HIGH HOPES: ON SETTLEMENT STRATEGIES IN THE TRIBEČ MOUNTAINS (WEST SLOVAKIA)

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In the paper, preliminary results of archaeological research in the Tribeč Mountains are introduced, based on new data acquired by airborne laser scanning and their verification in the field. Thanks to this research, the view on the number and distribution of relics of anthropogenic activities in this area in the Late Bronze and Early Iron Ages has changed substantially. In addition to previously known hillforts, other structures were also newly identified, such as fortifications and new fortification elements, areas formed by numerous artificial terraces, as well as mounds and roads.

INTRODUCTION

In the Tribeč Mountains, Western Slovakia, there is a large concentration of hillforts dated to the Urnfield and/or Hallstatt periods, however, the present knowledge does not allow to resolve their relationships and to precise their dating. Most of the known settlements and cemeteries were located at the lower altitudes on more fertile soils of Žitava and Nitra hills and the Nitra River plain (Fig. 1–4). In the presented paper, preliminary results of the current archaeological research of habitation in the higher altitudes of the landscape will be presented, stimulated mainly by the data acquired by airborne laser scanning.

The Tribeč Mountains are located between the towns of Nitra, Partizánske, and Zlaté Moravce. They are part of Inner Western Carpathians and are surrounded by Danubian Lowland from the south and valleys of the river Nitra from the west and north, and the river Žitava from the east. The Tribeč Mountains consist of four units (from the south to the north): Zobor, Jelenec, Veľký Tribeč, and Rázdiel unit.

The geomorphological terrain of the Tribeč Mountains is from upland to highland (400–800 m above mean sea level) divided by deep stream valleys. The highest peaks are mountain tops of the main ridge, namely the Veľký Tribeč (829.6 m), Malý Tribeč (769.4 m), and Javorový vrch (730.6 m), all formed of granitoid rocks. In the SW part of the mountains, Žibrica (616.6 m) and Zobor (587 m) are the highest and most significant. They are formed of Mesozoic complexes (*Jahn 2009*, 10, 11). The peripheral parts of the Tribeč Mountains consist of resistant quartzites that form rocky hillocks, such as Hrdovická, Veľký Lysec, and Svinec (*Košťál 2007*, 23, 24).

Large parts of the Tribeč Mountains belong to the Ponitrie Protected Landscape Area.

HISTORY OF RESEARCH – TRIBEČ MOUNTAINS IN THE LATE BRONZE[1] AND EARLY IRON AGES

Information on finds and sites dated to the Urnfield and Hallstatt periods has been coming to light gradually from the early twentieth century. The finds were usually collected in the areas of hillforts. The hillfort on the top of Veľký Tribeč Mountain, along with adjacent roads and water sources in its

[1] In this paper, the term Late Bronze Age or the Urnfield period is used for a time span from the Br D to Ha B stage (including).

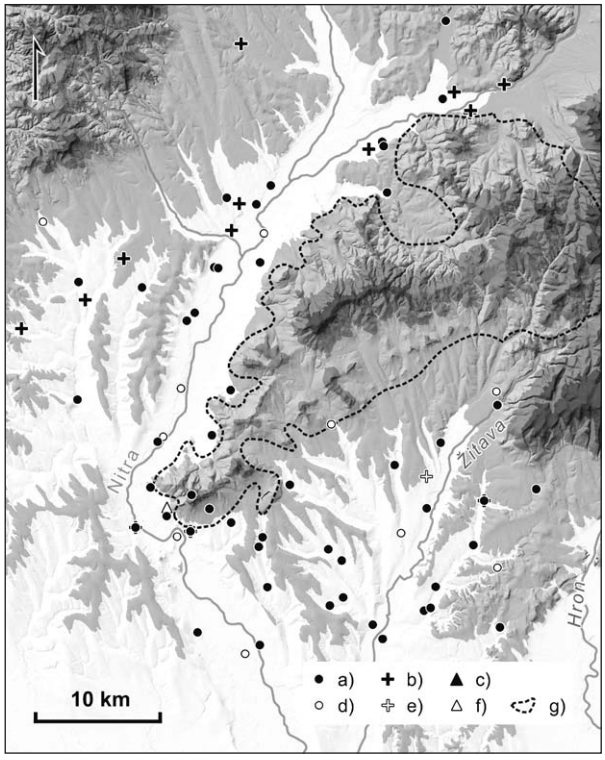

Fig. 1. Previously known sites dated to the Urnfield period (Br D–early Ha A2) in the wider surroundings of the Tribeč Mountains on a topographic terrain model. Legend: a – settlements; b – settlements of uncertain dating (e.g. 'Br D?'); c – cemeteries/burial mounds; d – questionable cemeteries/barrows; e – hillforts; f – hillforts of uncertain dating; g – the area of interest. The sites were mapped according to the available publications. Authors P. Kmeťová and P. Bisták; graphics T. Lieskovský.

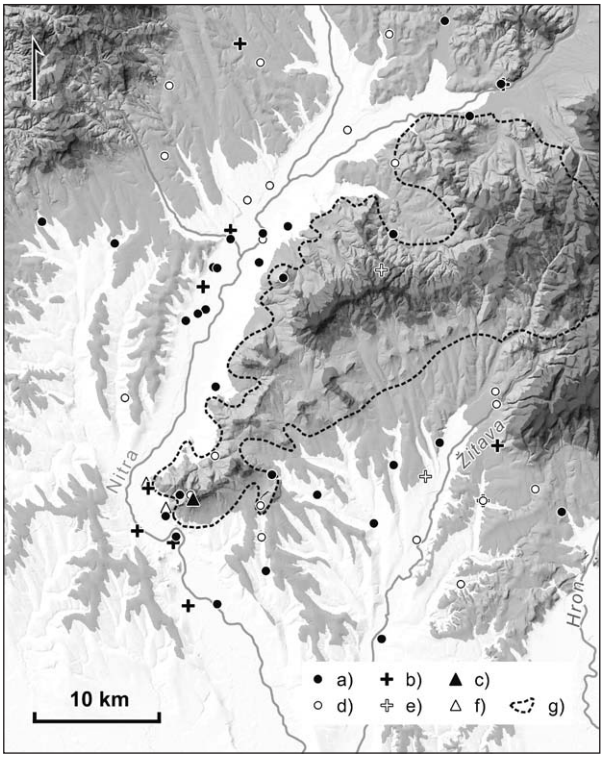

Fig. 2. Previously known sites dated to the Urnfield period (Ha A2–Ha B1) in the wider surroundings of the Tribeč Mountains on a topographic terrain model. Legend: a – settlements; b – settlements of uncertain dating (e.g. 'Ha A2–Ha B1?'); c – cemeteries/burial mounds; d – questionable cemeteries/barrows; e – hillforts; f – hillforts of uncertain dating; g – the area of interest. The sites were mapped according to the available publications. Authors P. Kmeťová and P. Bisták; graphics T. Lieskovský.

surroundings, was described and drawn by L. Odescalchi (*Odescalchi 1922*, 13–18). Hillforts on the tops of the Zobor and Žibrica Mountains were first mentioned by *J. Eisner* (*1923*, 125). Systematic surveys and geodetic documentation of fortified settlements in the 1920s and 1930s were realized by Š. Janšák who published ground plans, descriptions, and dating based on collected finds of hillforts in Nitra-Dražovce near Church of St. Michal, Nitra-Lupka, Nitra-Zobor, Žibrica and Veľký Tribeč (*Janšák 1929*). In the second half of the twentieth century several hillforts were discovered: Veľký Lysec near Kostoľany pod Tribečom, Šiance near Klátova Nová Ves, Hradište near Malé Uherce, and Michalov vrch near Kolačno.

