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WAS GORDINEŞTI II–STÎNCA GOALĂ ABANDONED DUE TO CULTURAL CHANGES OR ENVIRONMENTAL IMPACTS? THE CASE OF THE LATE TRYPILLIA SETTLEMENT IN NORTHERN MOLDOVA

ABSTRACT

Rybicka M., Wacnik A., Pokutta D., Kittel P., Okupny D., Król D., Sady-Bugajska A., Pankowski W., Sîrbu G., Makohonienko M. and Słowiński M. 2023. Was Gordineşti II–Stînca goală abandoned due to cultural changes or environmental impacts? The case of the late Trypillia settlement in northern Moldova. *Sprawozdania Archeologiczne* 75/1, 51-75.

This study aims to provide information on cultural and environmental factors influencing the development and decline of the Late Trypillia settlement at Gordineşti II–Stînca goală. The discussion is based on the results of archaeological excavations, non-invasive surveys (magnetometric and GPR), as well as radiocarbon, macroremains, palynological, archaeozoological, and isotopic analyses. All data suggests that Gordineşti II–Stînca goală consisted of at least 15 lightweight constructed dwellings. It was a small settlement existing *c.* 3300-2950 BC. Its inhabitants were oriented to cereal cultivation and livestock husbandry, using available areas with fertile soils. The livestock were well-fed.

However, the location of the settlement on a highly exposed outcrop probably did not facilitate the use of the flowing water of the nearby Racovăţ River. The rock underlying the site would have made digging the wells a very tough task. Hence, the water access problem may be one of the factors that made life inconvenient at the Gordineşti II-Stînca goală settlement.

Keywords: radiocarbon, palynology, stable isotopes, animal management, Late Trypillia, Gordineşti Group
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INTRODUCTION

In 2016-2021, archaeological excavations and non-invasive surveys were carried out on the eponymous settlement for the Gordineşti Group of the Late Trypillia Culture at Gordineşti II–Stînca goală in northern Moldova. Until recently, it was difficult to unequivocally establish the period during which the population of this group existed in this area and western Ukraine since the available radiocarbon dates were differing widely, either pointing at the last centuries of the 4th millennium BC (Diachenko and Harper 2016, figs 2 and 3) or the early half of the 3rd millennium BC (*e.g.* Sandraky; Tsviklivtsy; Rassamakin 2012). Additionally, many scholars have already pointed out that some of the dates are questionable (Harper *et al.* 2019; Rassamakin 2012; Król and Rybicka 2022). Hence, one of the objectives of this project was to determine the chronology of the settlement at Gordineşti II–Stînca goală as well as the length of its occupation. Of particular importance was determining the spatial arrangement of the Gordineşti II site (Rybicka *et al.* 2023) and subsistence strategies used by its inhabitants. Another interesting issue was answering the fundamental question – why was the site abandoned? Was this due to cultural or environmental causes? The explanation of the issues listed above – and covered below – are expected to launch verification of various hypotheses proposed by pertinent publications discussing changes in population and economy in the Dniester-Prut interfluve at the end of the 4th millennium BC (Rassamakin 2013).

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GEOGRAPHICAL LOCATION OF THE SITE

The Gordineşti II–Stînca goală site is located in the southern part of the Medobory (Toltry) Hills in northwestern Moldova (48°08'24.25" N; 27°09'34.58" E), some 9 km east of the Prut River and *c.* 48 km south of the Dniester River (Fig. 1). The settlement occupies one of the limestone hills roughly oriented N and S. The wedge-shaped, extensive, and flat hilltop is oriented SE and NW and is some 500 m in length and c. 100-120 m in width. The terrain is surrounded to its south, west, and north by the deeply incised valley of the Racovăţ River – a right-bank tributary of the Prut River. The promontory's maximum absolute elevation reaches 215 m a.s.l., whereas the Racovăţ River valley floor is between 140 and 130 m a.s.l. (Fig. 2: 1-3). The average river channel inclination is 0.4°.

GEOGRAPHICAL DESCRIPTION OF THE SITE

The Medobory (Toltry) Hills are a narrow ridge of Miocene reef limestone hills, running north and south for some 300 km across Ukrainian Podilla and northern Moldova (*e.g.*, Korolyuk 1952; Górka *et al.* 2012; Brusak and Moskaluk 2016). The Racovăţ River valley surrounding the site is an active gorge with highly inclined (up to 40-50°) rocky slopes (Fig. 2: 1-3). However, in the northern part of the site, fragments of a river terrace occur on both sides of the channel. The terrace is formed by two main units: fluvial deposits in the bottom part and loess deposits with buried soils strongly transformed by slope processes in the upper part. The fluvial unit is composed of imbricated gravels of channel lag deposits covered with a thin layer of overbank alluvia. The fluvial deposits are overlain by a sequence of loess layers with buried soils. These loess units contain Middle and Upper Palaeolithic ecofacts and artefacts of the Mousterian and Early Aurignacian complexes (Borziyak 1984). The upper cover of loess with gravel originates from redeposition by slope processes, possibly deposited between *c.* 26 and *c.* 17 k.y. BP according to the regional sequence elaborated by Haesaerts *et al.* (2003). The uppermost loess cover was deposited between 15 and 10 k.y. BP according to Haesaerts *et al.* (2003). The chronology of slope-aeolian deposits demonstrates that the alluvia of the river terrace were accumulated in the older part of the Weichselian (Valdai) Glaciation Period. This suggests that the fragments of the terrace in the Racovăţ River valley should be associated with the first (Skulyansk) terrace in the Prut River valley related to the first (Parkan) terrace in the Dniester River valley (*cf.* Gozhik and Chetlyga 1964; Bukatczuk *et al.* 1983; Lukina *et al.* 1985). All these terraces share similar lithology and chronology as well as elevation above the valley floor: the surface of the Racovăţ River terrace is elevated *c.* 10 m above the valley floor and up to 150 m a.s.l. The incision of the Prut River channel – and that of the Racovăţ as well – is principally related to the tectonic uplift of fragments of the Moldavian Plateau (Bobok 1980; Lukina *et al.* 1985; Matoshko *et al.* 2004, see also Perşoiu *et al.* 2017).

