system of land demarcation has been revealed. The distance between the basic lines of this is also c. 340 m, which corresponds to 1,000 feet.<sup>57</sup> Such uniformity, however, is still demanding explanation. In the different *poleis* in the region investigated, the landownership rights of the citizens may have been equal by the time of the land-division.

We have as yet no solid grounds for an exact dating of the emergence of the orthogonal system of land-division. We may, however, propose very cautiously that the date was the 4th century BC as suggested by practically all archaeological evidence from supposed farmhouses on the plots as well as by results of excavations near v. Michajlovka. It is well known that during the reign of Leukon I, son of Satyros I, (389/8-349/8 BC), the Bosporos became a powerful state comprising different cities situated on both sides of the Kimmerian Bosporos.<sup>58</sup> The rulers of the Bosporos, the Spartokids, were considered possessors of the entire Bosporan land and were themselves the most prominent landowners. As attested by Demosthenes, all the grain exported to Attica from the Bosporos was provided in the name of its rulers. Under Leukon I the annual export amounted to 400,000 medimnoi or 16,800 tons of grain (Dem. 20.31-32). According to V.D. Blavatskij's calculations, production of such quantities of grain must have required an area of about 5,000 km<sup>2</sup>, equal to the territory of the Bosporan State after the land acquisitions under Leukon I.<sup>59</sup> Moreover, we have at our disposal an important statement of Strabon recording a single exportation of 2,100,000 medimnoi or 88,200 tons of grain from Theodosia by Leukon I (7.4.6). It is probable that part of this immense quantity of grain was purchased by the Bosporan king from the local agricultural tribes who inhabited the region north-west of Theodosia and did not belong to the Bosporan State. Sites of settled agriculturalists of the Hellenistic period have been revealed here by S.G. Koltuchov and A.V. Gavrilov.<sup>60</sup> Such purchases may have become possible for the Bosporos only after the annexation of Theodosia.

In his role as supreme owner, the ruler of the Bosporan State could dispose of the land at his will and the simultaneous large-scale demarcation of lands was thus an example of royal actions. If we really are dealing with the distant *chora* of Theodosia then we could assume that the land-division took place after this city was subdued by the Bosporan Kingdom, because the uniformity of the land-division suggests a single design, a single will and a unified state organization. This may have been undertaken already in the days of Leukon I (or his closest successors) known both for his territorial acquirements and his large-scale overseas grain trade. In such a case, the location of some fields far from the major urban centres, their general layout and area are at least partially explainable.

We therefore propose that the revealed land-plots of Pantikapaion, Nymphaion and Theodosia date to the 4th century BC – the period of the utmost prosperity of the Bosporan Kingdom. The land-division was probably carried out by Leukon I synchronously throughout all the four territories specified above, as well as in some other parts of Bosporos. Along with the lands which belonged to the cities, there was also a *chora*, the owners of which were the Bosporan kings. This "royal *chora*" probably included a considerable area adjoining the coasts of the Azov Sea from v. Zolotoe to Cape Tarchan. Here, no land-lots are found but there are traces of the so-called "long" fields instead.

The reconstruction of the cadastre of cities of Bosporos proposed cannot be considered completed. Future studies will deal with new data from space and aerial photographs in the archives of Russian and foreign research institutions. In addition, surface surveys will continue including the application of the geophysical method for identification of remains of land-plots and farmhouses pertaining to them. By means of the interdisciplinary method described above we hope to reveal and reconstruct the cadastres, as far as possible, throughout the entire Bosporan territory.

#### Chersonesean chora in the Tarchankut Peninsula

A better understanding of the orthogonal land-division system of the European Bosporos can be provided by comparing it with the land cadastre of Chersonesos. In fact, the Chersonesean system of land-lots was discovered earlier than that of any other Greek *polis*. As early as 1786, it was marked on the map of the Herakleian and Majačnyj Peninsulas by A. Strokov. In 1848, F. Dubois de Montpéreux published a plan of the Chersonesean cadastre. N.M. Pečenkin's 1910 reconnaissance surveys and excavations in the Majačnyj Peninsula resulted in a plan of several land-plots. In fact, he was the first who succeeded in distinguishing a standard Greek land-lot,<sup>61</sup> something that M.I. Rostovcev immediately declared an important scientific discovery.<sup>62</sup>

The land-division system in the Majačnyj and Herakleian Peninsulas is the best-studied one in the Black Sea region,<sup>63</sup> and is also renowned because of its unique state of preservation. The rocky terrain forced the ancient agriculturalists to pick stones out of the meagre soil and to employ them in constructing division walls, which are still discernable in the vicinity of Chersonesos. As noted by A.N. Ščeglov, the preservation of the land-division system owes much to the fact that it was "senseless to destroy the monumental walls between the plots since it was impossible to dispose of the stone liberated. In the course of redistribution of the land and restructuring of the plots it was easier to continue using the old and strongest walls strengthening them with the stone obtained from the soil or disused agricultural structures".<sup>64</sup>

The systems of land-division have also been revealed in other territories of the Chersonesean state.<sup>65</sup> Here we shall mainly focus on the cadastre remains within the Tarchankut Peninsula, which are datable to the period of the most intensive agricultural use of the land, *viz*. the 4th through the first half of the 3rd century BC.

