Early Medieval Settlements and Land Use in the Kislovodsk Basin (North Caucasus)

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Abstract

In the context of searching for agricultural landscapes which have escaped recent anthropogenic disturbance, the evidence of the Kislovodsk basin (North Caucasus) has special importance. Its sheltered location and the fact that it is relatively well-studied, enable us to create, for the first time in Russia, an archaeological Geographic Information System (GIS) for the microregion, which currently includes data on over 920 archaeological sites, from the Aeneolithic to modern times. Preliminary analysis of the archaeological record of the Kislovodsk basin has revealed that the Early Medieval period dating to the fifth - eighth centuries AD was characterised by the highest population density. The Site Catchment Analysis used in the framework of GIS revealed over 120 fortified and unfortified settlements of the early medieval Alanic tribes. The investigation consisted of several stages in the course of which potential ploughing areas were modelled for each settlement. It was based on the combined archaeological and soil field survey around fortified settlements in the different parts of the area. It appears that from the fifth to the eighth centuries AD relatively flat territories of 1 km round the site were the most valuable for agriculture. The rest of the economic area, simulated using Thiessen tessellation, could have been used for pasture and hay-making. Computer simulation of the potential economic territories gives the possibility to determine the area of proposed ploughing and pasture holdings and to estimate the quantity of settled population along with their cattle. As a result, a modelling thesis of a small dimension of the patronymic society of the Alans who occupied these early medieval settlements and the affirmation of self-sufficiency of their economy were confirmed.

Keywords: Early Middle Ages, North Caucasus, GIS, Spatial Analysis, Agriculture

Introduction

The present study uses spatial GIS analysis and landscape archaeology (a multidisciplinary approach to interaction between people and the environment) (Aston, 1985; Darvill & Gojda, 2001; Steuer, 2001; David & Thomas, 2008) and gives, for the first time, a comprehensive analysis of how the Alanic population settled the Kislovodsk basin during the first millennium AD.

Medieval settlements and their economy have been the topic of many recent studies in Russia (Makarov, Zakharov & Buzhilova, 2001; Krenke, 2011; Afanasyev, Dobrovolskaya & Borisov, 2012) and the Ukraine (Koloda & Gorbanenko, 2010). However, the adaptation and usage of GIS technologies in landscape archaeology are scarce both in Russia and other Post-Soviet states (Garbuzov, 2007; 2008; Manigda, 2012; Tomaszewsky & Vovkodav, 2007). At the same time, GIS, remote sensing data and methods of spatial GIS analysis (Tomaszewsky & Vovkodav, 2007; Manigda, 2012) are instrumental in enlarging the scope of such studies. G.E. Afanasyev was the first to use those methods for the study of Alanic settlements in the Kislovodsk basin (Afanasyev, Kislov & Chernyshev, 2002; 2004: 50-88). The present study is an outgrowth of the already existing works on the
settlement system in the microregion in the first millennium AD. These works were based on the methods developed in the 1980s - 1990s and used the materials from forest-steppe Saltovo-Mayatsk settlements (Korobov, 2012a; 2012b).

Kislovodsk Basin - the Region of Investigation

It is not by chance that the Kislovodsk basin has become the testing ground for this research. As far as archaeology is concerned, the basin, which is a unique natural site, is rightfully considered to be the best-studied microregion in the North Caucasus. The over one hundred and fifty years of fieldwork by archaeologists and local amateurs (Afanasyev et al, 2004: 9-49) helped accumulate a large amount of information about sites there. The information was actually doubled with the elaboration of the Kislovodsk AGIS (archaeological geoinformation system), the first Russian system of its kind, which the present author created in the Institute of Archaeology of the Russian Academy of Sciences under the supervision of G.E. Afanasyev in 1996-2000 (Afanasyev et al, 2004: 60-62). As of the present millennium, we know over 900 archaeological sites from different periods and cultures covering about 1150 km² in the Kislovodsk basin. Primary analysis of their spatial distribution gives a general picture of how people from the Aeneolithic to the present day have settled in the basin (Afanasyev, Savenko & Korobov, 2004; Reinhold & Korobov, 2007; Korobov, 2013).