Fig. 1. Gordineşti II–Stînca goală. Site location on the map of Europe

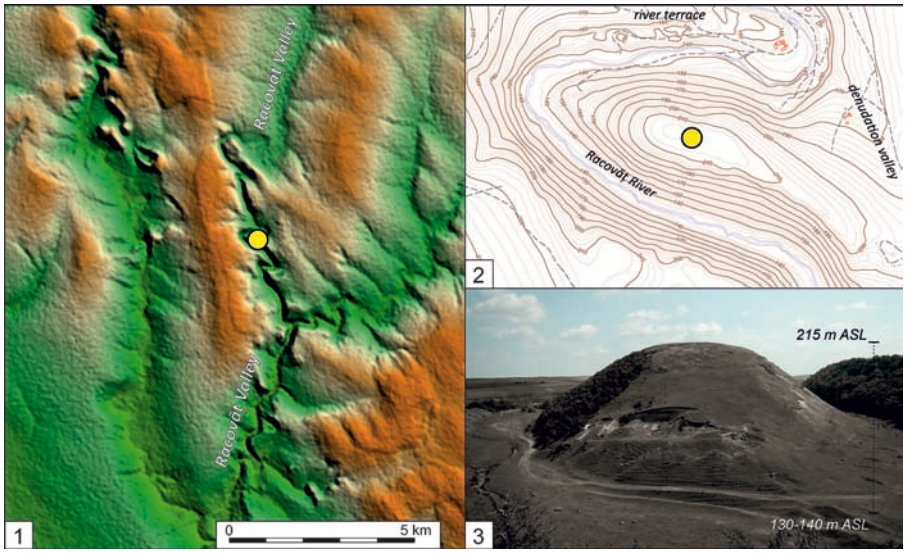

Fig. 2. Gordineşti II–Stînca goală. Site location. 1 – elevation model of the Racovăț River valley; 2 – topographic map (https://geoportal.md/); 3 – view from the west. Photo D. Król

The development of the Racovăţ River valley began in the Middle Pleistocene (Adamenko *et al.* 1997). The higher river terrace, buried by loess deposits, stretches to the east of the site. The elevated surface occupied by the site is a part of the upland zone formed by reef limestone overlaid with weathering-derived clay and loess partly redeposited by slope processes. In the Gordineşti II site area, limestone is encountered at between 30 to 50 cm in depth. To the east of the area of the site, the uppermost layer is constituted by a loess cover with a thickness of up to 1 m and with well-developed black soil. This sequence is similar to that found at the uppermost part of the river terrace. In the elevated areas of the plateau east of the Gordineşti II site, the unit of Lower-Sarmatian limestone is covered by Upper-Sarmatian clays. On the left bank of the Racovăţ River valley, Pliocene sands and silts are found related to the 7th-10th Prut River terraces (Gozhik and Chetlyga 1964; Bukatchuk and Burdnko 1973; Lukina *et al.* 1985; Adamenko *et al.* 1997).

SPATIAL ARRANGEMENT OF THE SETTLEMENT

The spatial arrangement of the prehistoric settlement in Gordineşti II–Stînca goală was studied using traditional archaeological methods such as field surveys and excavations, as well as active non-invasive geophysical prospection namely magnetometric surveys (Przybyła *et al.* 2017) and three-dimensional ground-penetrating radar investigations (3D GPR) (Rybicka *et al.* 2023, figs 3, 7, and 8). Excavations were used to explore three dwellings previously localized either during a basic field survey (House 1; Sîrbu and Król 2021; 2023), by magnetometric prospection (House 2; Sîrbu and Król 2023), or through 3D GPR investigation (House 3; Sîrbu and Król 2023). Neither magnetometric nor 3D GPR methods provided a sufficiently precise image as to how the settlement was arranged and how many dwellings there were within it, but general pointers as to the locations of single structures were only obtained (Przybyła *et al.* 2017; Rybicka *et al.* 2023). Therefore, it was not possible to establish the details of the settlement's layout. Nevertheless, these results sufficed to estimate the occupied area at about 3 ha, enclosed by a ditch-rampart system on its eastern side. The non-invasive research methods have shown that dwellings were located along the north and southern sides of the promontory, its central part being left empty. The three houses (nos 1-3) subjected to excavations were located near the southern edge of the site (Rybicka *et al.* 2023, fig. 3).

Owing to the fact that Houses 2 and 3 were identified inside a concentration of dipolar magnetic anomalies (Fig. 3; Przybyła *et al.* 2017), it was decided to analyze the spatial dispersion of those anomalies and develop a hypothetical model for potential locations of other houses. The Kernel Density Estimation (KDE) algorithm was used for this purpose (Rybicka *et al.* 2023, fig. 11). The generated model suggests that the settlement structure in Gordineşti II–Stînca goală may well have an oval shape (Figs 4 and 5), the fact also being