In the western part of the Tarchankut Peninsula, the divided area, which



Fig. 14. The Tarchankut Peninsula. The map of 1899 at a scale of 1:42,000 ("one-verst" map) taken as a topographical basis shows land plots discerned on aerial photos by Ščeglov. The roads revealed by the "one-verst" map and related to the land-division are marked with solid lines; dashed lines show those discovered in the map of 1957 (1:25,000). The hypothetical ancient routs of nomadic migrations are rendered by hatched lines. Dots reflect the barrows found on the "one-verst" map.

Ščeglov revealed by means of aerial photographs in 1979,<sup>66</sup> is nearly equal to that in the vicinity of Chersonesos. The outlines of the plots are clearly discernible in the photos, which simplifies the evaluation of their size. They all measure 420 × 250-255 m. In Ščeglov's opinion, the area divided into lots on the western extremity of the peninsula measured 100 km<sup>2</sup>, which with a lot size of 10.5 hectares must have corresponded to c. 950 lots.

It should be noted that the examination of aerial photographs, which provides proof of the very existence of land-lots, is extremely important as an initial stage of our studies. Yet, in most cases the aerial photos yield a clear pattern of the plot boundaries only within limited areas where the latter are best preserved, while all the divided land might have occupied a much larger territory. The large-scale maps, both old and modern, provide a useful tool in estimating the total area subjected to land-division, as well as in determining its main axes, major roads and correspondence with terrain features. As far as the western Crimea is concerned, the maps of the late 19th century at a scale of 1:42,000 (the *one-verst* map) and those of the 1950s at a scale of 1:25,000 are the most informative.

While examining the *one-verst* map of 1899 one can hardly overlook a constellation of parallel roads in the western area of the Tarchankut Peninsula, which intersect at right angles with another group of mutually parallel roads.<sup>67</sup> The deviation of this grid of roads from true north (15° westwards) corresponds precisely to the axes of land-division revealed on aerial photos. The intervals between the "latitudinal" roads are about 750, 500, 2,500, 3,000, 1,750, 1,000, 500, 1,500 metres while those between the "meridianal" ones are 4,200, 2,520, 3,360, 1,270, 420, 1,260 metres (Fig. 14). Despite the fairly large inaccuracy in determining these intervals it is evident that they are correspondingly equal to or divisible by the sizes of the land plots in the "meridianal" and "latitudinal" directions. This implies that the aforementioned road-grid should be interpreted as a reflection of the major axes and transportation routes laid out on the basis of the system of land-division.

The main road and possibly the original axis of that system may have been the central "latitudinal" road leading from the village of Karadža (now Olenevka) to that of Kunan (modern Krasnosel'skoe) and slightly further east (Fig. 14). It runs through the flattest terrain on the watershed and was possibly the easiest land route for conveying the harvest from the entire flatland of the peninsula. The longest of all roads revealed on the maps, it divides the peninsula into two equal parts (the northern and southern) and can be likened to an "axis of symmetry" for the latter's western extremity. This road is also marked on the map of 1957 (scale 1:25,000), as well as on all other maps of the Crimea, for it connects two fairly important modern settlements.

In antiquity also, this road undoubtedly connected some important areas. Most likely these were the Greek settlement of Karadžinskoe<sup>68</sup> on the shore of a very convenient bay (now Lake Liman which in the Hellenistic period was part of the Karadžinskaja Bay) and some sites located at the upper reaches of the deep and long Kel'-Šejch Ravine, which runs through most of the Tarchan-kut Peninsula cutting it in an almost meridianal direction. Only to the south, does a small area of flat steppe remain, which was probably crossed by the migration routes of the ancient nomadic population. This is suggested by an almost uninterrupted chain of kurgans ranged along the entire peninsula on the edge of a raised plateau that further south descends down to the sea (Fig. 14).

The Kel'-Šejch Ravine formed a natural border for the divided land on the peninsula and separated the western part of the Tarchankut from the territory which led towards Kalos Limen. South of the "main" road mentioned above three other roads have their origins running parallel to it at a distance of 1,000, 1,500 and 3,000 metres. These roads are shown on maps of 1899 (1:42,000) and 1957 (1:25,000). Like the "main" road, they head towards the settlement of Karadžinskoe. Supposedly some settlements or sentry points were located at the eastern terminals of these roads. The "main" road and the one closest to it on the south ran alongside neighbouring watersheds – the banks of a long ravine which ends in Lake Liman.

Fairly long parallel paths are also discernable north of the "main" road. On the *one-verst* map of 1899, at least eight such paths may be seen. They all begin at the Kel'-Šejch Ravine and stretch westwards as far as the upper reaches of the ravines which end at the Kastel' Bay (Fig. 14). On the map of 1957, they are fewer in number amounting to only six or seven short sections found mostly in the west.