A significant part (over one-third) of the located archaeological sites in the basin belongs to the first millennium AD and may be connected with the Alanic population of the North Caucasus. Even though some scholars defy their ethnic interpretations (Abramova, 1997: 137-54), this connection is implied by the abundance of burials in T-shaped catacombs generally believed to have been a kind of “visiting card” of the Alanic culture for a thousand years, from the first century AD to the time of the Mongol invasions (Kouznetsov, 1962: 13-14; 1992; 37-42; Afanasyev, 1992; Kouznetsov & Lebedinsky, 1997; 22; Kovalevskaya, 2005: 151-52; Gabuev & Malashev, 2009: 146-49). Recent studies in anthropology, including those of ancient DNA (Afanasyev et al, 2014; Berezina, Frizen & Korobov, 2014), seem to confirm the above assumption. Thus, the Kislovodsk basin provides great possibilities for further studies of Alanic settlement in Central Ciscaucasia in the first millennium AD.

Results of Paleoenvironmental Studies in the Kislovodsk Basin

Throughout the basin, settlements are found at altitudes up to 1500-1800 m above sea level, which implies that they were all located in an environment suitable for mixed farming: cattle-breeding and crop-growing. The conclusion is supported by the results of the paleoclimate GIS-modelling carried out with the help of a special computer module created by a team of geographers, climatologists and archaeologists headed by G.E. Afanasyev (Afanasyev, Kislov & Chernyshev, 2002: 74-75; Afanasyev, Savenko & Korobov, 2004: 78-80; Korobov, 2008; Borisov & Korobov, 2013: 25-60). However, the means of treating the soil changed with time and seriously influenced the settlement system. The pedological and archaeological investigations that we have been jointly conducting with A.V. Borisov since 2005, the results of which have recently been published (Borisov & Korobov, 2013; Korobov & Borisov, 2013), provide the key to understanding some of the consistent patterns in the settlement system of the Kislovodsk basin in different time periods. Below we list some of the main conclusions that we have arrived at in our work.

The large isolated terraces on steep slopes (Type 1 terraces) are clear evidence of agriculture back to the Koban culture population in the first millennium BC. Agriculture was intense and covered almost all the territories in the microregion, thus inevitably contributing to erosion processes. The unprecedented cultural expansion of the Koban culture population, which had reached its peak by the mid-first millennium BC (a period of drastic climatic change in the Kislovodsk basin),
was fraught with truly catastrophic consequences for the soils of the microregion. The landscapes had radically changed; the watershed plateaus had practically lost their surface soil covering; the slopes which housed Type 1 terraces were covered over with a thick layer of infertile loamy colluvial sediments. Traces of erosion processes have also been found on promontories near the slopes, where it was possible for eroded materials to accumulate. Most of the areas near the slopes, however, had no soil covering.

For about 500 to 700 years the Kislovodsk basin remained practically uninhabited. We can assume that during that period soil formation was at the initial stage, plant life was represented by pioneer species, and the productiveness of plant formation was not sufficient for even minimal amounts of grazing.

However, by the beginning of the present era the consequences of the above-described palaeoecological catastrophe became to a certain extent less evident. Soil formation gradually processed the thick colluvial layer that covered the entire territory of the basin, a natural plant cover developed on the yet thin soils, and in some areas the thickness of the soil layer was already sufficient for agriculture. Yet on the whole the vast territories of the basin were still unsuitable for agriculture in the fifth - eighth centuries when the Alanic population were settling there: the soil had recovered its fertility only on the small flat promontories at the bottom of mountain slopes. It is possible that the early medieval population chose the locations for their settlements depending on whether there were fertile areas suitable for agriculture. It was in these areas that pottery from the first millennium AD was found, proving that organic fertiliser was used for the fields around the settlements (Williamson, 1984; Wilkinson, 1989; Bintliff, 2000; O’Connor & Evans, 2005: 245).