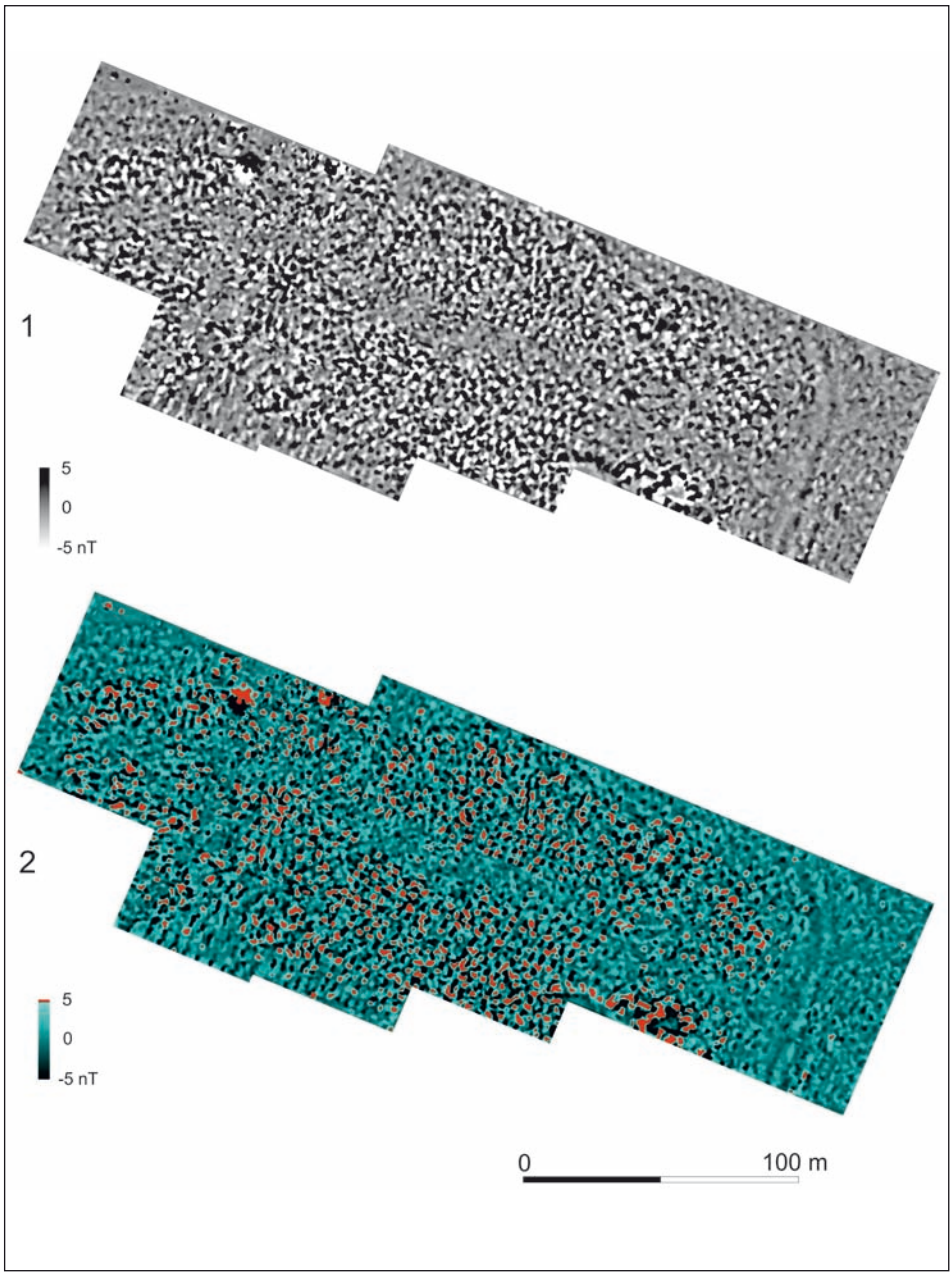

Fig. 3. Gordineşti II–Stînca goală.
Magnetometry image of the site. 1– in the range of −5/5 nT in the greyscale; 2– in the range of −5/5 nT in the colour scale, the highest values are highlighted.
After Przybyła *et al.* 2017, 53-54, figs 3 and 4

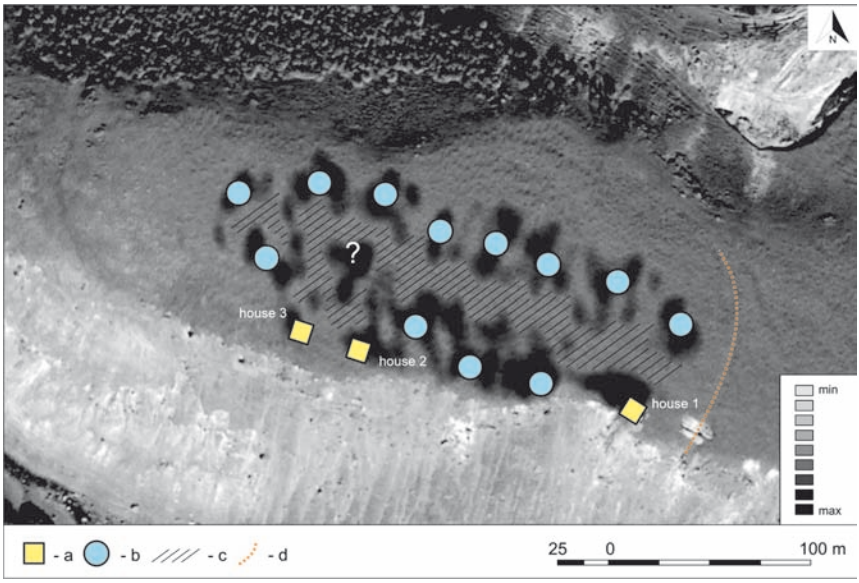

Fig. 4. Gordineşti II–Stînca goală. Site's spatial organization model based on KDE-analysis.
a – excavation units (Houses 1-3); b – hypothetical houses; c – open space courtyard; d – ditch-rampart system. After Rybicka *et al.* 2023; modified)

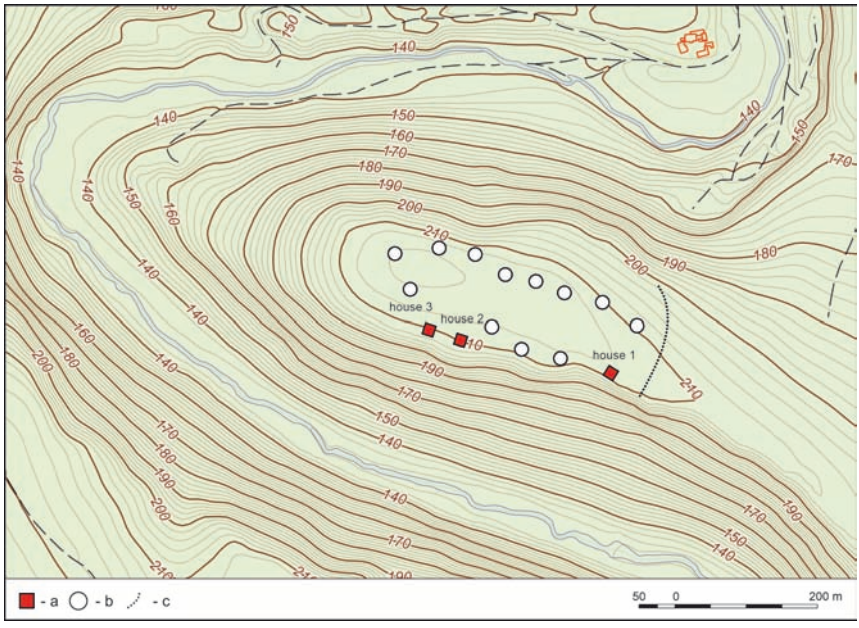

Fig. 5. Gordineşti II–Stînca goală. Site's spatial organization reconstruction.
a – excavation units (Houses 1-3); b – hypothetical houses; c – ditch-rampart system

suggested by magnetometric research (Przybyła *et al.* 2017, 58). On the basis of these analyses, it was estimated that the settlement could have consisted of at least 15 houses (Figs 4 and 5; Rybicka *et al.* 2023).

DWELLINGS AND THEIR EQUIPMENT

The discovery of postholes and daub fragments with imprints of wattle may suggest that the three excavated dwellings were of lightweight construction (Fig. 6; Sîrbu and Król 2021; 2023). They were supported by the poles and their walls were wattle and daub. The rectangular structures were quite uniform in size (no. 1– *c.* 11.2 × 10.4 m; no. 2 – *c.* 10 × 8 m) and alignments: no. 1 – NE and SW; nos 2 and 3 – SE and NW). Each of these structures had its own hearth. The wide dispersion of flakes and chips of flint in various parts of the houses and their surroundings may suggest that there were, however, no areas evidently