Only a few hillforts have been excavated up to now, most of all by a small-scale trenching: Tábor near Krnča (Ha C1 + ?), excavations in 1965–1966, 2017 (*Benadik 1967*, 612–618, 622; *Felcan/Gróf 2019*), and yet unpublished rescue excavations in recent years; Zobor near Nitra (Ha B1–esp. Ha B3–Ha C1), excavations in the late 1960s, 1973, and 1986–1987 (*Danielová 2017*; *Veliačik/Romsauer 1994*, 122); Šiance near Klátova Nová Ves (Ha B3–Ha C1), excavations in 1972 (*Wiedermann 1985*, 51); Žibrica near Štitáre (Ha B3–esp. Ha C and Ha D1), magnetic survey in 2000 and 2005, and excavations in 2002–2003 (*Felcan 2019*; *Felcan/Stegmann-Rajtár 2018*; *Stegmann-Rajtár 2004*); and Veľký Lysec and Malý Lysec hillfort[2] near Kostoľany pod Tribečom (Ha C–Ha D1), excavations in 2013–2014 (*Borzová/Borza/Bisták 2014*; *Romsauer/Borzová/Bisták 2013*).

In a few other hillforts, only insignificant finds roughly dated to the Urnfield and Hallstatt periods were obtained during excavations aimed at habitation in the later eras: Michalov vrch near Kolačno (Hallstatt period?), Nitra-Dražovce (Ha A2–Ha B1 [?]), and Lupka in Nitra (Late Bronze Age; *Veliačik/Romsauer 1994*, 81, 121, 123, with additional references). Only field surveys with find collecting were carried out in the areas of hillforts Veľký Tribeč (Ha B3–Ha C1) and Hradište near Malé Uherce (Ha B3–Ha C1 [?];

[2] The fortified area of the hillfort stretches on two close hilltops, Veľký Lysec and Malý Lysec.

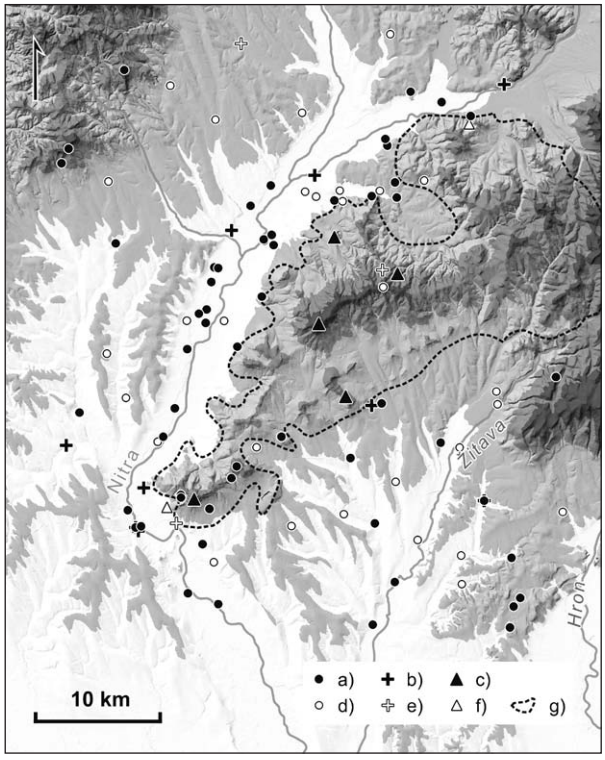

Fig. 3. Previously known sites dated to the turn of the Urnfield and Hallstatt periods (Ha B3–Ha C1 according to dating by *Veliačik/Romsauer 1992*) in the wider surroundings of the Tribeč Mountains on a topographic terrain model. a – settlements; b – settlements of uncertain dating (e.g. 'Ha B'); c – cemeteries/burial mounds; d – questionable cemeteries/barrows; e – hillforts; f – hillforts of uncertain dating; g – the area of interest. The sites were mapped according to the available publications. Authors P. Kmeťová and P. Bisták; graphics T. Lieskovský.

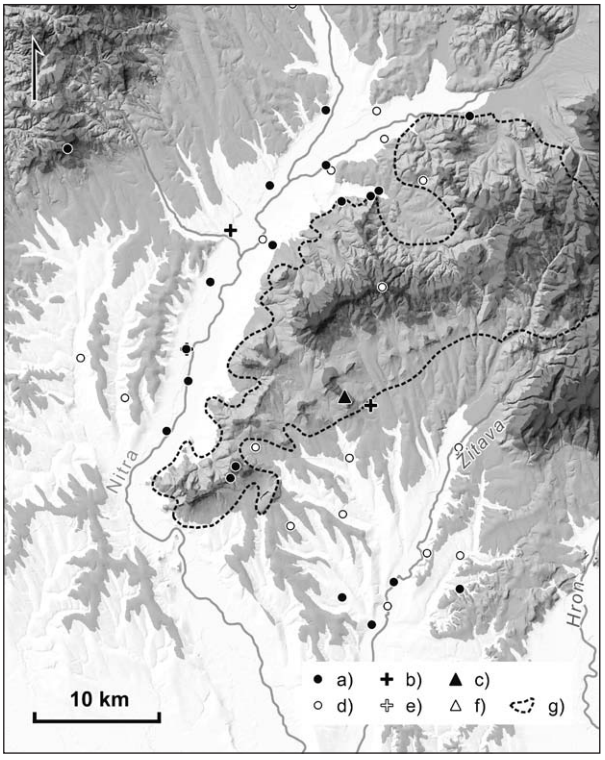

Fig. 4. Previously known sites dated to the Hallstatt period (Ha C2–Ha D1) in the wider surroundings of the Tribeč Mountains on a topographic terrain model. Legend: a – settlements; b – settlements of uncertain dating (e.g. 'Hallstatt period'); c – cemeteries/burial mounds; d – questionable cemeteries/barrows; e – hillforts; f – hillforts of uncertain dating; g – the area of interest. The sites were mapped according to the available publications. Authors P. Kmeťová and P. Bisták; graphics T. Lieskovský.

Veliačik/Romsauer 1994, 87, 142). In the case of Šípok hillfort near Malé Uherce, the published information is unclear (*Horňák/Stegmann-Rajtár 2008*, fig. 1).

Open settlements in the vicinity of hillforts were identified only sporadically in the woody highland terrain. They are known mainly from fieldwork and collecting finds in the areas as follows: some of the artificial terraces near hillfort Zobor (Late Bronze Age, Ha B3; *Pieta 2011*), near the hillfort Žibrica (*Felcan 2019*, 96, 100, fig. 42), and outside the fortified area of the hillfort Veľký Lysec and Malý Lysec (*Bisták/Borzová/Borza 2017*); and settlement on the hillock Hrdovická near Nitrianska Streda (Ha A2; *Vavák 2007*). A settlement was researched by trenching only in a single case: Panská hora/Panský les site near the Žibrica hillfort near Štitáre village: P. Romsauer, 1984, and the earlier fieldworks of Š. Janšák (Hallstatt period; *Felcan 2019*; *Janšák 1929*; *Romsauer 1985*).

METHODS

Recently, a large amount of new information was recovered from the evaluation of visualisations of data acquired by the airborne laser scanning, carried out from 2019 on. The anthropogenic relics were subsequently verified by field research.