Now, let us consider the transverse roads. At least 10 of them are marked on the *one-verst* map but their lengths differ. Some of these roads cross almost the entire flatland of the peninsula north to south (Fig. 14). This aggregation of the "latitudinal" and "meridianal" roads constituted the "skeleton" of the land-division system. The extent of these routes may provide an idea about the area once divided into lots, which may actually have been much larger than the one discernable on the aerial photographs. In fact, it seems very likely that the entire western half of the Tarchankut Peninsula was covered by a grid of orthogonal plots (Fig. 14).

The fact that the main trunk lines were orientated towards the Karadžinskoe settlement suggests an important role of the latter in organizing production and shipment of grain collected from the entire western part of the Tarchankut Peninsula and exported via the harbour situated in what is now Lake Liman. The importance of that centre is emphasised by the closeness of a sanctuary, probably well-known in antiquity. The latter was situated in the *uročišče* of Džangul',<sup>69</sup> being linked to the settlement by one of the most noticeable meridianal roads. Moreover, this road, marked on the map of 1957 and many other present-day maps, is consistent with the land-division pattern of the entire peninsula.

As assumed by S. Saprykin, the Chersonesean state was divided into "administrative and economic districts each with a centre constituted by a large fort controlling a territory with smaller farms ... or settlements of dependent indigenous population".<sup>70</sup> The settlement of Karadžinskoe is likely to be one of such centres.<sup>71</sup> It possessed a convenient harbour, which by means of a network of good land routes was connected to the entire flatland of the peninsula.

A special note should also be made of the spatial interrelationships between the Greek cadastre and kurgans, which dot nearly the whole of the Tarchankut Peninsula. On the map at a scale of 1:25,000 only relatively high mounds are marked with their heights, mostly 1 or 2 m, being indicated. The largest number of barrows, both fairly large and smaller ones, is discernable, however, on the *one-verst* map where they are marked by special symbols with no information as to their height. Here, one can easily notice an almost uninterrupted chain of mounds, which range along the southern edge of the elevated part of the peninsula and appear to be markers of ancient roads and routes of nomad migrations.

Quite a number of groups of smaller barrows occupy the land divided into plots. Often they are ranged in lines which occasionally coincide precisely with the plot borders. It makes one think that these mounds might be the necropoleis of the rural population which inhabited the farmsteads. The traces of the latter also seem likely to be found along the roads revealed on the *one-verst* map.

The cadastre remnants are also discernable along the north-western shore of the peninsula. On the aerial photographs of 1977, traces of a large rectangular plot are distinctly visible near the site of Masliny. Part of the plot is destroyed by the erosion of the seashore. One of the sides now existing is approximately 350-380 metres long, thus coinciding almost exactly with the size of the preserved side (387 metres) of a land-lot at Cape Ojrat.<sup>72</sup> At some distance from the shore, the aerial shots reveal certain direct lines parallel to the long side of the above plot. On the *one-verst* map of the late 19th century a number of parallel roads, which parallel the seashore, correspond to the mentioned lines. This suggests that the area near Masliny was also divided into rectangular plots, although this supposition requires further proof.

In the coastal area north-east of Kalos Limen up to Jarylgač Bay, the *one-verst* map of 1899 shows an orthogonal grid of roads resembling the one we have distinguished in the western part of the Tarchankut Peninsula (see Fig. 14). Presumably, it also reflects the main axes of the cadastre which existed here in the 4th to 3rd centuries BC. It has to be noted, however, that their orientation slightly differs from that of the plots revealed by Ščeglov in the immediate surroundings of Kalos Limen.<sup>73</sup>

The aerial photographs also expose an orthogonal grid of dark lines east of the northernmost extremity of Lake Donuzlav. A number of these lines coincide with some roads marked on the *one-verst* map of 1899. Possibly, the coastal area of the south-western Crimea near the villages of Kača and Solnečnoe was also divided into plots, as suggested by the parallel roads shown on the *one-verst* map and some "bank-like bulges – land-lot boundaries" revealed by L.A. Moiseev's surveys.<sup>74</sup> Presumably, this area was also a part of the Chersonesean *chora*,<sup>75</sup> even though this assumption requires further checking based on aerial photographs, which will be accomplished as soon as possible.

The comparison of orthogonal systems of land-division both in the European part of the Bosporos and Chersonesos allows the disclosure of the following similar features. In both cases the land-division embraced considerable territory, being carried out according to a common plan.

The roads, of which many, both in the eastern and western Crimea, are reflected in the *one-verst* maps of the late 19th century, constituted main structural elements of the cadastre system. The territories were divided into absolutely equal rectangular plots independently of the relief or any other peculiarities of the terrain. The area of the plots corresponded to a common "module" throughout the entire state. Both in Chersonesos and Bosporos such a length module is likely to be the Egyptian foot equal to 0.35 m, the areas being measured in *plethra*.