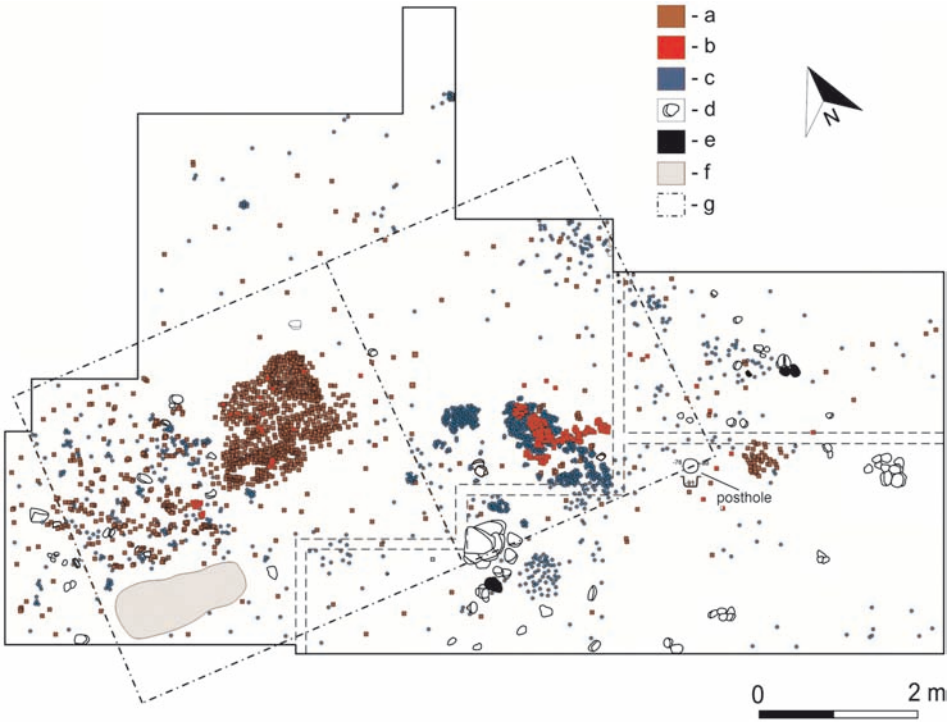

Fig. 6. Gordineşti II-Stînca goală. The house no. 1: a – burnt daub fragments (wall), b – burnt daub fragments (floor), c – pottery, d – stone, e – granite stone, e – limestone pavement, d – schematic delimitation of dwelling. After Sîrbu and Król 2021; 96, fig. 2; modified

specialized in flint knapping (Sîrbu and Król 2021; 2023). All the dwellings and their surroundings contained numerous spindle whorls and loom weights. No clearly defined areas for weaving were identified though. Such dispersion of finds indicates the lack of areas dedicated to specific tasks and is suggestive of *ad hoc* use of habitable interiors and their vicinity (Sîrbu and Król 2021; 2023).

The tableware in various site contexts turns out to be highly uniform in terms of stylistics and morphology, while cooking ware displays a restrained and simple manner of ornamentation (Sîrbu *et al.* 2019a; Sîrbu *et al.* 2019b; Sîrbu and Król 2021; 2023). The number of pottery sherds found in individual dwellings is roughly equal. Neither houses nor their surroundings were revealed to contain special concentrations of tools and utensils (Sîrbu *et al.* 2017; Sîrbu *et al.* 2019a; Sîrbu *et al.* 2019b; Sîrbu and Król 2021; 2023).

CHRONOLOGY ISSUES

At present, we possess 12 radiocarbon dates for three Gordineşti II–Stînca goală dwellings (Fig. 7). These dates have been obtained by the AMS method from selected organic remains taken from habitation levels. Four dates for House 1 were derived at Poznań

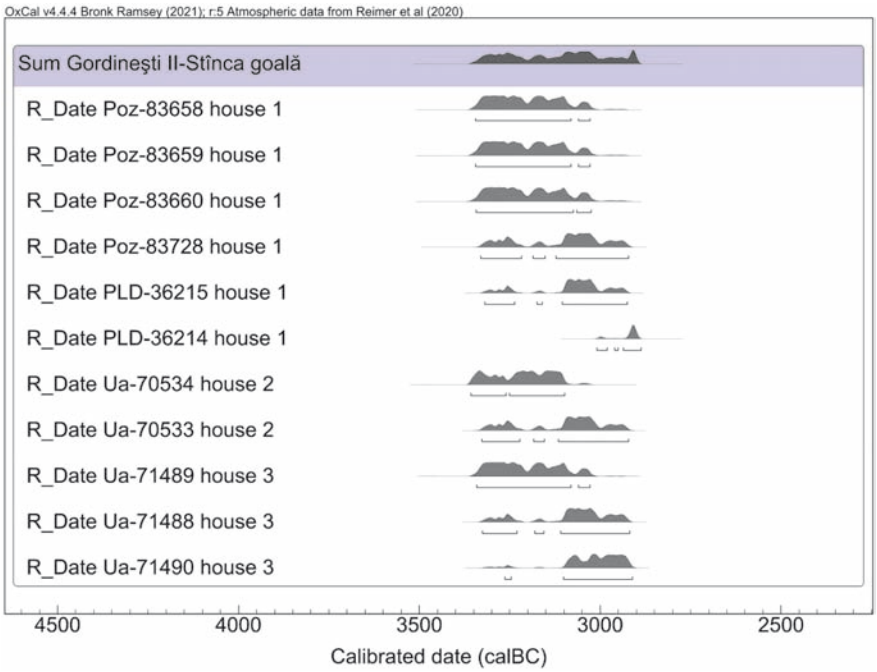

Fig. 7. Gordineşti II–Stînca goală. List of radiocarbon dates

Radiocarbon Laboratory and two more at the Japanese Paleo Lab Co; three of them come from animal bones and three from charred wheat grains discovered in the southern section of the dwelling (Rybicka *et al.* 2020; Sîrbu *et al.* 2020; Król and Rybicka 2022; 2023). In turn, all dates for Houses 2 and 3 come exclusively from animal bones and were derived by the Radiocarbon Laboratory at Uppsala University. Judging by variously modelled (through Bayesian and other statistical analysis) radiocarbon dates, House 1 was occupied c. 3300/3250–2900 BC (models using an outlier date – PLD-36214 4315±20) or 3300/3250–3000/2950 BC (without this debatable date) (Król and Rybicka 2022, 18-21; 2023). Absolute dates for Houses 2 and 3 appear to correspond with those for House 1 (Fig. 7). Hence, the conclusion is that all three researched dwellings could have been used in pretty much the very same period. What is crucial is that no artefacts from any cultural group other than the Late Trypillia Gordineşti Group were unearthed.

MACROSCOPIC REMAINS OF CULTIVATED PLANTS

The archaeobotanical analysis provides evidence for the cultivation of grain crops by the local community of Gordineşti II–Stînca goală and sheds light on the taxonomic spectrum and size diversity of individual taxa represented in each individual house (Sady-Bugajska 2023). In House 1, charred kernels of emmer wheat (*Triticum dicoccon*) and wheat (*Triticum* sp.) were identified, and fragments of kernels of otherwise unidentified grains (Cerealia indet.) are represented. In the organic admixture to the daub, some imprints were observed and identified as vestiges of hulled wheat emmer (*Triticum dicoccon*) and einkorn (*Triticum monococcum*). The cultivation of barley is suggested by a kernel imprint (*cf. Hordeum vulgare*).