Airborne laser scanning

For the area of interest, there are four sets of airborne laser scanning (ALS) data, but only one covers the entire territory of the Tribeč Mountains.

The first two ALS data sets were aimed only at selected areas and were of low density (*Bisták/Borzová 2018*; *Borzová/Bisták 2020*, 39, 40; *Borzová et al. 2017*; *Ruttkay 2017*, 302, 315–326). From 2019, a digital terrain model at a resolution of 1 m/px created based on ALS data by the National Forest Centre is also available; however, since ALS was performed during the vegetation period, it is not very suitable for archaeological remote sensing.

From 2017 on, the whole territory of Slovakia is gradually scanned under the auspices of the Geodesy, Cartography and Cadastre Authority of the Slovak Republic (GCCA SR). The area of the Tribeč Mountains has been scanned in winter and early spring 2017/2018 (region 08 Nitra) and 2018/2019 (region 13 Partizánske). The acquired ALS data are with a very high density of 20–40 points per m^2 and with an exceptionally high vertical accuracy of 3 cm and a positional accuracy of 12–15 cm. The data are available via open access in a form of digital elevation model at a resolution of 1 m/px (*Leitmannová et al. 2022*). For the purposes of archaeological remote sensing and field research purposes in the Tribeč Mountains, a digital elevation model was derived with a very high resolution of 25 cm/px and a special 'integrated' visualisation was developed that has been used for detailed archaeological remote sensing. Due to this, in the territory of approximately 261 km^2 (SW and central parts of the Tribeč Mountains), more than 11,500 assumed anthropogenic relics of various ages were identified, such as ramparts, ditches, artificial terraces, remnants of lime and charcoal kilns, field systems, vineyards, and roads, which substantially change the view on habitation and human use of the region in the past (*Bisták 2022*). For this study, the remaining NW part of Tribeč Mountains (Rázdiel unit) was investigated mainly using the above visualisations.

Archaeological field research

The use of ALS has caused a substantial improvement in the efficiency of planning and conducting field research. Visualisations based on high-resolution ALS data were used to create the *MB Tiles* file format imported into the *Locus Map Pro* application suitable for collecting fieldwork data (*Leitmannová et al. 2022*). Data acquired by archaeological remote sensing of visualisations of ALS data and by fieldwork were processed in the open-source *Quantum GIS* environment (version 3.16).

Archaeological field surveys in forested terrain from 2019 on comprised surveys focused on anthropogenic relics, and of surface artefact collection, supplemented by sample collection. Although the artefact collection is not optimal in the forested environment, it was carried out regularly during the mapping of anthropogenic relics in order to date and interpret the original function of identified areas (see *Kuna 2004*, 305). Since field surveys in the surroundings of the Veľký Tribeč hillfort have yielded only chronologically insignificant finds, and illegal pits dug by site looters with metal detectors were discovered in a few areas with anthropogenic relics, metal detector surveys were also carried out in a few areas in 2022 and 2023.[3]

In 2021, a survey was also carried out to find suitable wetlands to sample for pollen analysis in cooperation with the palynologist M. Čierniková on the eastern and western slopes of the central Tribeč Mountains, in the larger surroundings of the Veľký Tribeč Mountain. All presumed sites turned out to be unsuitable. Ultimately, a peat bog was sampled in Partizánske-Veľké Bielice outside the area of Tribeč Mountains; however, the results of the analysis are not yet available. The results of the pollen analysis are planned to be compared with archaeological dating of sites in the Tribeč Mountains from the Late Bronze Age onwards.

Geophysical survey

Non-invasive archaeological research was supplemented in selected areas by magnetic survey (*Pašteka/Mikuška 2021*). Data were gathered with a Bartington Grad 601-2 fluxgate gradiometer. The survey area was divided into grids and their corner points were measured using a GNSS set for precise localisation. The data were extracted in the standard way and the results were visualised after processing and filtration.

[3] The Monuments Board of the Slovak Republic has carried out the metal detector surveys in cooperation with the associations OZ Hradiská and Archeo Moravia z.s.

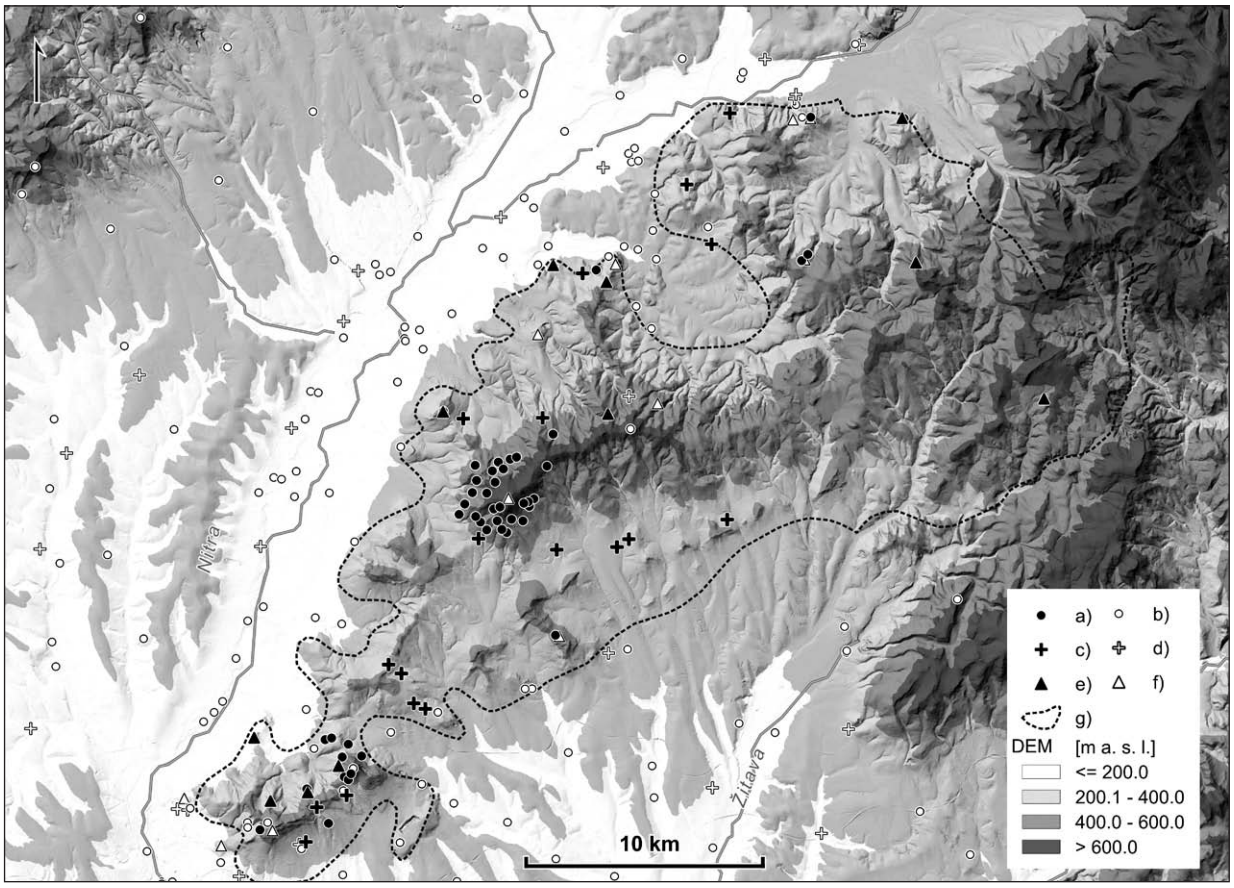

Fig. 5. Newly identified sites in the Tribeč Mountains possibly dated to the Urnfield and Hallstatt periods and previously known sites on a topographic terrain model. Legend: a – newly identified areas with artificial terraces – settlements (?); b – previously known settlements; c – newly identified burial (?) mounds/areas with burial (?) mounds; d – previously known cemeteries/burial mounds; e – newly identified hillforts; f – previously known hillforts; g – the area of interest. Previously known sites were mapped according to available publications. Authors P. Bisták and P. Kmeťová; graphics T. Lieskovský.