There were also certain differences between the cadastre systems of Bosporos and Chersonesos. Throughout the entire European Bosporos we have found common dimensions (c. 350 × 350 m that equals 100 *plethra*) and an invariably square form to the plots. Even though the area of the Chersonesean plots is based on a common basic unit equal to 2.25 *plethra*,<sup>76</sup> it varies depending on the district. The areas subjected to continuous orthogonal land-division also differed: in the Bosporos they were much larger which resulted in a different grain potential for the two neighbouring states. While the Bosporos was able to provide considerable amounts of grain, the grain exports from Chersonesos, if there were any, must have been much more unassuming.<sup>77</sup>

Despite the slight metrological differences between land-lots in Bosporos and Chersonesos, we must state that in the 4th through the first half of the 3rd century BC there was a uniform plan of land plots throughout the entire territory of the state, a common system of measures, as well as expansive areas subjected to land-division, and an equality in plot sizes (although only within certain districts, as long as the Chersonesean state is concerned). All these facts point towards a state, and possibly synchronous, character of land-division. The supreme proprietors of the land both in Bosporos and Chersonesos were the civil communities of the *poleis*. In the European Bosporos such a *polis* was evidently Pantikapaion, which also controlled Nymphaion and Theodosia.<sup>78</sup> In the western Crimea it was Chersonesos.<sup>79</sup> In both cases we are dealing with expansive land possessions managed from a single centre.

#### List of referenced maps

- K. Hablitz's map "Karta poluostrova Tavričeskogo i okolo ležaščich mest, sočinennaja po izvestijam grečeskich pisatelej drevnich i srednich vremen" (Map of the Tauric Peninsula and Nearby Places Composed on the Basis of the Evidence of Greek Writers of the Ancient and Middle Periods), 1803.
- Karta Severnogo berega Černogo mor'ja ot mysa Chersonesa do Tamani, sostavlennaja kapitan-lejtenantom Manganari (Map of the Northern Coast of the Black Sea from Cape Chersonesos up to the Taman' Peninsula), 1836.
- 3) Military topographical map of 1865 at a scale of 3 *versts* in 1 inch (*three-verst* map).

- 4) Map at a scale of 1:42,000 (*one-verst* map) of the surveys of 1892, 1896 and 1899.
- 5) Map at a scale of 1:25,000 drawn after the reconnaissance of 1955; some sheets are corrected on the basis of aerial photographs and surface surveys of 1982.
- 6) Map at a scale of 1:100,000 of the surveys of 1955-65; corrected after a map of 1:50,000 renovated in 1988. The conditions of the locality presented in the year of 1986.

# Notes

- 1 The research presented here was carried out with the financial support of the Russian Research Foundation in Humanities, project no. 06-01-12120 and the Russian Basic Research Foundation, project no. 05-06-80009. We are sincerely grateful to I.I. Popov (IVI RAS) and L.L. Suchačeva (State Unitary Company "Scientific Research Institute of Space and Aerial Geological Methods") for their help in the studies of aerial photographs. *This paper was not presented at the conference, but we are grateful to be able to include it in the present volume. Eds.*
- 2 Košelenko & Kuznecov 1992, 24.
- 3 Vinogradov 1995, 68; Zin'ko 2004, 19.
- 4 Blavatskij 1953, 176, 178.
- 5 Except for Diodoros's well-known passage on King Eumelos (309-304 BC) having allotted land to one thousand Kallatians for which purpose the area of Psoa had been divided into land plots (Diod. 20.25).
- 6 Trousset 1977, 186-188.
- 7 Ščeglov 1978, 89; Nikolaenko 1985, 12-13. However, there is an opinion which holds that feet of the Doric standard equal to 0.3265 m were used in demarcation of the urban territory of Chersonesos (Bujskich & Zolotarev 2001, 115).
- 8 Dilke 1971, 82. *Cf., however, the Neue Pauly RE (H.-J. Schulzki, s.v. Masse, col. 989) where the* schoinos *is defined traditionally as the "Wegstunde' equal to c. 6,300 m – Eds.*
- 9 Dilke 1971, 84.
- 10 Blanc 1953, 39.
- 11 Vallat 1983; Clavel-Lévêque 1983; Chouquer 1983; Fisher & Soyer 1983; see also the *Barrington Atlas of the Greek and Roman World*, maps 15, 17-19, 32-34, 39-42, 44-45.
- 12 Dilke 1971, 84.
- 13 The natural mechanism of the rise of the intensity of magnetization of the upper soil layers is well known. See Frantov & Pinkevič 1966, 118-121.
- 14 Probably, the territories of land-plots in the European Bosporos were not limited by these four regions. Thus, a few similar areas have already been found near Kytaia (Smekalova, Maslennikov, Smekalov & Kulikov 2004), near the village of Čokrakskij Mys (Smekalova, Maslennikov & Smekalov 2006), but these are, in our opinion, of rather "local" character differing from fairly "extensive" divisions in the four regions enumerated. There are certain data on the possibility that similar division patterns existed directly in the vicinity of the city of Tyritake. However the studies in the region still are not completed and have additionally to be checked, therefore we will discuss them only tentatively in this paper.

