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ВЛИЯНИЕ ПОЧВЫ КАК ПРИРОДНОГО РЕСУРСА НА ФОРМИРУЮЩИЕСЯ ПОСЕЛЕНИЯ В СТЕПЯХ ЕВРАЗИИ

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Аннотация

В статье исследуется взаимосвязь между развитием поселений и их потенциально доступными природными ресурсами. Особое внимание уделяется качеству почвы как основе сельскохозяйственных методов. Ключевое внимание уделяется изучению калмыцкой степи между Черным и Каспийским морями в раннем средневековье, когда в регионе появились первые городские поселения. В качестве сравнительного материала мы использовали результаты изучения современного состояния почв и недавних процессов деградации почв, а также состояния древних почв, которые хранились, например, в могилах (курганах), тумбах или в археологических условиях.

Ключевые слова

территория поселения, природные ресурсы, почвы, калмыцкая степь, сельскохозяйственное использование, пастбища, опустынивание.

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THE IMPACT OF SOIL AS A NATURAL RESOURCE ON EMERGING SETTLEMENTS IN THE STEPPES OF EURASIA

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Annotation

The article explores the relationship between the development of settlements and their potentially accessible natural resources. Particular emphasis is placed on soil quality as the basis of agricultural practices. Key attention is paid to the study of the Kalmyk steppe between the Black Sea and the Caspian Sea in the early Middle Ages, when the first urban settlements appeared in the region. As a comparative material, we used the results of a study of the current state of soils and recent soil degradation processes and the condition of ancient soils, which were stored, for example, in graves (mounds), bollards, or in archaeological conditions.

Key words

settlement territory, natural resources, soil, Kalmyk steppe, agricultural use, pastures, desertification

INTRODUCTION

How to choose a location for a settlement? The reasons can be manifold, and one answer could be: Where agricultural practice can successfully feed their inhabitants. We want to investigate the interrelations between the development of urban settlements and their potentially available natural resources, with a special focus on soil quality as a basis of farming practices. Human-environment interactions will be studied, focusing on chronological periods during which urban settlements (or urban-like settlements) appeared for the first time: The Kalmykian steppe between the Black Sea and the Caspian Sea, where first settlements with urban structures appeared in Early Medieval.

MATERIALS AND METHODS

Settlements are always related to the landscapes in which they were founded. The natural environment has an impact on their location, maintenance, decline and also fate after abandonment. The availability of natural resources steers the development of urbanity, since urban societies depend on the provisions generated in their hinterlands. Natural processes like fluvial activity or sedimentation of specific mineral materials therefore influence the foundation of settlements because they govern the availability of natural resources, including the characteristics of soils that are demanded by the inhabitants of villages or cities. Despite of the importance of soil resources, we hardly know anything about soil fertility in the past, and how this changed over time. This is especially true for regions that have been at the frontiers of political entities, or of specific ecosystems, and which have not been focus areas of previous research. Open questions are: How did the prevalent soils affect the foundation of urban structures in this area? And how did human influence affect the quality of the used soils? Did (pre)historic societies design their environment to their needs? Today, many soils are overused and affected by degradation processes, was this also an issue in the past, and was the degradation of soils comparable to recent processes? Did agricultural use (cropping and livestock) led to a degradation of soil quality and therefore to lower productivity?

First interdisciplinary research showed that we are struggling to answer those questions. It is necessary to understand the general environmental history of a settlement area in greater detail. We therefore want to compare the recent status of soils and recent processes of soil degradation with ancient soils that have been preserved, e.g. under gravemounds (kurgans), colluvium or in archaeological contexts and apply interdisciplinary methods, including geochemical analysis, dating, remote sensing and GIS technologies, to attend to the main research questions:

• What were or are the characteristics of soils when settlements evolved (here: Bronze/Iron Age, Medieval), were soil conditions in the past suitable for agricultural use? What was the nutrient status and organic matter content?

• Can we identify climate and vegetation changes that would influence soil formation?

• Can we identify soil degradation processes in the past that were connected to land-use and overexploitation of resources? What would be the effect of soil degradation on the production of food and other essential resources? Are they related to changes in society and economy?

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• How did erosion and/or fluvial activity influence the formation and properties of soils? Were the areas influenced by other natural processes that disturbed or stimulated agricultural activities?

• Can we identify activities connected to local and regional resources also in the settlements? Can we identify differences in sediment characteristics related to economic activities or building materials?

To find answers to those questions, it is necessary to find areas where settlements emerged at a specific period of time, and where also the environmental history can be investigated, which excludes areas with long chronologies of inhabitation. Regions at the frontiers of political or ecological units are suitable investigation areas because they were often settled after the mainlands, or for specific purposes. Excellent examples is the Kalmykian steppe between the Black Sea and the Caspian Sea, where first settlements were established not before Early Medieval.

DISCUSSION

Recent soils are usually affected by former activities and remains of the past, their characteristics can reflect their former use but not necessarily their former quality. Often the question emerges, how "natural" soils really are. This is especially true for regions which have been settled early, as in the Near East, where settlements and their inhabitants interact with their environments under changing climatic conditions since millennia. What we know about soils in areas that have been settled since prehistoric times can be seen in this example from the Near East, where it is said that "almost no virgin soils occur in Iraq, because human influence over a period of some thousands of years has directly or indirectly changed soil conditions" (Buringh, 1960: 23). The landscape as we see it today, and its capability to deliver natural resources for the survival of a city, is therefore not a source of information for the status quo in ancient times, and it is not the exclusive result of climate-related processes.