The distance between the measured lines was 1 m and the data acquisition used a sampling interval of 0.125 m. The internal precision of the measured induction field vector magnitude was ±0.1 nT, the acquisition error (outer resolution) was approximately ±1 nT. The positioning of acquisition points was performed in a local coordinate system (local northing and easting directions were used), and later the data were transformed into the global system JTSK-03. After the field data acquisition was completed, the data were transferred to a PC, where basic quality control was performed. Data have been corrected for diurnal variations of the Earth's magnetic field by means of a median filter applied to each data line. Subsequently, the data were interpolated by means of a kriging method into a regular grid with cell dimensions 0.25 × 0.25 m. The median filter was applied, and the Earth's normal magnetic field removed to derive the anomalous magnetic field.

Acquired magnetic field anomalies were displayed as a black-and-white map, which was later interpreted for archaeological use.

NEW KNOWLEDGE ACQUIRED BY CURRENT ARCHAEOLOGICAL RESEARCH

A significant amount of previously unknown anthropogenic structures of assumed Late Bronze and Early Iron Age dating have been identified in the Tribeč Mountains based on ALS data. Most of these structures were verified by field survey. These structures include previously unknown fortification structures of long-known hillforts, newly recognised fortified sites and ramparts, areas of artificial terraces, roads systems between these areas, and burial (?) mounds (Fig. 5).

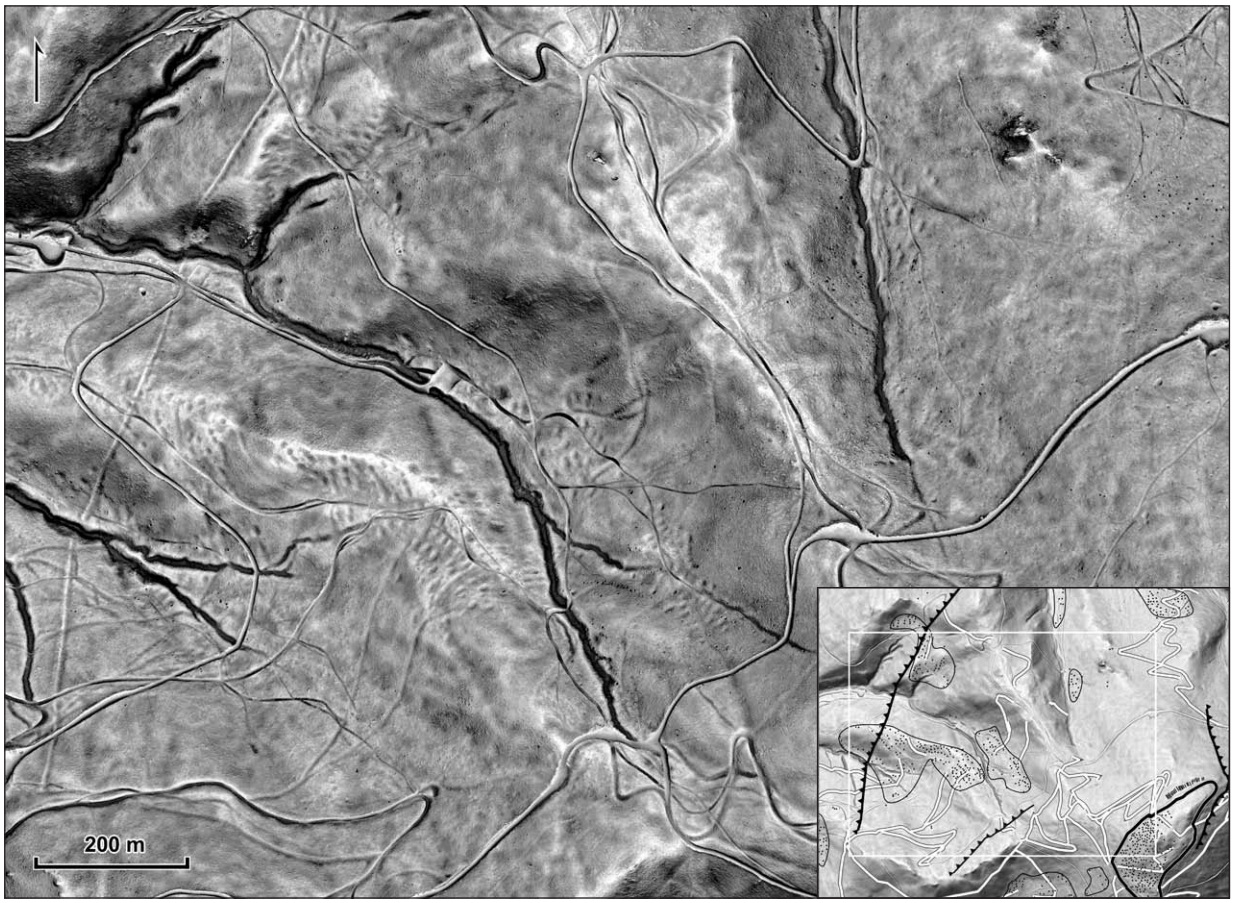

Fig. 6. Terrace concentrations on the north-western slopes of the Veľký Tribeč Mountain. Source GCCA SR; visualisation T. Lieskovský.

Fortified sites

Several previously unknown fortifications and smaller fortified areas were recognised (Fig. 5: e). These small hillforts thicken the network of fortified areas in the Tribeč Mountains. The existence of the rampart was newly recognised in some of previously known sites (Nitrianska Streda, site Hrdovická; Klátova Nová Ves-Sádok, site 'vicinity of the church'). Current research has also identified the site of unknown location ('hillfort near Javorový vrch hill') from where the Hallstatt period pottery finds were reported (*Ruttkayová/Ruttkay 1991*, 58) with a small hillfort Brloh near Krnča. As for newly recognised enclosed sites, field surveys in some of them have not yet bring any finds (Podhorany-Mechenice, sites Korytnice, Horanča, and Pod Žibricou; Staré háje near Klátova Nová Ves; Chlmok near Pažiť), and some have not yet been surveyed (Oselný vrch near Veľké Uherce, and Noviny near Malá Lehota).

Archaeological remote sensing of visualisations based on ALS data combined with field surveys has also brought a variety of new information on known hillforts, such as hillforts Zobor, Žibrica, Veľký Lysec and Malý Lysec, Veľký Tribeč, Tábor near Krnča, and Šiance near Klátova Nová Ves (Fig. 5: f; *Bisták 2022*).

Artificially formed terraces

Previous research has recognised artificially formed terraces in the Tribeč Mountains only sporadically. Some of them were detected in the areas of hillforts and their surroundings (Veľký Lysec and Malý Lysec [*Bisták/Borzová/Borza 2017*, 52–56]; Zobor [*Pieta 2011*, 202]; Žibrica [*Felcan 2019*, fig. 39; *Jansák 1929*, 12, 13, fig. 19; 20; *Stegmann-Rajtár 2004*]).