- 15 Maslennikov 2001; Smekalova, Maslennikov, Smekalov & Kulikov 2004.
- 16 The territory under consideration is situated within the limits of an ordnance yard forbidden for reconnaissance on foot. Probably it is to the withdrawal of modern agriculture from this area that we owe the excellent preservation of the traces of land-plots here.
- 17 Zagnij & Rusakov 1982, 76.
- 18 It is noteworthy that within our grid, there is a curious formation here called a "pitted circle" on the 1:25,000 map but absent on the *one-verst* map.
- 19 Dragan 2004, 55, 165.
- 20 Kruglikova 1975, 273.
- 21 Veselov 2005.
- 22 See the contribution by A.V. Gavrilov in this volume. Eds.
- 23 Peters 1978, 122.
- 24 Peters 1978, 119. Stripes of cereals ripening faster in the present-day fields and darker vegetation are observable in the places where the boundaries of ancient land-plots once had been. We are grateful to B.G. Peters for his kind communication of May, 2004, about the details of such identification of boundaries.
- 25 Peters 1978, 122.
- 26 Moreover, it is possible that land-plots continue also to the south from this large square structure though these must have somewhat distorted outlines due to the peculiarities of the local relief.
- 27 Zin'ko 2003, 14. Cf. also his contribution to this volume.
- 28 Dragan 2004, 55, 165.
- 29 Peters 1978, 122.
- 30 Kruglikova 1975; Scholl & Zin'ko 1999; Zin'ko 2003.
- 31 Kruglikova 1975, 263.
- 32 Dragan 2004, 55, 165.
- 33 This hypothesis, however, has still to be proved by surveys and excavations.
- 34 Cf. Stolba 2003, 81; 2005a; 2005b.
- 35 Cf. Stolba 2005a; 2005b.
- 36 Vinokurov 1999, 85.
- 37 Maslennikov 2003, 172-173.
- 38 See Smekalova, Maslennikov & Smekalov 2006.
- 39 Andrusov 1893, 277.
- 40 Crew & Musson 1996, 23; Bradford 1956, pl. IX.
- 41 Deuel 1979, 33.
- 42 Kruglikova 1975, 48, 86-88.
- 43 Indeed, in the majority of the above mentioned farmhouses in the *chora* of Nymphaion, fragments of Saltovo-Majackaja pottery of the 8th-9th century AD have been found. In addition, some other medieval settlements are known in the immediate vicinity of the Greek period land-plots.
- 44 The beginning of one of these roads running via the northern bank of Lake Čurubaš and farther on along the borders of the land-plots, as reconstructed by us, are shown in Zin'ko 2003, 43, fig. 19.
- 45 We may not rule out that during demarcation of the land-plots the surveyors employed some appliance like the modern compass. This hypothesis is suggested by the coincidence of the land-division orientation in the southern part of the peninsula and near Mt Temir-Gora with the direction to the magnetic northern pole of the Hellenistic period (deviated c. 14-15° to the west from the present-day magnetic north [Zagnij & Rusakov 1982, 76]).

- 46 Maslennikov 1998, 77.
- 47 See, e.g., a detailed discussion of his evidence in Maslennikov 2003, 10-14.
- 48 Gavrilov 2004a, 42-43.
- 49 The term "kurgan" is used here for small elevations of round plan and supposedly of artificial origin. On maps these mounds are notated with special marks.
- 50 Hablitz 1803.
- 51 Gavrilov 2004a, 164.
- 52 Andrusov 1885, 70.
- 53 Fedoseev 1999, 77.
- 54 Cvetaeva 1957, 229.
- 55 Gavrilov 2004a, 44-45.
- 56 Gavrilov 2004a, 45.
- 57 Garbuzov, Liseckij & Galeusov 2004, 114.
- 58 We can supplement the information presented by Blavatskij on the budget of the very determined actions conducted by Leukon I (Blavatskij 1953, 201-204). The aggressive wars and the settling of new territories (including their demarcation) required huge expenses, which were paid for by the international grain trade. However, under the conditions of Bosporos where precious metals could be obtained only by import, other sources of money also had to be found. Thus it is the formation of a powerful territorial state that enabled the introduction of the first coins of conventional value into circulation: after a century and a half of minting exclusively silver, parallel issues of silver and copper, and later of gold, appeared. This character of minting continued in Bosporos until the end of the 2nd century BC. Remarkably, there is literary evidence on the issue of the earliest coins of conventional value. Thus, according to Polyainos (Strat. 6.9.1), the Bosporan King Leukon was compelled to withdraw the old coin declaring it invalid and to overstrike it with new dies doubling the nominal value of the new coins. Half of the currency was restored to its owners, while the other half was kept by the enterprising king. Scholars are of the opinion that coins of Leukon I which appear in this tale were the last series of Bosporan silver preceding the issues of gold (Boldyrev & Zavojkin 2000, 7-9), i.e. the coins with the types of the satyr head / lion and satyr's head / forepart of a lion (Zograf 1951, pl. 40.1-2). It was possible for King Leukon to conduct this operation only with the coins which circulated within the state's limits. In the external market only full-valued electrum coins of Kyzikos could be used as currency or, later, gold staters had to be minted.
- 59 Blavatskij 1953, 179-180.
- 60 Koltuchov 2004; Gavrilov 2004b.
- 61 Pečenkin 1911.
- 62 Ščeglov 1993, 12.
- 63 See, e.g., Pečenkin 1911; Strželeckij 1961; Kruglikova 1981; Žerebcov 1985; Nikolaenko 1985; Ščeglov 1993, and many others.
- 64 Ščeglov 1993, 25.
- 65 Ščeglov 1978, 86-101; Ščeglov 1980, fig. 14; Chtcheglov 1992; Kolesnikov & Jacenko 1999, 291.
- 66 Ščeglov 1980.
- 67 It is curious that in the first detailed *one-verst* map drawn in 1855-1857 no vestiges of the Tarchankut orthogonal system of land-division are indicated. In our opinion, this was caused by the economic structure and the character of land-use which existed during that period. Namely, distant-pasture animal husbandry was