Celtic Fields and Strip Lynchets in the Kislovodsk Basin

Since fertile land was so scarce, tillable areas were of special value and were treated with special care. This gave rise to a new form of agricultural plot: rectangular-shaped and bordered by the stones collected during tillage. Hardly visible on aerial photographs, these land plots can be identified in the course of field work if the lighting is favourable. The area of the plots varies from 0.1 to 0.3 ha (Korobov & Borisov, 2013: 1097-99).

First recorded by Dutch cartographers in the late seventeenth century, such plots of land were popular in Europe and have been called Celtic fields. The fields appeared after cross-ploughing with a symmetrical ard. This type of instruments had existed in Northern Europe throughout the Early Iron Age and had been encountered in some areas until the Early Middle Age (Muller-Wille, 1965: 108-14; Bradley, 1978: 267, 275; Fries, 1995: 122, 133). In the Early Middle Age Alans used agricultural tools similar to the simple symmetrical ard, as indicated by the iron share dating from the eighth - ninth centuries, found at Kozyi Skaly settlement near Pyatigorsk (Kouznetsov & Rudnitsky, 1998: 297-98: 300, fig. 12, 5).

The choice of areas suitable for tillage was very limited. At watersheds the soil layer was preserved only partially, at the bottom of dense rock formations; the steep slopes with Type 1 terraces were only suitable for cattle-grazing; the soil layer on the promontories in the lower part of the slopes was either eroded or covered over with a thick layer of colluvial sediments. Tillage was only possible in the areas with a slope inclination of 5° to 10° where the perforce thin colluvial layer had been altered due to soil-formation by the first century AD.

These smooth slopes housed another type of agricultural plot: cascades of narrow terraces up to 400 m in length, sometimes ending in an S-shaped curve (Korobov & Borisov, 2013: 1096-97). These agricultural plots have striking analogies in Western Europe known as strip lynchets. Such plots appear on slopes ploughed with a heavy plough or mouldboard ard that turned the soil in the downslope direction only. There are different opinions about the age of these tilled terraces. The basic viewpoint is that mouldboard ploughing tools appeared in Europe at a rather late stage, and,
consequently, that ploughed terraces emerged only at the turn of the second millennium AD. The researchers stress that ploughed terraces are typologically close to a similar type of land plots, that is, to open ridge and furrow fields traditionally dated to the High and Late Middle Ages. Actually, lynchets are also terraces, located on smooth slopes (Crawford, 1923: 356; Curwen, 1946: 49, 63, 70; Bowen, 1961: 42; Evans, 1967: 295; Fowler & Taylor, 1975: 88-90; Fowler, 2002: 196-97).

However, there are arguments in favour of more ancient dates for some of the ploughed terraces in Great Britain and southern Germany. Besides the numerous finds of Roman pottery in the ploughed layers of the investigated terraces, the very fact that mouldboard ploughing tools could have existed throughout the territory of Europe in the Late Roman times speaks in favour of that assumption (Taylor, 1975: 91; Bradley, 1978: 267; Taylor & Fowler, 1978; Fowler, 1983: 177; Fries, 1995: 134, 152).

Alanic Settlements in the Kislovodsk Basin

The specific features of settlement and land-use in the Kislovodsk basin in the first millennium AD are studied here mainly on the basis of data from fortified and unfortified settlements, the monuments that have to do with the day-to-day activities of the Alans. Since little is known about them at the present stage, we suggest creating a starting-point for analysis through dividing the entire mass of available data into several classes in accordance with topographic features. We divided the 153 fortified sites into four classes depending on their location: on residual mountains (butes), on rocky promontories, on promontories with escarped slopes and on high hills (Korobov, 2012a: 48-54). The 131 settlements have also been divided into four classes: settlements on promontories, plateaus, slopes and river terraces. However, only the 29 open settlements which have architectural ruins, cultural layer and abundant surface finds can be reliably considered places of habitation outside the fortified sites. The other sites which have been identified as settlements on the basis of pottery found on the surface are more likely to have been resource ploughed area around the fortifications or places where waste was dumped. Thus, the study uses data from 182 fortified and unfortified settlements in the Kislovodsk basin of the first millennium AD.