Fig. 7. Large terraces in the area north of the Žibrica hillfort. Photo P. Kmeťová.

Nevertheless, recent archaeological research based on visualisations of ALS data revealed that slopes with artificially formed terraces are much more frequent in the territory of the Tribeč Mountains, within the enclosures of hillforts,[4] but mainly in their immediate vicinity, usually within a distance of 500 m. Exceptions to the rule are two largest zones with concentrations of terraces in the broader surroundings of the Žibrica and Veľký Tribeč hillforts, with the most distant terrace concentrations about 1.5 km (Žibrica), and 3 km (Veľký Tribeč) from the hillfort. Together, 2,665 terraces have been counted, of which 2,127 were outside the hillforts located mainly in 50 concentrations (Fig. 5: a).[5] Up to now, 29 areas with terraces outside the hillforts and seven within the hillforts have been verified by the field survey. In the Zobor unit of the Tribeč Mountains, 509 terraces have been recorded (the Zobor and Žibrica hillforts and their surroundings), in the Veľký Tribeč unit 2,012 terraces (Veľký Tribeč, Veľký Lysec and Malý Lysec, Tábor, and Šiance hillforts, with their surroundings), and in the Rázdiel unit 144 terraces (Michalov vrch near Kolačno, Hradište near Malé Uherce, Šípok near Malé Uherce, and Chlmok near Pažiť hillforts, with their surroundings). The terrace concentrations form spatially limited areas that might be considered as individual components (Fig. 6). The largest area with terraces (approximately 25 ha) is located on the northern slopes of Žibrica. The area of other concentrations reaches 0.5 to 12 hectares. The areas with terraces are located at an altitude of 276.6 m to 827.9 m with an average altitude of 522.7 m.

Most of the terraces appear to have been created by cutting them into a slope forming flat platforms of roughly oblong to oval ground plan. The areas of these platforms range from 25 to 80 m^2. Occasionally, exceptionally large terraces occur, especially north of the surroundings of the Žibrica hillfort, where their areas reach up to 500 m^2 (Fig. 7). At least some terraces have been constructed with the dry-stone

[4] Artificial terraces have been identified within the enclosures of most of the larger hillforts: Zobor, Žibrica, Veľký Lysec and Malý Lysec, Veľký Tribeč, Šiance, Tábor near Krnča, Hradište and Šípok near Malé Uherce, Chlmok near Pažiť.

[5] A terrace concentration, as used in this paper, is an area with at least three terraces close to each other. However, a low number of terraces (three to nine) have been recorded only in eight cases, while in most cases the concentrations consist of several dozens of terraces.

Fig. 8. A terrace with a dry-stone wall that stabilises its front located in the area west of the Veľký Lysec and Malý Lysec hillfort. Photo P. Bisták.

wall stabilising its front, as documented in three terraces in the surroundings of the Veľký Lysec and Malý Lysec hillfort (Fig. 8; *Bisták 2022*, 74).

Artificial terraces that were field surveyed in the Tribeč Mountains have similar appearance and character; therefore, it is assumed that they had the same or similar function, including terraces that have not yet been surveyed. They differ considerably from other terrace-like structures, such as remains of charcoal kilns.[6] The field surveys in most of the areas provided only insignificant pottery sherds and clay daub fragments. The function of terraces as settlement units or at least as production sites is indicated by the discovery of 15 loom weights in a wind-throw on a terrace west of the Veľký Tribeč hillfort (see below).

Burial (?) mounds

There is only a very limited amount of information on the Late Bronze or Early Iron Age burial places in the region of the Tribeč Mountains. Geographically closest earlier known cemeteries are located in the lowland or at the foothills (Fig. 1–4; *Veliačik/Romsauer 1994*, 95, 101, 111, 119, 121–125, 141, 142, 123, 139–141, 154, 155, 211, 212, with references). Nevertheless, archaeological remote sensing of visualisations of ALS data has identified 36 mounds in the Tribeč Mountains (Fig. 5: c). Subsequent field survey has examined 11 of them in cadastral communities of Nitrianske Hrnčiarovce, Dolné Štitáre, Žirany, Solčany, and Práznovce, and nine of them appear as burial mounds. These mounds have smaller dimensions and are hardly visible in the woods. They form groups of two to four or five mounds. The earlier survey in the area around the mounds in Nitrianske Hrnčiarovce yielded some Hallstatt period pottery sherds (*Ruttkay 2017*, 320; *Veliačik/Romsauer 1994*, 126). However, without further research, the function and dating of the mounds are assumed only.

[6] In the Tribeč Mountains, remains of approximately 2,000 charcoal kilns have been recorded, and many of them were also verified by the field research. Platforms with remnants of charcoal kilns located on the slopes are round to oval with sharper and less eroded rims (*Bisták 2022*, 129–137) than the artificial terraces presented in this article.