then prevailing. Therefore no boundaries were needed for the lands intended only for pasturing and moving cattle and these remained forgotten and neglected. The roads between different points followed the shortest routes. Only after the arrival of agriculturalists in the western Crimea and the tilling of these vast lands was the commodity production of grain renewed in the last quarter of the 19th century, for the first time after the Hellenistic epoch. Boundaries again became necessary for fields as well as roads for the transportation of harvests. For that reason, the ancient conduits lying between land plots were restored and this fact has been reflected in the large-scale topographic map of the late 19th century.

- 68 Ščeglov 1984, 122.
- 69 Ščeglov 1988.
- 70 Saprykin 1986, 153. This proposition is shared by many researchers. See, e.g., Vinogradov & Ščeglov 1990, 338-339; Zubar' 1993, 24-25; 2004, 44.
- 71 In that case, the "Schematic Plan of Mastering the North-Western Crimea by Chersonesos" composed by V.M. Zubar' (1993, 25, fig. 10) must be supplemented by an additional seaborne transportation route between Karadžinskoe and Chersonesos.
- 72 Ščeglov 1977, 211.
- 73 Cf. Ščeglov 1978, 89.
- 74 Koltuchov, Zubar & Myc 1992, 86, 92; Moiseev 1926, 116.
- 75 Lancov 2004, 133.
- 76 Nikolaenko 1985, 14.
- 77 Kryžyc'kyj & Ščeglov 1991; Ščeglov 1989, 129-131; Stolba 2005b, 300-303.
- 78 Saprykin 2004, 203.
- 79 Zubar' 2004, 45.

## Bibliography

- Andrusov, N. 1885. Geologičeskie issledovanija v zapadnoj polovine Kerčenskogo poluostrova, proizvedennye letom 1884 g., *Zapiski Novorossijskogo Obščestva Estestvoispytatelej* 11.2, 69-116.
- Andrusov, N. 1893. Geotektonika Kerčenskogo poluostrova, Materialy po geografii Rossii 16, 63-335.
- Blanc, S. 1953. Les traces de centuriation romaine et les origines de la cité de Valence, *RStLig* 19, 35-42.
- Blavatskij, V.D. 1953. Zemledelie v antičnych gosudarstvach Severnogo Pričernomor'ja. Moskva.
- Boldyrev, S.I. & A.A. Zavojkin 2000. Reforma Levkona I, in: *Vos'maja Vseros*sijskaja numizmatičeskaja konferencija, aprel' 2000 g. Tezisy dokladov. Moskva, 7-9.
- Bradford, J. 1956. Fieldwork on aerial discoveries in Attica and Rhodes. Part II. Ancient field systems on Mt. Hymettos, near Athens, *AntJ* 36.3-4, 172-180.
- Bujskich, A.V. & M.I. Zolotarev 2001. Gradostroitel'nyj plan Chersonesa Tavričeskogo, VDI 1, 111-132.