Now that we have created a classification of the fortified and unfortified settlements in the Kislovodsk basin and analysed the specifics of their spatial distribution, access to water supplies, visibility of the terrain from the fortified sites and settlements of different classes, spatial correlation with the already known ground cemeteries, available data on pottery, stray finds, and radiocarbon dates for the coals and animal bones recovered from trenches and ground surfaces, we can tentatively divide the entire mass of settlements into two chronological groups. The first one includes fortified settlements on promontories with escarped slopes and on hills (elevations) as well as unfortified settlements on river terraces, which more often yield material from the first half of the first millennium AD. Pottery, metal objects and radiocarbon dates, as well as the burial sites from the second half of the first millennium AD associated with settlements, are more typical of stone fortresses on residual mountains and rocky promontories, and also of the open settlements on promontories, plateaus and slopes. Here we examine the sites of the second period including 110 fortified and thirteen unfortified settlements (fig. 1).

Methods of GIS Analysis of the System of Habitation

We studied the settlement system of the Alanic population in the Kislovodsk basin through spatial GIS analysis, which is covered in more detail below. Such type of analysis seems to be very effective when we manage a large amount of spatial data distributed on a rather wide area. Archaeologists have been using spatial analysis of
archaeological data for some decades now, after
the science adapted the methods of New Geogra-
phy (Hodder & Orton, 1976; Korobov, 2011: 111-
23). In the mid-1980s archaeologists started using
Geographic Information Systems (GIS), giving new
possibilities and advantages to such area of study
as landscape archaeology, which actively uses the
methods of spatial GIS modelling (Garbuzov, 2007).

Landscape archaeology has not yet become
widespread in Russian archaeological science.
There are almost no theoretical studies on the use
of GIS as an instrument for analysing and mod-
elling the archaeological record. Hence, one of
the major tasks is to adapt methods of spatial GIS
analysis to archaeology, which is one of the main
goals of the study of settlement structures of the
first millennium AD being carried out by the author
in Central Ciscaucasia on the Kislovodsk basin.

Spatial analysis provides a new perspective on
archaeological sites and allows us to model their
economic environment (Korobov, 2012b). For the
modelling we use GIS, remote sensing data, field-
work data, palaeopedology, osteologic analysis of
animal bones, study of the macrobotanical re-
mains discovered through flotation of the cultural
layer at the fortified settlements, the results of
gophysical survey at archaeological sites, etc.

We used Site Catchment Analysis and Cost
Distance Analysis, which enabled us to outline the
boundaries of the settlements and the minimum
size of the tilled areas on the basis of the time
needed to cover certain distances (Wheatley &

The present study analyses the main economic
parameters of a sedentary population that practic-
es agriculture and animal husbandry. The radius
for potential ploughed lands around a settlement
is the distance that correlates with the time
required for covering 1 km of open terrain while

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Fig. 1. Types of fortified and unfortified settlements of
the Early Middle Ages in the Kislovodsk basin divided by
means of “mask” polygons.
the radius for potential pasture lands is 5 km. This limitation of agricultural activity around the place of permanent habitation correlates with the time limit of one hour of movement. It has been demonstrated on a lot of ethnological material and became the basis for further modelling of resource zones in different archaeological cultures (Jarman, Vita-Finzi & Higgs, 1972).

The boundaries of the potential resource zone between the settlements were modelled through Thiessen tessellation. They are created through building polygons around point objects whose boundaries are drawn halfway between them (Wheatley & Gillings, 2002: 149-51). The main drawbacks of the procedure include the fact that the polygons along the periphery of the data array under analysis have no boundaries, the internal spatial boundaries (e.g., deep river canyons) are not taken into consideration and neither are the efforts and energy needed for covering an irregular terrain (for details see Ruggles & Church, 1996: 147-73). To overcome these limitations we used the following procedures:

1) we divided the territory of the basin into seven polygons ("masks") along the main rivers, which are natural internal boundaries;

2) in building the Thiessen polygons, we used Cost Distance Analysis, which takes into consideration the steepness of the ground, hence the use of the time required for crossing the irregular terrain between the settlements instead of the geometric distance between them; and

3) the modelled zones of potential agricultural areas between the sites were limited to a five-km radius when taking into account the calculated energy needed for covering that distance (one hour of walking).