The burnt daub of House 2 contained hollow imprints of hulled wheat – emmer and einkorn (*Triticum dicoccon*, *Triticum cf.*, *monococcum*), with the former predominating (Sady-Bugajska 2023). Some imprints were classified broadly as those left by hulled wheat – either einkorn or emmer (*Triticum monococcum* vel *dicoccon*) or simply *Triticum* sp. Most vestiges were categorised as grains and/or as unidentified grasses (Cerealia indet./ Poaceae indet.).

In the case of House 3, the analysis of the burnt daub from the central hearth produced interesting results. The discernable morphological features – imprints of ears – were used to identify remains of hulled wheat – mostly emmer (*Triticum dicoccon*) and einkorn (*Triticum monococcum*). Imprints of kernels which could not be further identified were classified broadly as wheat (*Triticum* sp.) or cereals (Cerealia indet.). Identically, as in the above-described materials, the most numerous imprints on the daub of House 3 were those of cereal chaff (Sady-Bugajska 2023).

MACROSCOPIC REMAINS OF WILD PLANTS

A highly salient fact is the presence of macroscopic remains of plants in soil/sediment samples taken from dwelling interiors (Sady-Bugajska 2023). In the debris of all three houses, charcoals of ash-wood (*Fraxinus excelsior*) and cornel seeds (*Cornus mas*) were found. Furthermore, examined samples from dwellings contained a charred oak acorn (*Quercus* sp.). A charred fragment of maple wood (*cf. Acer* sp.) was identified. Seven fragments of charcoal found in House 2 were classified as coming from deciduous trees (Sady-Bugajska 2023).

Furthermore, remains of feather grass (*Stipa* sp.) were found in all three huts, plus a single imprint of a corn-cockle diaspora (*Agrostemma githago*) was evidenced. Other diasporas, probably from brome grass (*cf. Bromus* sp.), were also recorded (Sady-Bugajska 2023).

REMAINS OF LIVESTOCK AND WILD ANIMALS

Livestock animals consisted of both mobile species like cattle (*Bos taurus*), sheep (*Ovis aries*) and goat (*Capra hircus*) as well as pig (*Sus domesticus*) (Croitor and Sîrbu 2017; 2019) – the last species not so suitable for being driven in migrations (Albarella *et al.* 2011; Mileto *et al.* 2018). It was possible to fully identify bone fragments found in House 1 and its vicinity (Croitor and Sîrbu 2017; 2019). Most of them were from cattle, yet with high shares of sheep and – less so – goats (Croitor and Sîrbu 2017; 2019). Bones of wild animals were also found to represent red (*Cervus elaphus)* and roe deer (*Capreolus capreolus*), whose habitats are mostly broadleaf and mixed woods and thickets.

VEGETATION IN THE AREA OF THE GORDINEŞTI II–STÎNCA GOALĂ SITE DURING THE OCCUPATION OF THE LATE TRYPILLIA CULTURE

According to Bohn *et al.* (2004), the main type of vegetation that would potentially emerge if the region was to be completely abandoned by humans would be broadleaf forest communities consisting of *Carpinus betulus*, *Quercus robur*, *Q. petrea*, *Tilia cordata*, *T. tomentosa*, *Fraxinus excelsior* and *Fagus sylvatica*. The river valleys are suitable for development of riparian forests with *Q. robus*, *Ulmus laevis*, *U. minor*, *Fraxinus*, as well as willows (*Salix alba*, *S. fragilis*) and poplar (*Populus alba*, *P. nigra*). Not far from the Gordineşti II settlement, to its south-east and south-west, the land would be re-occupied by forest-steppe-type vegetation. The European forest-steppe ecotone represents a mosaic landscape of open and wooded patches extending from the Carpathian to the Ural Mountains.

Fig. 8. Sediment sampling sites in the vicinity of Gordineşti II–Stînca goală in 2019 (http://www.etomesto.com)

The history of vegetation of the studied area in the Holocene to date has not been subject to many studies and our knowledge about it is definitely incomplete.

The character of vegetation was in large part identified through palynological research. To date, the closest palynological sequence was the Orhei profile from Moldova, north of Chişinău (today in the steppe zone) (Kremenetskiy 1991; Kremenetski 1997; 2003) and (more distant) sites in southern Ukraine: the Dovjok swamp, Kardashinski swamp (Kremenetskiy 1991; Kremenetski 1995) and Nebelivka (Albert *et al.* 2020), as well as those from the Romanian Carpathians: Călimani Mts (Fărcaş *et al.* 1999), Bardău (Fărcaş *et al.* 2009), and Poiana Ştiol (Tanţău *et al.* 2011; Gałka *et al.* 2017). Palynological data from the Orhei site points to the presence of broadleaf forests mixed with steppe areas during the