- Chouquer, G. 1983. Localisation et extension géographique des cadastres affichés à Orange, in: Clavel-Lévêque (ed.) 1983, 275-295.
- Chtcheglov, A.N. 1992. *Polis et chora: Cité et territoire dans le Pont-Euxin* (Annales littéraires de l'Université de Besançon, 476). Paris.
- Clavel-Lévêque, M. 1983. Cadastres, centuriations et problèmes d'occupation du sol dans le bitterrois, in: Clavel-Lévêque (ed.) 1983, 207-258.
- Clavel-Lévêque, M. (ed.) 1983. *Cadastres et espace rural: approches et réalités antiques*. Paris.
- Crew, P. & Ch. Musson 1996. *Snowdonia from the air. Patterns in the landscape*. Snowdonia National Park Authority.
- Cvetaeva, G.A. 1957. Kurgannyj nekropol' Pantikapeja, *MatIsslA* 56, 225-250.
- Deuel, L. 1979. Polet v prošloe. Moskva.
- Dilke, O.A.W. 1971. *The Roman land surveyors. An introduction to the Agrimensores*. Newton Abbot.
- Dragan, N.A. 2004. Počvennye resursy Kryma. Simferopol'.
- Fedoseev, N.F. 1999. Ešče raz o pereprave čerez Bospor Kimmerijskij, in: N.F. Fedoseev (ed.), *Archeologija i istorija Bospora, 3.* Kerč', 61-102.
- Fisher, J.-P. & J. Soyer 1983. Recherches sur le centuriations de la région de Nimes, in: Clavel-Lévêque (ed.) 1983, 324-325.
- Frantov, G.S. & A.A. Pinkevič 1966. Geofizika v archeologii. Leningrad 1966.
- Garbuzov, G.P., F.N. Liseckij & P.V. Galeusov 2004. Drevnjaja sistema zemleustrojstva u pos. Garkuša (Tamanskij poluostrov), *Drevnosti Bospora* 7, Moskva, 100-116.
- Gavrilov, A.V. 2004a. Okruga antičnoj Feodosii. Simferopol'.
- Gavrilov, A.V. 2004b. Antičnoe selišče Uzun-Syrt (Podnož'e) v jugo-vostočnom Krymu, in: S.G. Koltuchov, S.B. Lancov & A.E. Puzdrovskij (eds.), *U Ponta Evksinskogo (pamjati P.N. Šul'ca)*, Simferopol', 199-211.
- Kolesnikov A.B. & I.V. Jacenko 1999. Le territoire agricole de Chersonèsos Taurique dans la région de Kerkinitis, in: M. Brunet (ed.), *Territoires des cités greques. Actes de la Table Ronde Internationale, organisée par l'École Française d'Athènes 31 octobre-3 novembre 1991* (BCH Suppl., 34). Athènes, 289-321.
- Koltuchov, S.G. 2004. Varvarskie poselenija klassičeskogo i ranneellinističeskogo vremeni v Vostočnom i Jugo-Vostočnom Krymu, *Drevnosti Bospora* 7, Moskva, 217-237.
- Koltuchov S.G., V.M. Zubar & V.L. Myc 1992. Novij rajon chori Chersonesa ellinističnogo periodu, *ArcheologijaKiiv* 2, 85-95.
- Košelenko, G.A. & V.D. Kuznecov 1992. Grečeskaja kolonizacija Bospora, in: V.D. Kuznecov, A.A. Maslennikov & G.A. Košelenko (eds.), *Očerki* archeologii i istorii Bospora, Moskva, 6-28.
- Kruglikova, I.T. 1975. Sel'skoe chozjajstvo Bospora. Moskva.
- Kruglikova, I.T. 1981. Zemel'nye nadely chersonesitov na Geraklejskom poluostrove, *KSIA* 168, 9-16.

- Kryžyc'kyj S.D. & O.N. Ščeglov 1991. Pro zernovyj potencial antičnych deržav Pivničnogo Pryčornomor'ja, *ArcheologijaKiiv* 1, 46-36.
- Lancov S.B. 2004. O granicach territorii Chersonesskogo gosudarstva na rubeže IV-III vv. do n.e., *ChSbor* 13, 121-153.
- Maslennikov, A.A. 1998. Ellinskaja chora na kraju ojkumeny. Sel'skaja territorija Evropejskogo Bospora v antičnuju epochu. Moskva.
- Maslennikov, A.A. 2001. Sel'skie poselenija evropejskogo Bospora (Nekotorye problemy i itogi issledovanij), *Bosporskie issledovanija* 1, Simferopol'-Kerč', 75-100.
- Maslennikov, A.A 2003. Drevnie pogranično-oboronitel'nye sooruženija Vostočnogo Kryma. Moskva.
- Moiseev L.A. 1926. Sledy irrigacii, melioracii i vodosnabženija drevnego Chersonesa na Geraklejskom poluostrove, *Zapiski Krymskogo Obščestva Estestvoispytatelej i Ljubitelej Prirody* 9, 116-117.
- Nikolaenko, G.M. 1985. Razmeževanie polej Chersonesskoj chory, *KSIA* 182, 11-15.
- Pečenkin N.M. 1911. Archeologičeskie razvedki v mestnosti Strabonovskogo starogo Chersonesa, *IAK* 42, 108-126.
- Peters, B.G. 1978. Michajlovskoe gorodišče antičnogo vremeni, in: V.V. Kropotkin, G.N. Matjušin & B.G. Peters (eds.), *Problemy sovetskoj archeologii*. Moskva, 117-127.
- Saprykin S.Ju. 1986. Gerakleja Pontijskaja i Chersones Tavričeskij. Vzaimootnošenija metropolii i kolonii v VI-I vv. do n.e. Moskva.
- Saprykin S.Ju. 2004. Chora and Polis in the Kingdom of Bosporus in the Classical and Hellenistic Periods, in: F. Kolb (ed.), *Chora und Polis* (Schriften des Historischen Kollegs, 54). München, 185-210.
- Scholl, T. & V. Zin'ko 1999. Archaeological map of Nymphaion (Crimea). Warsaw.
- Smekalova, T.N., A.A. Maslennikov, S.L. Smekalov & A.V. Kulikov 2004. Predvaritel'nye nabljudenija o sistemach zemlevladenija i zemlepol' zovanija antičnogo Bospora, in: V.N. Zin'ko (ed.), Bospor Kimmerijskij i varvarskij mir v period antičnosti i srednevekov'ja. Etničeskie processy (Bosporskie čtenija, 5), Kerč', 321-328.
- Smekalova, T.N., A.A. Maslennikov & S.L. Smekalov 2006. Primenenie GIS-technologij dlja izučenija "bližnej" zemel'noj okrugi antičnych poselenij na južnom beregu Čokrakskogo ozera, in: N.M. Kukoval'skaja (ed.), Sugdejskij sbornik. Kiev-Sudak.
- Stolba, V.F. 2003. Monetary Crises in the Early Hellenistic Poleis of Olbia, Chersonesos and Pantikapaion. A Re-assessment, in: XIII Congreso Internacional de Numismática. Resúmenes de las Comunicaciones. Madrid, 81.
- Stolba, V.F. 2005a. Monetary Crises in the Early Hellenistic Poleis of Olbia, Chersonesos and Pantikapaion. A Re-assessment, in: C. Alfaro, C. Marcos & P. Otero (eds.), XIII Congreso Internacional de Numismática (Madrid, 2003). Actas – Proceedings – Actes. Madrid, 395-403.