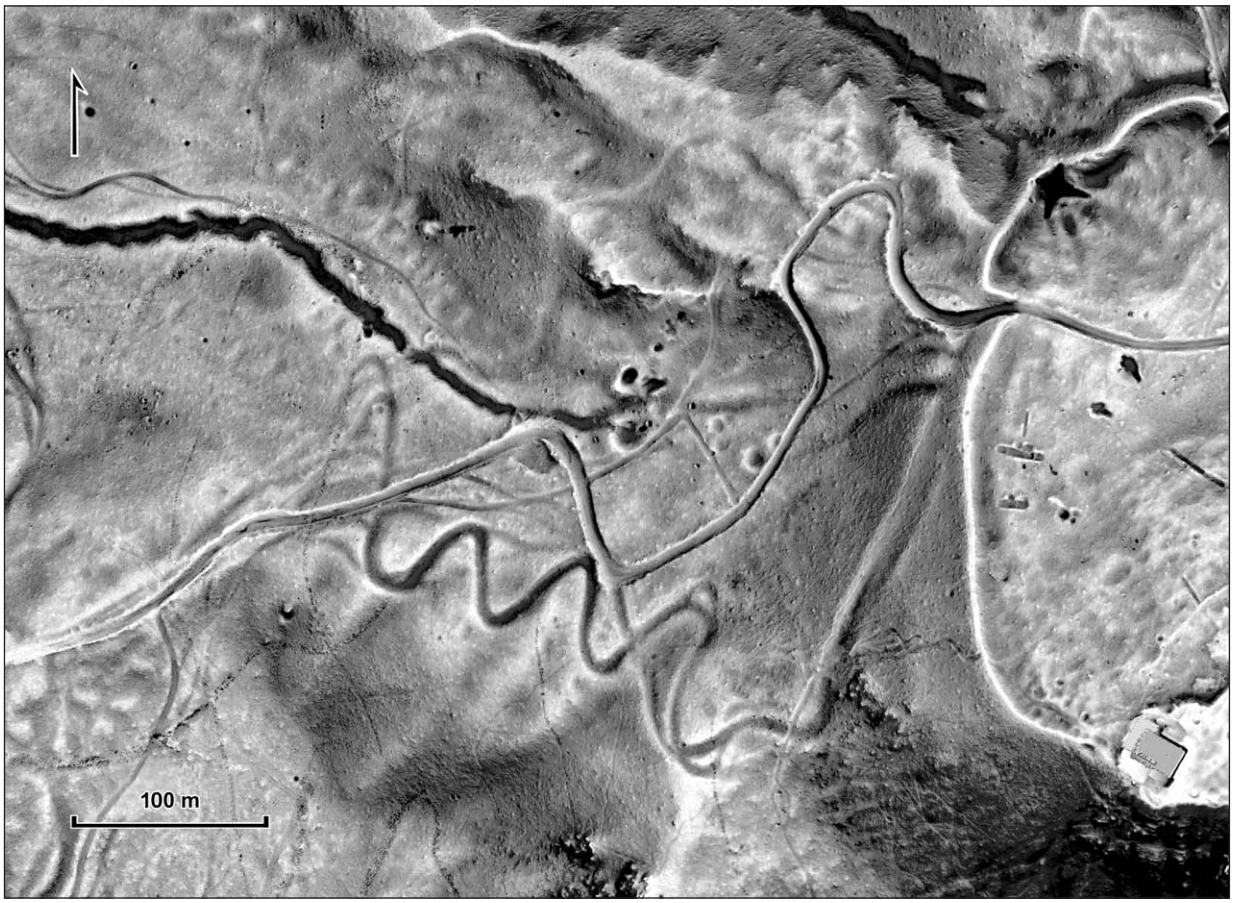

Fig. 9. Prehistoric (?) road leading to/from the western gate of the Zobor hillfort. Source GCCA SR; visualisation T. Lieskovský.

Roads

Visualisations of the ALS data have also revealed hundreds of old road lines. The first reports on the ancient roads in the Tribeč Mountains were published in the early twentieth century. The roads leading to the Veľký Tribeč hillfort were described and sketched by count L. Odescalchi from the nearby village of Solčany. He also mentioned the so-called Curved road, which was considered very ancient by locals and was already not in use at that time (*Odescalchi 1922*, 15–18, fig. 4; 5). A part of the road leading to the Žibrica hillfort was documented by Š. Janšák (*1929*, 12, 13, fig. 19).

The roads identified by the current research vary and often form stratigraphy with other roads. Based on these facts, the earlier (prehistoric?) level of communications was divided from the later levels of communications. In contrast to the hollow ways of the Middle Ages and Modern Era of 2.5–4 m width and usually grouped in bunches of numerous lines, the roads of the earlier (prehistoric?) level were wider (4–7 m) and were usually represented by a single rather shallow hollow way, only occasionally by two or more lines. The wide and shallow roads also lead from the entrances of the hillforts and decline moderately, usually in a serpentine style (Fig. 9). This type of communication was also documented in areas with terraces, and their solitary segments also in the lower parts of the Tribeč Mountains, however, only as very shallow lines. These roads connect hillforts with each other, and hillforts and terraced areas in their surroundings, in several cases. Furthermore, roads of this type are disturbed by later bunches of hollow ways (of the mediaeval and Modern Era type) or other mediaeval to modern or recent era structures. Together, 311 segments of these earlier (prehistoric?) roads have been documented. Their length is 114.44 km in total. Although these communications have not been dated by finds so far, it can be assumed that at least some of them were of the same age as the hillforts and areas with artificial terraces in their surroundings.

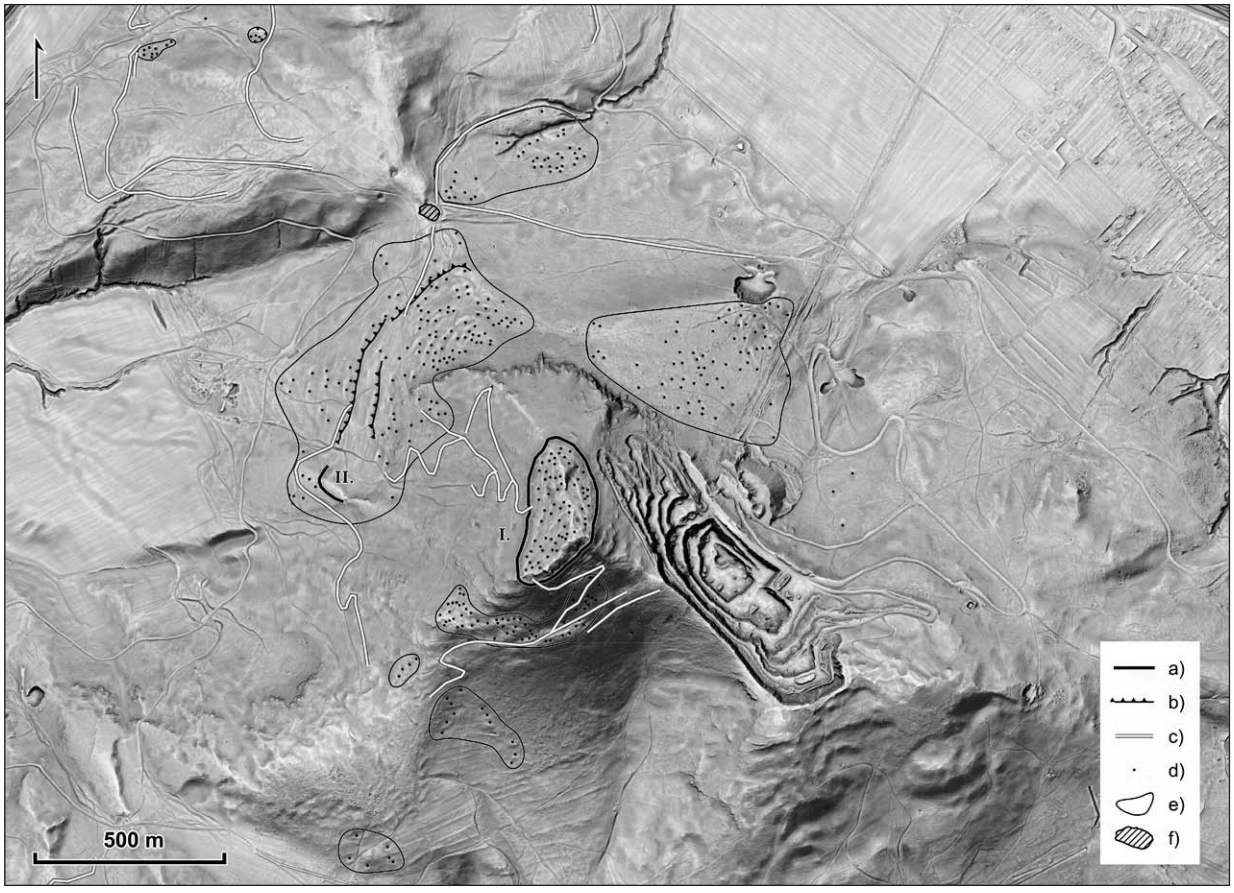

Fig. 10. Žibrica hillfort and its surroundings. Legend: a – ramparts of the Žibrica hillfort (I) and newly identified hillfort (II); b – lines of assumed ramparts; c – prehistoric (?) roads; d – settlement terrace; e – areas with artificial terraces; f – water reservoir. Source GCCA SR; interpretation P. Bisták; visualisation T. Lieskovský.

CASE STUDIES

Žibrica hillfort and its surroundings

The Žibrica hillfort was built around the summit of the Žibrica mountain, the natural dominant of the northeast part of the south Tribeč Mountains (Zobor Mountains/Zoborské vrchy), situated on the border of three cadastral communities (Žirany, Podhorany-Mechenice, and Štitáre-Dolné Štitáre). The hillfort in height 565 to 617 m covers an area of approximately 5.6 ha. It was in use from the end of the Bronze Age (Ha B3) to the early Ha D1, and the most numerous finds are dated to Ha C and Ha D1 stages. Sporadic finds indicate the habitation also in the Middle La Tène period, High Middle Ages, and Modern Era (*Felcan 2019*; *Felcan/Bisták/Lieskovský 2020*; *Felcan/Stegmann-Rajtár 2018*; *Stegmann-Rajtár 2004*).