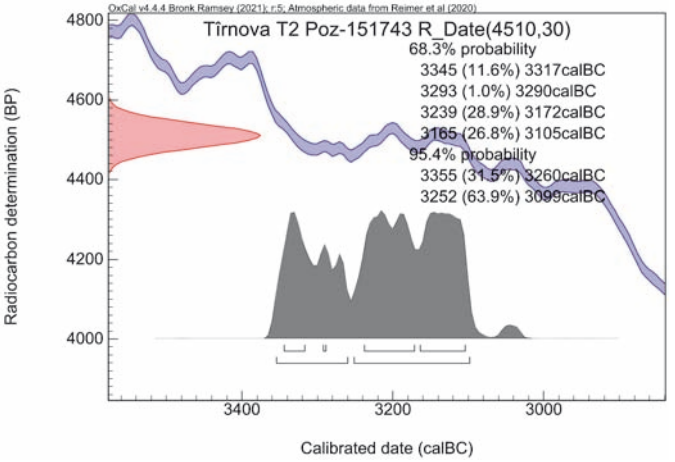

Fig. 9. *Tîrnova* T2 profile. Radiocarbon date

Atlantic and early Subboreal Periods as well as major changes in vegetation cover beginning around *c.* 5500 cal. BP (≈3550 BC) and associated with the growing relevance of open herbaceous plant communities (Kremenetski 2003). In Harper's (2019) opinion, Trypillia Culture tribes had spread across most of the contemporary forest-steppe zone. The link between Trypillia settlements and this vegetation type seems to be corroborated by the currently sparse palynological data from southern Moldova and Ukraine (Pashkevich 2003; Pashkevich 2005; Pashkevych 2012; Kremenetskiy 1991; Yanushevich *et al.*1993). The location of the Gordineşti II–Stînca goală site, on a well-drained limestone ridge surrounded by the steep-sided gorge of the Racovăţ River valley was not favourable for the formation of deposits preserving pollen from the period of the Trypillia settlement up to our times. The sediment profiles containing microremains of plants were located by a team headed by Piotr Gębica (Rzeszów University) near Tîrnova (48°11'25.8"N;27°10'53.1"E) and Trinca (48°12'45.72"N;27°8'9.84"E) in northwestern Moldova (Fig. 8). Palynological analyses and radiocarbon dating showed that only a few pollen grains from a period close to the Gordineşti II–Stînca goală occupation were preserved solely in the older part of the Tîrnova T2 profile. The taxonomic composition of the pollen spectrum dated by AMS ^{14}C (Poz-151743; using a charred fragment of *cf. Quercus* to 4510±30 BP; 3355-3099 BC – 95.4% probability range; Fig. 9) includes pollen from Scots pine *Pinus sylvestris*, European spruce *Picea abies* and oak (*Quercus* sp.); from herbaceous plants only pollen from Cichorioideae and *Aster* type was identified. Such data are, naturally, insufficient to draw conclusions concerning the character of vegetation cover. However, looking at the macroscopic finds of wood from *Quercus* sp., *Acer* sp., *Fraxinus excelsior*, indeterminate deciduous taxa (Dicotyledones indet.), as well as charred *Cornus mas* seeds and *Quercus* sp. acorns, and the presence of oak pollen in the T2 profile, we may assume that the aforementioned

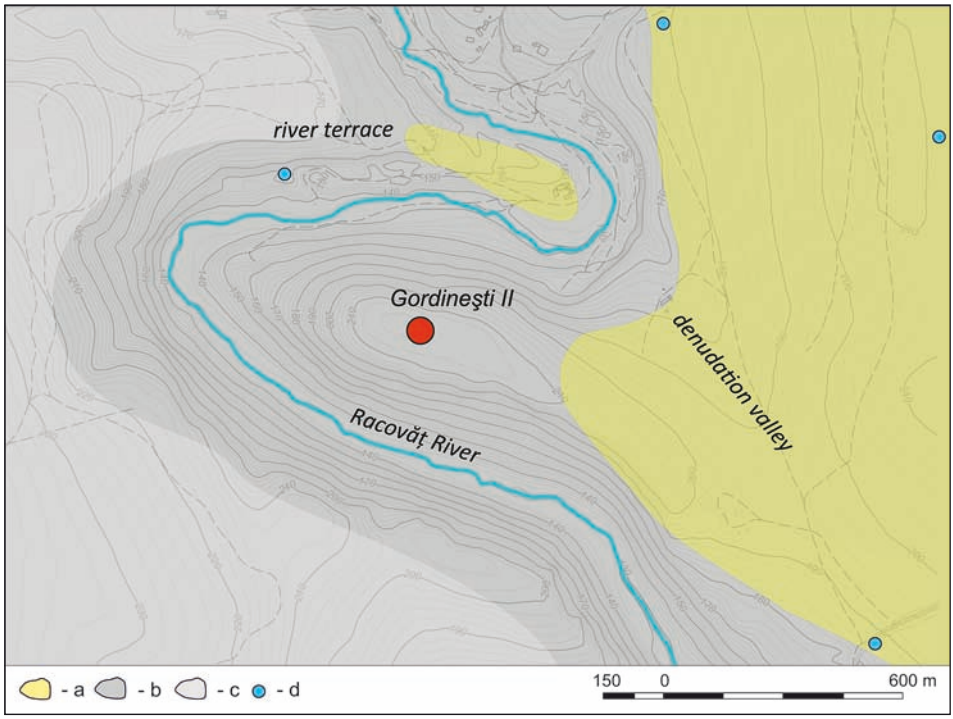

Fig. 10. Gordineşti II–Stînca goală.
Soil and water conditions in the vicinity of the site. a – loess soils; b –rendzina soils; c – sierozem soils; d – springs

trees – probably part of oak or broadleaf forests, grew in the neighbourhood of the Gordineşti II–Stînca goală site.

In spite of the studied area's belonging, according to Bohn *et al.* (2004), to the deciduous forests zone, we may speculate that in the early Subboreal Phase of the Holocene local relief, with its limestone foundation and low groundwater level, may had been favourable to a more open type of vegetation, closer in character to the forest-steppe.

It is possible that the hilltops and dry slopes with strongly mineralised soils were covered by a mosaic of vegetation types comprised of patches of dry grasslands with *Stipa* sp., *Bromus* sp., and possibly representatives of Cichorioideae and *Aster* mixed with patches of dry open woodland composed of various species of *Quercus* sp. with admixtures of – at the very least –*Acer* sp. and *Cornus mas*. One should note that even today oak forests of Moldova and south Ukraine include certain floral elements typical for the sub-Mediterranean Zone in the western Pontic Region, such as the aforementioned *Cornus mas* (Bohn *et al.* 2004; Goncharenko *et al.* 2020). The presence of charred remains of feather grass *Stipa* sp., a plant typically found in forest-steppe and steppe areas, points to

the existence of patches of open, dry areas covered with dry grasslands. Such grasslands require much sunlight, very dry and warm habitat, and poor soils (Zarzycki *et al.* 2002). *Fraxinus excelsior* probably grew in humid terrain depressions, in gullies with fertile soils underlain by clay or loess redeposited by slope processes. An issue yet unanswered is the degree of forest cover.

During the site's occupation, at least the following types of cereals were cultivated: *Triticum monococcum*, *T. dicoccon*, and *Hordeum vulgare*. These plants are highly suitable for primitive agricultural practices and well adapted to the existing climate (Pashkevych 2012; Lityńska-Zając and Wasylikowa 2005). The fields, as indicated by archaeobotanical research, attracted weeds such as *Bromus* sp. or *Agrostemma githago*.

In the vicinity of Gordineşti II–Stînca goală, good edaphic conditions propitious for grain crops are provided by soils accounting for over 30% of the area in a 1 km radius around the settlement (Fig. 10). Such a distance is considered to produce optimal effectiveness of grain farming (Flannery 1976; Pelisiak 1985; 2003; Kruk and Milisauskas 1999; Rybicka 2004). Inside this radius, we find loess-based soils, particularly to the east of the site, where chernozem has emerged. To the west of the settlement, on the right bank of the Racovăţ River, there is an extensive area of sierozem soil (Fig. 10). In the area occupied by the settlement, a rather thin layer of rendzina soils lies on top of Miocene limestone. Such soils are considered unsuitable for farming practices of that time (Kostrowicki 1973).

LOCAL ISOTOPIC ECOLOGY: AN OVERVIEW

Over the last 20 years, analysis of natural variations in stable isotope ratios ($^{15}N/^{14}N$, $^{13}C/^{12}C$) has revolutionized our view on animal trophic ecology. The stable isotope approaches, particularly those of nitrogen and carbon, may provide a number of potential advantages and have already enhanced our understanding of trophic structure and dynamics of ecological communities, such as the one located in the Edineţ region, as well as ontogenetic shifts in consumer diet. Stable isotopes offer three potential advantages in terms of food web analysis; firstly, the $\delta^{13}C$ and $\delta^{15}N$ ratios in animal tissue represent the integration of carbon and nitrogen over a prolonged period (integration of different functions and environmental events over time periods); secondly, they are based on assimilation rather than ingestion (measurement of the effective use of food); and third, they can be measured using comparatively small samples. In addition to time-integrated trophic information, isotope signatures have the potential to simultaneously capture complex interactions, including trophic omnivorous, and to track energy or mass flow through ecological communities.