- Stolba, V.F. 2005b. The Oath of Chersonesos and the Chersonesean Economy in the Early Hellenistic Period, in: Z.H. Archibald, J.K. Davies & V. Gabrielsen (eds.), *Making, Moving and Managing: The New World of Ancient Economies*, 323-31 BC. Oxford, 298-321.
- Strželeckij, S.F. 1961. Klery Chersonesa Tavričeskogo. K istorii drevnego zemledelija v Krymu (ChSbor, 6). Simferopol'.
- Ščeglov A.N. 1977. Zemel'nyj nadel u mysa Ojrat, in: M.M. Kobylina (ed.), Istorija i kul'tura antičnogo mira. Moskva, 210-215.
- Ščeglov, A.N. 1978. Severo-Zapadnyj Krym v antičnuju epochu. Leningrad.
- Ščeglov, A.N. 1980. Utilisation de la photographie aérienne dans l'étude du cadastre de Chersonésos Taurique (IV<sup>e</sup>-II<sup>e</sup> av. n.è.), *DialHistAnc* 6, 59-72.
- Ščeglov, A.N. 1984. Chora Chersonesa, in: G.A. Košelenko, I.T. Kruglikova & V.S. Dolgorukov. (eds.), Antičnye gosudarstva Severnogo Pričernomor'ja. Moskva, 53-56, 122-123.
- Ščeglov, A.N. 1988. Bol'šoj Kastel' i svjatilišče II v. do n.e. v uročišče Džangul', Tezisy dokladov Krymskoj naučnoj konferencii "Problemy antičnoj kul'tury", 19-24 sentjabrja 1988 g. Part 3. Simferopol', 273-275.
- Ščeglov A.N. 1993. Osnovnye strukturnye elementy antičnoj meževoj sistemy na Majačnom poluostrove (Jugo-Zapadnyj Krym), in: Ju.M. Mogaričev (ed.), Istorija i archeologija Jugo-Zapadnogo Kryma. Simferopol', 10-38.
- Talbert, R.J.A. (ed.) 2004. Barrington Atlas of the Greek and Roman World. Princeton.
- Trousset, P. 1977. Nouvelles observations sur la centuriation romaine a l'est d'el Jem, *AntAfr* 11, 175-207.
- Vallat, J.-P. 1983. *AGER PUBLICUS*, Colonies et territoire agraire en campanie du nord à l'èpoque républicaine, in: Clavel-Lévêque (ed.) 1983, 187-198.
- Veselov, V.V. 2005. Svodnaja vedomosť rezul'tatov archeologičeskich razvedok na Kerčenskom i Tamanskom poluostrovach v 1949-1964 gg. (Drevnosti Bospora. Suppl., 2), Moskva.
- Vinogradov, Ju.A. 1995. Nekotorye diskussionnye problemy grečeskoj kolonizacii Bospora Kimmerijskogo, *RosA* 3, 152-160.
- Vinogradov, Ju.G. & A.N. Ščeglov 1990. Obrazovanie territorial'nogo Chersonesskogo gosudarstva, in: E.S. Golubcova (ed.), *Ellinizm: ekonomika*, *politika*, kul'tura. Moskva, 310-371.
- Vinokurov, N.I. 1999. Vinodelie antičnogo Bospora. Moskva.
- Zagnij, G.F. & O.M. Rusakov 1982. Archeovekovye variacii geomagnitnogo polja v jugo-zapadnoj časti SSSR. Kiev.
- Zin'ko, V.N. 2003. *Chora bosporskogo goroda Nimfeja* (Bosporskie issledovanija, 4). Simferopol'-Kerč'.
- Zin'ko, V.N. 2004. Poselenija VI v. do n.e. evropejskogo poberež'ja Bospora Kimmerijskogo, *Bosporskie issledovanija* 5, Simferopol'-Kerč', 19-26.
- Zograf, A.N. 1951. Antičnye monety (MatIsslA, 16). Moskva-Leningrad.
- Zubar', V.M. 1993. Chersones Tavričeskij v antičnuju epochu. Kiev.

- Zubar', V.M. 2004. Chersones Tavričeskij i naselenie Tavriki v antičnuju epochu. Kiev.
- Žerebcov, E.N. 1985. Materialy k periodizacii pamjatnikov Majačnogo poluostrova, *KSIA* 182, 38-45.

# Abbreviations

ChSborChersonesskij sbornik. Sevastopol'.IAKIzvestija imperatorskoj Archeologičeskoj komissii. St Peterburg.