Artificial terraces inside the enclosed area, as well as southwards and eastwards from there, were already recorded by earlier research (*Felcan 2019*, fig. 39; *Janšák 1929*, fig. 19). Recent research based on ALS data has also identified terrace concentrations to the north and northwest from the hillfort, up to a distance of 1.5 km (Fig. 10). In total, 65 terraces have been recorded in the enclosed area of the hillfort and 337 terraces outside. Field surveys were carried out in the southern, western, and northern areas with terraces and yielded mainly pottery sherds (also some specimens with Hallstatt period decoration), a pyramid-shaped loom weight and also a few small metal finds dated to the Hallstatt and La Tène periods.[7] Terrace concentrations to the north and northwest of the hillfort are exceptional for their very large terraces. The area of some of them is up to 500 m^2 and they are visible especially on steep slopes (Fig. 7).

[7] Metal detector survey in the area of western and northern terraces was performed in spring 2023 and is not yet evaluated.

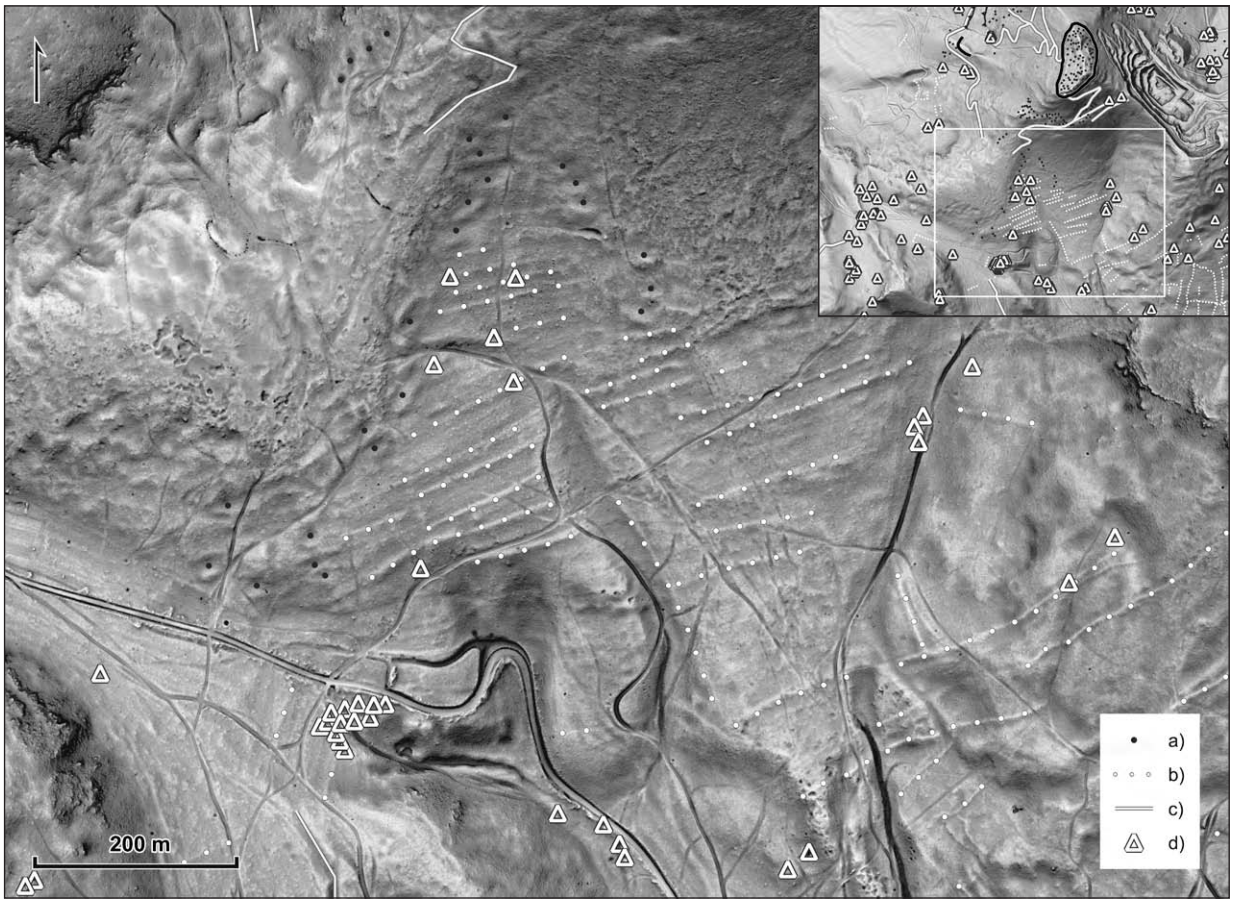

Fig. 11. Štitáre, site Panský les. Legend: a – settlement terrace; b – 'lynchets' of abandoned field area; c – prehistoric (?) roads; d – remains of lime kilns. Source GCCA SR; interpretation P. Bisták; visualisation T. Lieskovský.

An interesting situation appears in the area south of the hillfort, on the Panský les (Panská hora) site near Štitáre village. Several types of archaeological relics are preserved there: the artificial terraces of oval to elongated oval ground plan right under the steep slopes, the 'lynchet' field system and the remnants of lime kilns of most likely Modern Era origin (Fig. 11). Between the oval terraces and the 'lynchet' field system, some less visible terrace-like structures are observable, as if the oval terraces were partially erased by later 'lynchets'. The Panský les site was known from the earlier field surveys and a small rescue excavation in 1984, all focused on the areas outside the oval terraces – on the area of 'lynchets' and the present-day forest road (*Felcan 2019*, 90–93, fig. 39; *Janšák 1929*, 12, 13, pl. VI: 19; *Romsauer 1985*). The rescue excavation (*Romsauer 1985*) yielded finds of layers of destructed clay daub and numerous pottery sherds of settlement-like character dated to the Hallstatt period (*Romsauer 1993*, pl. V). The dating of the site to the Early Iron Age (Ha C–Ha D1) and estimation of its function as a settlement was corroborated by the current field survey which recorded the occurrence of pottery sherds and fragments of clay-daub scattered throughout the area, also collected find of a small boat-shaped fibula with a rhomboid-shaped bow of arch cross-section with two side knobs and a decoration on top of the bow (lines made by chasing), and originally with a long foot (Fig. 12: 1; *Eles Masi 1986*, 136–141, pl. 104–110, esp. Nos. 1257, 1296, and 1304; *Novotná 2001*, 82, 83; *Říhovský 1993*, 93, 94; *Trachsel 2004*, 207, 220–242; *Vavák 2015*, 222) and several other Hallstatt period finds.[8] Therefore, the settlement was contemporaneous with the habitation of the Žibrica hillfort. If we assume that the finds relate to the use of oval terraces similarly to the terraces at the Žibrica hillfort (see *Felcan 2019*, 98–103; *Stegmann-Rajtár 2004*), not to the later 'lynchets' (assumed field

[8] The most recent metal detector surveys in 2023 and 2024 (realised after submission of the article) have brought collection of small finds dated to the Hallstatt period (including bronze fibulae of several types, pendants, small bronze and iron horse-harness fittings, knives with bent back and several bronze triangular arrowheads of the so-called early eastern or early Scythian type).