After analysing the specific features of the data and the methods, it became possible to start GIS
modelling of the potential economic zones around the Alanic settlements in the Kislovodsk basin, taking into consideration the differences in its economic use. Initially we created a model of the terrain based on the remote sensing data obtained through ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) that has a spatial resolution of up to 15 m and an accuracy of spatial referencing of up to 20 m.

The resulting digital model of the surface became the basis for analysing the steepness of the slopes, which was done with Slope procedure in the 3D Analyst module of the ArcGIS software. The analytical raster with data on the steepness of the slopes was reclassified (Reclassify procedure in Spatial Analyst) to six classes of relief with a 10° step. The procedure created a map with an analytical raster, where each 10 x 10 m cell contains information on the steepness of the relief from 0° to 60°.

After that, the potential resource zones were built as Thiessen polygons around the fortified and unfortified settlements inside the polygonal “mask” layers. A total of seven “masks” were used, corresponding to the seven microregions of the Kislovodsk basin, with natural boundaries along the canyons of the main rivers: the Podkumok, the Eshkakon, the Alikonovka, the Berezovaya, the Kabardinka, the Kichmalka and the Karsunka (fig. 1). The distance limit for the Thiessen tessellation was the radius of a one-hour walk (5 km), the most favourable zone for agriculture and sedentary stock farming. Thus, in building the inner boundaries between the polygons and their outer boundaries, we took into consideration the energy costs that are required for moving across...
irregular terrain. For this we used Create Allocation procedure for Cost Weighted analysis in the Spatial Analyst module. The analysed raster was the layer in which the surface slope was categorized with an increment of 10°, as described above. The work created a map of potential economic territories for the Early Medieval fortified and unfortified settlements (fig. 2).

The next step was to model the potential ploughlands for each of the settlements. For this, two criteria were used: distance from the settlement and inclination of the slope. Studies in Caucasian ethnography show that these factors are the ones that determine the value of land. The most valuable plots are level and tillable land with a good soil and located near the settlement (Kantarria, 1989: 56-57, 67).

On the basis of the above-mentioned palaeoeconomic reconstructions of the economic zones of sedentary farmers (Jarman, Vita-Finzi & Higgs, 1972), the most likely ploughland zone is deduced from the minimum distance that corresponds to the time needed for crossing 1 km of open terrain and the maximum distance of a 1 km radius around the settlement. The canyons of the major rivers were included as internal boundaries of the radial zones around the settlements in order to better identify the location of the land-plots (fig. 3). However, each of the zones can include landscapes with very different surface slopes. Palaeopedological investigations at the potential agricultural zones around early medieval fortified sites have shown that the most probable locations of Alanic agricultural plots are level surfaces with a slope of 5°-10° or less (Borisov & Korobov, 2013: 198-205).
On the basis of that assumption we corrected the results of the modelling. First, we used the instruments of the program to identify the class of relief that has an inclination of 0° to 10°. The resulting analytical layer was multiplied by the layer for which maximum and minimum zones (1 km round the settlements) were built. The result was a new analytical layer, which identifies the parts of the relief with an inclination of less than 10° located at a distance which corresponds to the time needed for crossing a 1 km of open terrain around a settlement or at 1 km as the crow flies (fig. 4).

Next, through multiplying the raster layers with the Thiessen tessellation by the layers that show the potential ploughlands within 1 km of the settlements, we get maps of possible ploughlands for each of the settlements within the identified resource zones represented by the Thiessen polygons (fig. 5). The number of 10 x10 m cells for each of the settlements allows us to estimate the size of their potential ploughlands. We have tested this model in the field and it proved to be adequate. Nearly all the soil sections taken at the potential agricultural territories modelled in our analysis yielded early medieval pottery, which must have found its way to the fields along with the fertiliser [Williamson, 1984; Wilkinson, 1989; O’Connor & Evans, 2005: 245; Borisov & Korobov, 2013: 65-66, 171-83]. We also found some natural indicators of such fertilisers by means of soil studies (Chernysheva et al, 2015: 28-29).