Isotopic and elemental analyses have been executed within the scope of this project, and the data will be published in a separate paper. Here we will briefly summarize the results of isotopic analysis. The methodological principles have already been published

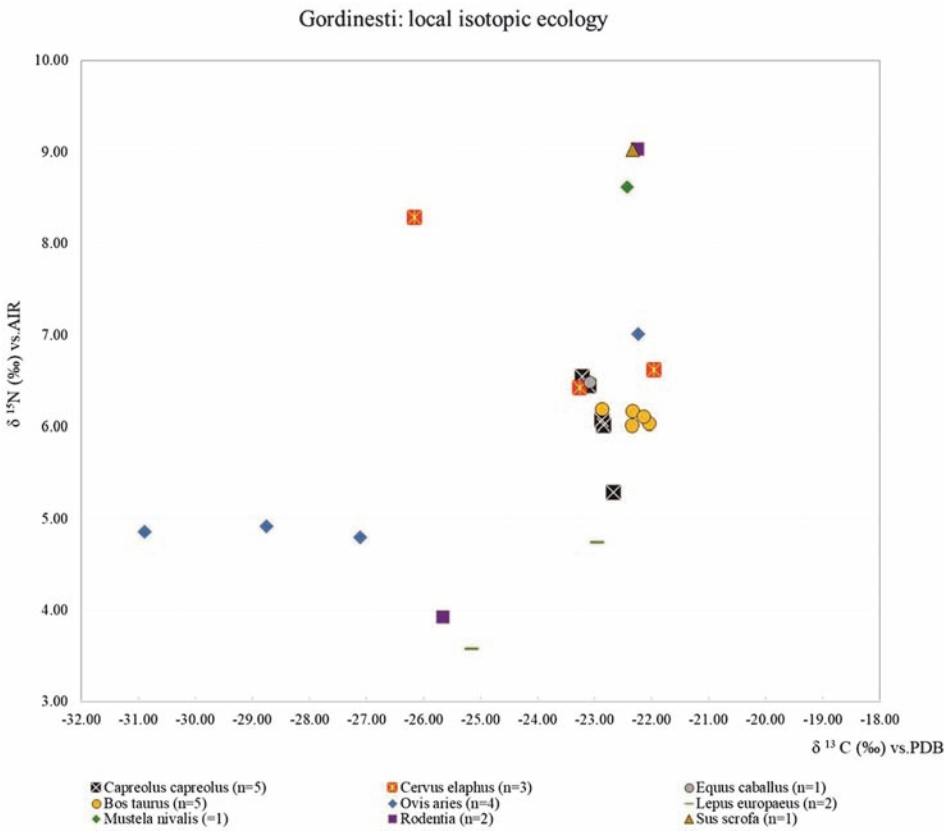

Fig. 11. Gordineşti II–Stînca goală. Local isotopic ecology

(Schoeninger and De Niro 1984; Ambrose 1993; Sealy 2001; Lee-Thorp *et al.* 1989; Grupe *et al.*1997; Katzenberg and Harrison 1997; Chenery *et al.* 2010; Evans *et al.* 2009).

The radiocarbon dating of organic materials from Gordineşti II was carried out on the basis of 12 samples from various backgrounds: $^{87}Sr/^{86}Sr$ isotopic analysis (137 measurements including baselines), $^{13}C/^{15}N$ dietary analysis (25 measurements), and trace elements analysis (As, Hg, Cd, Ba, Y, and a few others; 990 measurements). The analyses were carried out in collaboration with several laboratories in Poland and Sweden. Based on the available data, we can briefly characterize local isotopic ecology in Gordineşti. Unfortunately, the volume of bone remains from the settlement is limited; we do not have any human remains at all, and the animal bones are generally poorly preserved. However, skeletal remains of both wild (*e.g.*, red deer, weasel, rabbits, and rodents) and domesticated animals (cattle, several sheep, a horse, and a pig) were collected. The results of the $^{13}C/^{15}N$ analysis are shown in the diagram (Fig. 11).

The area of Gordineşti is fairly typical for the broader landscape of the Edineț region in northern Moldova, so we may apply our isotopic data to a broader region. This particular location suffered from deforestation, land degradation, and gradual aridification over centuries, and those global processes are visible in general carbon and nitrogen pool data obtained from the faunal sample. The diagram displays three clusters of isotopic data. Interestingly, the upper cluster includes a pig, a sheep, a wild weasel, and a red deer; the first two may have been non-local livestock brought by humans, while the other two may eventually represent migratory animals hunted down in the local forests by the inhabitants of Gordineşti II–Stînca goală. These data clearly indicate a foreign biome. The central cluster of the diagram is made up of the majority of samples, especially those of cattle (*Bos taurus*, marked in yellow). The last cluster comprises several samples of *Ovis aries* from Gordineşti II.

This brief overview enables us to formulate a series of fundamental observations. First of all, we find no evidence for use of manure or natural fertilizers at the Gordineşti II site. Secondly, we can also observe certain elements of livestock management techniques, for example, the diet of cattle and wild deer do not vary massively, both those animals occupying the same ecological niche. On the other hand, the isotopic data for sheep may signalize deliberate segregation from cattle by farmers. As both cows and sheep consume grass, the inhabitants of Gordineşti II–Stînca goală were trying to avoid food competition between them. Intensive sheep farming could be devastating for the biomass of local pastures and meadows, and in Gordineşti II we can see farmers keeping their cattle separated from sheep and goats. The final observation concerns rodents (mice and rats) who lived in the village; their diet indicates both scavenging and feeding on organic waste and represents a typical herbivore subsistence. It seems feasible that some vermin-attractive granaries existed there, but also a large volume of organic garbage accumulated all around the houses to attract synanthropic animals such as mice.

A SITE ABANDONED DUE TO CULTURAL OR ENVIRONMENTAL CAUSES?

Various geophysical prospections and the GIS KDE analysis have led to the conclusion that the Late Trypillia Culture settlement in Gordineşti II–Stînca goală was oval-shaped, with a central courtyard, probably empty and the settlement area was limited by a deeply incised river valley (Figs 4 and 5). To date, none of the surveys have identified a dwelling being situated in some sort of undeveloped area, so the houses were placed close to the natural edge of the raised area of terrain. The dwellings are located at some distance from each other. The site consisted of at least 15 houses (Rybicka *et al.* 2023). Accepting such premises provides us with an image of a small settlement inhabited by a small community.