The steppes of Eurasia were often not considered when looking at urban developments or changes in soil quality, but it is known that they have been used as pastures by nomadic tribes since Early Iron Age. Steppe ecosystems are very sensitive to changes in climate and land-use, and soil degradation is and was a common challenge (Demkin et al., 2010 Ochir-Goryaeva et al., 2020). An outstanding example are the steppes of Kalmykia, which are known today «for their severe state of degradation and desertification, mainly by overgrazing but also by inadequate arable use, which affected large parts of the formerly fertile soils. In the late 1980s, 47.8 % of the area of the Republic of Kalmykia was damaged by strong or even extremely severe degradation» (Bananova, 1989; Bananova and Lazareva, 2014).

The climate of Kalmykia is continental and semi-arid, with an average annual precipitation of 200-350 mm. Typical soils are "Chestnut soils", or Kastanozems, but a distinctive feature of this subregion is the sandy steppe zone, which is related to sediments from the Caspian Sea (Zonn, 1995). Grazing lands are located mainly in the steppe areas, but also in semi-deserts, sand and salt deserts of the Caspian Lowlands (Smelansky and Tishkov, 2012). The earliest urban sites date to the Early Medieval Epoch and, in particular, to the time of the Chasarian Kaganat (7th–9th century). Only a few settlements

have been documented, located along the Don river and the artificial Tsimlyansk lake, e.g. the fortress Sarkel-Belaya Vezha (Artamonov, 1958; Afanas'ev, 2018: 166–189; Larenok, Semenov, 1999: 63–70). Our study area is situated in the south-western part of Kalmykia, the Manych Steppe, south of the Kuma-Manych depression, where annual precipitation is higher. No archaeological sites dating to the Bronze or Early Iron Age have been discovered here so far; which is in stark contrast to the archaeological data of the other parts of the territory of Kalmykia (Ochir-Goryaeva et al., 2011). The early Medieval settlements of Bashanta-I and II, located in the basin area between Manych and Egorlyk, are therefore the earliest settlement sites in the Manych Steppe. Seven kurgans located near Bashanta-II seem to belong to the same period. We want to address the question why the Medieval settlements were the first to appear in the area. We hypothesise that earlier environmental conditions were unfavorable for any agricultural use.

The rather late arrival of settlements in the Manych steppe might be associated with previous environmental conditions, in particular high soil moisture and swamp areas that were prevalent at that time. During the early Medieval period, the soil might have become drier, either because the climate was more favourable, or because of melioration efforts (documented drainage systems). Additional evidence comes from archaeozoological material in the cultural layer of Bashanta-II. The bone material represented kitchen remnants: twice as much meat of cattle and horse was used for food than of sheep (Eckmeier et al., 2018). This may serve as an indirect piece of evidence of more humid conditions climate which favored higher grass species and hence raising horses and cattle rather than sheep. Paleoclimatic data from the Black Sea suggests that vegetation types and climate were fluctuating often during the Holocene (Bolikhovskaya et al., 2018).

The Kalmykian steppe was and is impacted by severe soil degradation (wind erosion, loss of fertile top soil) and a late urban development in the Manych steppe. Natural steppe disappeared, mainly due to overgrazing, so that a comparison with "natural soils" is not possible.

Effects of climate. The region between the Black Sea and the Caspian Sea, or between the rivers Don and Volga, is characterised by an increase in aridity from west to east, which is strongly affecting the characteristics of the Kalmykian steppe.

RESULTS

Modern analogies will be studied in detail to establish knowledge on the effects of (over)grazing and agricultural production on soil characteristics. The case studies will be selected in known sites in Kalmykia, where overgrazing had severe consequences, but no data on soil characteristics is available.

Fieldwork. After identification of suitable locations for sampling according to the research questions, environmental conditions and site specifics, samples will be taken either in (i) excavation areas (settlement structures, pit fillings), (ii) under (pre)historic structures like gravemounds or ditches, or under colluvial sediments, or (iii) from recent topsoils. To establish knowledge of the landscape on a larger scale we will also sample soil and sediment cores using a Cobra drilling equipment.

Landscape analysis. The research areas will be analysed using remote sensing data (vegetation cover and modern land-use) and GIS analysis (DEMs and spatial analysis).

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Available environmental data will be collected using literature data on climate and vegetation history, climate data databases, and local studies (e.g. unpublished data from geological surveys).

Laboratory analyses. The analyses of sediment and soil material will be performed either in the laboratories of the Department of Geography (LMU), or in the laboratories of the Geographical Faculty, Lomonosov State University, Moscow. Following parameters will be determined: particle-size distribution, calcium carbonate (CaCO3), pH, carbon (C) and nitrogen (N), total, inorganic and organic phosphorous (P) and colour (VIS) spectra, near-infrared (NIR) and mid-infrared (MIRS) spectra, and multi-element-analysis (XRF). The aim is to gain information on soil quality and status, and how this changed (e.g. Eckmeier et al. 2011; Lauer et al., 2014), and to apply a microarchaeological approach for the settlement areas (Weiner 2010). The nutrient status of samples will additionally be determined by multi-element analysis using an ICP-MS (TU München, Lehrstuhl für Bodenkunde). As it is also important to date the time of sedimentation of the colluvial or fluvial sediments, it is necessary to apply optically stimulated luminescence (OSL) and radiocarbon (14C) dating. Biomarker analysis will be performed to determine if manure was applied to the soils (only in buried soils).

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