It seems likely that the associated territory was used for pasturage and haymaking, which assumption is confirmed by Caucasian ethnography [Kaloev, 1993: 68-69, 104-105, 112-13; Shamanov, 1972: 73] and analogies in synchronous agricultural patterns. For instance, starting with the third - fourth centuries the system of land use in Northern Europe included infield and outfield systems.
(located close to settlements or at a distance) with the first being used for tillage and the second for pastures and hayfields (Hedeager, 1992: 205; Fowler, 2002: 217; Thurston, 2001: 98; Widgren, 1983: 73-84).

Results and Conclusions

The Alans settled the entire territory of the Kislovodsk basin in the early fifth century AD and stayed there until the mid-eighth century. Early medieval sites are thickly scattered almost throughout the territory of the basin and are found at 1800 m of altitude and higher. Most of them are in the lower and middle reaches of the Podkumok and its tributaries (fig. 1). The Alans usually lived in small (up to 0.5 ha) fortified settlements at the edges of rocky promontories adjoined by level areas of fertile land followed by slopes of low hills. The latter were frequently used for catacomb burials. There are also some unfortified settlements that show traces of habitation, i.e. ruins of stone buildings on the surface.

The analysis allowed calculating the spatial cells of the territory, providing an estimate of the area of potential tillage and pasture plots for each of the first-millennium settlements in the microregion. In modelling and interpreting the results we used ethnographic and archaeological evidence. For instance, for reconstructing the population numbers we assume that with two-field crop rotation one small family used a tilled area of about 5 ha (about 1 ha per person) (Ebersbach, 2007: 43-46; Gadzhiev, 2000: 339-40; Kaloev, 1981: 37-33). The number of farm animals in conversion to great cattle is calculated on the premise that 4 ha of pastures and hayfields are required per head of cattle (Ebersbach, 2003: 84; 2007: 53-54; Osmanov, 1990: 126). According to these assumptions the majority of the settlements could have been created by rather small groups of population, around 30-50 people, with possible live stock of up to 100 cows. These calculations are substantiated by the number of dwellings visible on the ground surface of the sites as stone ruins.

In some of the cases, the modelled zones of ploughlands included the agricultural plots with boundary walls (the so-called “Celtic fields”) that we had discovered in the environs of the fifth - eighth centuries AD settlements of Zubchikhinskoye 1 and 3, Kich-Malka 1, Medovoye Prawoberezhnaya 1, and Podkumskoye 6. It appears that such land plots were the main form of agricultural plot for the Alans in the Kislovodsk basin during the period in question (Korobov, 2012a: 50; Borisov & Korobov, 2013: 135-42, 167, 182-83; Korobov & Borisov, 2013: 1097-99).

Thus, the majority of settlements from that period were small patronymic villages, inhabited by family clans comprising one - five families (Afanasyev, 1978) and located inside the resource zones that could provide sufficient food for the clan. This situation indicates a dispersed model of settlement, which implies a high degree of autonomy for social communities and, consequently, a low level of hierarchy and social development.

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References

Abramova MP, 1997: Rannie alany Severnogo Kavkaza III-V vv. n.e. [Early Alans of the North Caucasus in the 3rd - 5th cc. AD], Institute of archaeology RAS, Moscow.


Afanasyev GE, MV Dobrovolskaya & AV Borisov 2012: Irano-turkiskiy kondominium v resursnykh i tranzitynych zonakh vostochnoevropeyskoy lesostepi I tysyacheletiya i faktor vizantysko-hazarskogo protivostoyaniya russam [Irano-Turkic condominium in reserve and transit zones of the East European forest-steppe in the first millennium and a factor of Byzantine-Khazar opposition to the Russ], in Chernykh EN (ed.), Megastruktura Evraziyskogo mira: osnovnyie etapy formirovaniya: materialy Vserossiyskogo nauchnogo sovetov z gumanitarnymi nauchnymi interesami: 42-60. Institute of archaeology RAS, Moscow.