The principles followed in dwelling use and their internal arrangement were quite uniform, and the same also applies to the stylistics of the pottery (Sîrbu *et al.* 2017; Sîrbu and

Król 2021) and bone tools (Pankowski 2019; 2023). This indicates that there was no disruption of cultural norms inside the Gordineşti II community. As we have already mentioned elsewhere, all three excavated dwellings date back to the same period. Radiocarbon dating does not identify the real length of their use, but there are relatively low levels of waste inside and around the dwellings, which may suggest a short time of occupation.

The use of the same pattern of dwelling arrangement and similarity of finds from both house interiors and their surroundings may suggest that the cause for site abandonment was not some sort of cultural change, for instance, as an effect of the impact of other human groups. Nor were any vestiges found of any social crisis stemming from, for example, an external threat. It is difficult to unequivocally determine whether the role of the rampart and ditch was as a defence against human attack or protection of livestock from predators.

Hence, in the absence of any clear evidence of a cultural crisis that could explain the site's abandonment, perhaps it was due to some economic or environmental reasons that it was no longer occupied.

Results of analysis of plant macroremains, animal bones and stable isotopes provide a record for a precursory overview of human activity at the Gordineşti II–Stînca goală settlement area. During the site's occupation, the cultivation of crops was of major importance. The samples of *Triticum dicoccon* and *Triticum monococcum* identified on the premises of all examined dwellings (Sady-Bugajska 2023) indicate that wheat was the primary grain type in the diet of the inhabitants of Gordineşti II–Stînca goală. It is not easy to assess the relevance of barley, which was represented by grains found inside all dwellings, yet in smaller numbers. The site is surrounded by fertile loess-based soils, favourable for the cultivation of grains (Fig. 10).

The diet was supplemented by meat, both from farm and wild animals (Croitor and Sîrbu 2017; 2019). Analysis of isotopes sheds some light on the husbandry techniques used. Sheep and goats were kept apart from cattle to avoid competition for their main source of food, *i.e.*, herbaceous plants. Cattle may have been grazed on the flat areas east and north of the settlement; sheep could have been grazed in a variety of grasslands down the valley and inside the settlement (Fig. 12). Intensive grazing of small ruminants can be destructive for forests and shrub communities, but it can also have a positive effect on the maintenance of meadows and pastures (Moinardeau *et al.* 2020). However, it is not easy to determine the herd size of various animal species that were bred in the Gordineşti II–Stînca goală settlement. The predominance of sheep bones among the finds near House1 is admittedly not direct proof of intensive ovine husbandry (*cf.*, Kruk 1980, 293-294), but may suggest that this species was important for the economy of Gordineşti II–Stînca goală; sheep not only provided meat for food but also wool for textiles as is evidenced by numerous finds of spindle whorls and loom weights.

Research to date has not revealed any buildings or spaces which may have been used to winter farm animals. The reason could be the current stage of exploration of the site, or

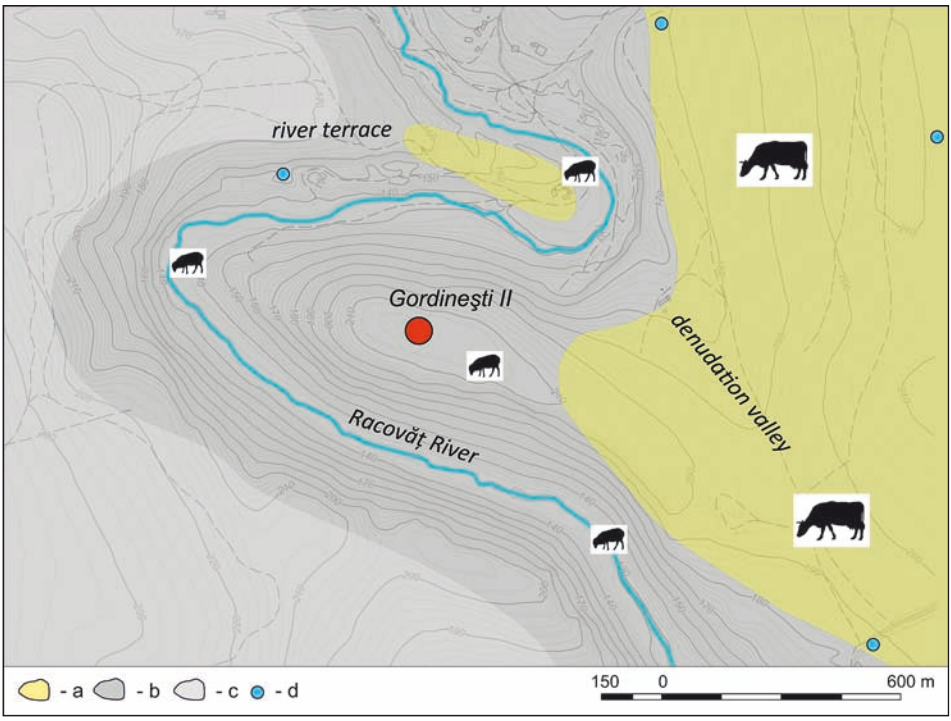

Fig. 12. Gordineşti II–Stînca goală. Possible areas for grazing animals. For further explanation see Fig. 10

this could be resulted from the character of site sediments, which are not conducive to the preservation of vegetation macroremains; these are found chiefly inside dwellings in the context of burnt daub clusters.

The inhabitants of these 15 – or a few more –houses could not have been many. They managed to grow crops and graze animals around the village, thus providing food for themselves. It was probably not a food crisis that led to the abandonment of Gordineşti II–Stînca goală.

A major hindrance for the inhabitants, particularly in winter, was limited access to stable sources of water, a commodity required in large quantities for animal husbandry (Kruk 1980, 316, note 40; Gillis *et al.* 2022). The Gordineşti II–Stînca goală settlement being located on a steeply sloped hilltop raised over 80 m above surrounding terrain made drawing water from the Racovăț River, or from springs, very difficult (Figs 2: 1-3; 5 and 10). No presence of wells inside the settlement has been recorded; also, the rock underlying the site would have made digging them an exceedingly difficult task. It may be carefully surmised that it was precisely this environmental factor – water access – which may have led to the abandonment of Gordineşti II–Stînca goală after a short period of occupation. Obviously,

to verify this suggestion, detailed environmental research should be undertaken to determine at least the approximated water conditions (deficiencies, fluctuations, *etc.*) at the end of the 4th millennium BC in the vicinity of the settlement. Another possible explanation for the lack of evidence of its long-term occupation could be its function as a subsidiary settlement dependent on the central one (*cf.* Moszyński 1953; Szmyt 2004). Sadly, we cannot confirm this suggestion at present because the settlement model (pattern) of the Late Trypillia communities of the Gordineşti Group is still poorly understood (Kobyliński 1988).

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