Afanasyev GE, SN Savenko & DS Korobov 2004: Drevnosti Kislovodskoy kotloviny [Antiquities of the Kislovodsk basin], Nauchnyi mir, Moscow.


Bereina NYa, SYu Frizen & DS Korobov 2014: Antropologicheskie materialy iz kurgannogo mogil’nika Levopodkumskiy 1 (Kislovodskaya kotlovina) [Anthropological materials from the Levopodkumskii I barrow cemetery (Kislovodsk basin)], Vestnik antropologii, 1(27), 170-8.


BorisoV AV & DS Korobov 2013: Drevnee i srednevekovoye zemledelie v Kislovodskoy kotlovine: itogi pochvenno-arheologicheskikh issledovanii [Prehistoric and medieval agriculture in the Kislovodsk basin: results of the soil and archaeological studies], TAUS, Moscow.


Ebersbach R, 2003: Paleoeccological Reconstruction and Calculation of Calorie Requirements at Lake Zurich,


Gadzhiev MS, 2000: K izucheniyu zemledeliya Kavka-zskoy Albanii [To the investigation of arable farming of the Caucasian Albania], Problemyi istorii, filologii i kulturyi 8, 332-43.


Kaloev BA, 1993: Skotovodstvo narodov Severnogo Kavkaza s drevneyshikh vremen do nachala XX veka [Cattle-breeding among North Caucasian people from prehistoric time to the early 20th century], Nauka, Moscow.


Koloda VV & SA Gorbaneenko 2010: Sel’skoye hozyaystvo nositeley saltovskoy kultury v lesostepnoy zone [Agriculture of the bearers of the Saltovo culture in the forest-steppe zone], Institute of Archaeology NAS Ukraine, Kiev.


Korobov DS, 2012b: GIS-modelirovanie pakhotnykh ugody epokhi rannego srednevekovya u alan
Kislovodskoy kotloviny [GIS-modelling of the Early Medieval agricultural landscapes in the Kislovodsk depression], Kratkie soobscheniya instituta arheologii RAN 226, 17-27.

Korobov DS, 2013: Etapy zaseleniya Kislovodskoy kotloviny po dannym arheologii [Stages of settling the Kislovodsk depression according to the archaeological data], Kratkie soobscheniya instituta arheologii RAN 228, 19-33.

Korobov DS & AV Borisov 2013: The origins of terraced field agriculture in the Caucasus: new discoveries in the Kislovodsk basin, Antiquity, 87(338), 1086-103.


Kovalevkaya VB, 2005: Kavkaz - skify, sarmaty, alany. I tys. do n.e. - I tys. n.e. [The Caucasus: Scythians, Sarmatians, Alans. 1st millennium BC - 1st millennium AD], Institute of archaeology RAS, Moscow.

Krenke NA, 2011: Dyakovo gorodische: kultura naseleniya basseyna Moskvy-reki v I tys. do n.e. - I tys. n.e. [Dyakovo hilfort: the culture of the population of the river Moskva basin in the 1st millennium BC - 1st millennium AD], Institute of archaeology RAS, Moscow.

Makarov NA, SD Zakharov & AP Buzhilova 2001: Srednevekovoe rasselenie na Belom ozere [Medieval settlement in the Beloozero region], Yazyki russkoy kul'tury, Moscow.


Osmanov M-ZO, 1990: Formy tradiccionnogo skotovodstva narodov Dagestana v XIX - nachale XX v. [Forms of traditional cattle-breeding among Dagestan people in the 19th - beginning of 20th cc.], Nauka, Moscow.


Shamanov IM, 1972: Skotovodstvo i khozyaystvennyiy byt karachaevtsev v XIX - nachale XX v. [Cattle-breeding and economic life of the Karachay in the 19th - early 20th cc.], Kavkazskiy etnograficheskiy sbornik 5: 67-97, Nauka, Moscow.

Steuer H, 2001: Landschaftsarchäologie, in Realelexikon der germanischen Altertumskunde, 17, 630-34.