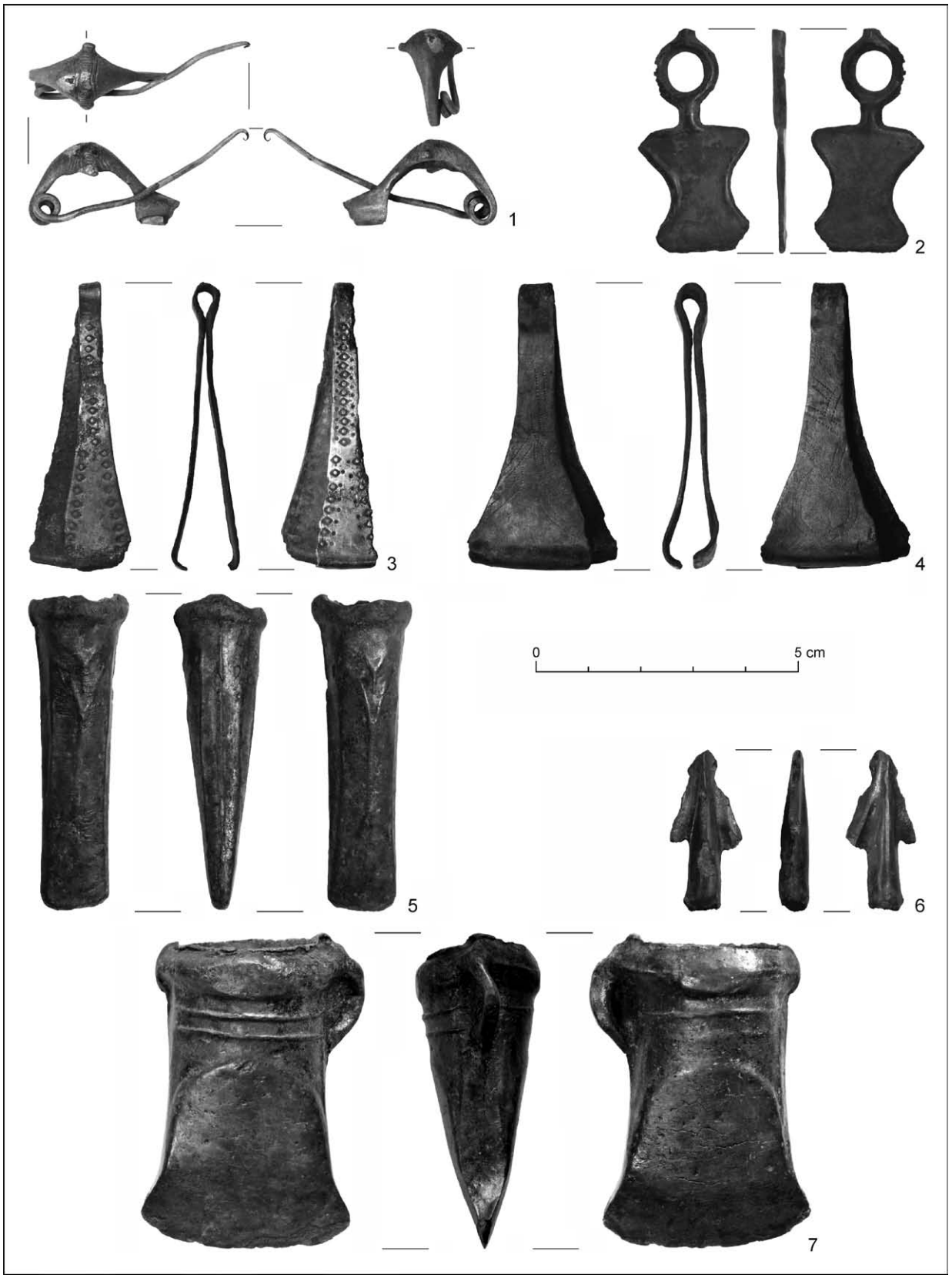

Fig. 12. Selected finds discovered during the surveys in the Tribeč Mountains in 2022. 1 – Štitáre, Panský les site in the vicinity of the Žibrica hillfort, bronze boat-shaped fibula collected; 2–7 – Kovarce and Nitrianska Streda, east and north slopes of the Veľký Tribeč, bronze artefacts found during the survey with metal detectors, 2 – sand-glass-shaped pendant, 3, 4 – tweezers, 5 – socketed chisel, 6 – arrowhead, 7 – socketed axe. Photo and graphics P. Kmeťová.

system), it can be hypothesised that the settlement originally consisted of much more oval terraces than is preserved and was once much larger than was considered by earlier research.

Other newly discovered anthropogenic relics in the surroundings of the Žibrica hillfort are as follows: a small fortified site Pod Žibricou; in its vicinity two parallel wall-like structures 350 m and 200 m long leading roughly along the contour lines; and to the north another parallel wall-like structure of 250 m in length, in the field all appearing as a sharp edge, and lines of prehistoric (?) roads including those connecting the hillfort with areas with terraces. The rim of the terrace concentration on the northern slope of the Žibrica is also lined by a low wall of about 60 m in length.

It is also worth mentioning that in the saddle north of the Žibrica hillfort there is a clearly visible dam of assumed water reservoir (wet environment up to the present) and several nearby situated water springs (Kamenný most site) from where the finds of insignificant pottery sherds were collected. A similar dam and a depression, interpreted as a water reservoir or iron ore mining remains (*Baxa et al. 2016*, 70), are in the saddle between the Veľký Lysec and Malý Lysec hills (parts of a single hillfort complex; *Bisták/Lieskovský 2020a*).

Thus, the area of the hillfort, together with presumably settlement areas with terraces, delimited by anthropogenic relics and verified by collected finds, is almost 2 km^2 (193 ha) in total.

Veľký Tribeč hillfort and its surroundings

The Veľký Tribeč hillfort (Fig. 13) is located on the main ridge of the Tribeč Mountains on the summit of the highest mountain Veľký Tribeč (829.6 m), in the border of two cadastral communities (Kovarce and Velčice). The fort covers an area of 15.6 ha, with several entrances in the rampart. On the platform near the summit, remains of a stone enclosure were documented (*Bisták/Lieskovský 2020b*; *Katkinová/Katkin 2002*). However, no excavations were carried out at the hillfort, only field surveys that yielded sporadic finds of pottery sherds dated to the turn of the Bronze and Iron Ages (Ha B3–Ha C1; *Veliačik/Romsauer 1994*, 87). Based on these finds and the lack of information on other structures within the hillfort, it was hypothesised that the site might have served for seasonal transhumance and pasturing (*Horňák/Stegmann-Rajtár 2008*, 49).

The archaeological view of the hillfort and especially its surroundings has changed substantially based on ALS data, subsequent field surveys, and magnetic surveys. A variety of new data acquired from 2020 on either refined the knowledge on already known elements of the fortification, or brought completely new information on previously unknown structures.

The stone enclosure located *inside the fort* near the summit, known from the earlier surveys (*Katkinová/Katkin 2002*), has an area of 60 × 40 m and an opening in the south near the road crossing the hillfort (an entrance?). This road connects the northwest gate to the northeast gate and leads between two highest places on the hillfort (*Bisták/Lieskovský 2020b*). Archaeological remote sensing of the enclosed area did not yield any other structures in the higher northeast part, but in the steeper south-western part identified a clearly visible system of terraces ordered in rows. Altogether, 225 terraces have been counted there. Field surveys have also yielded a small number of pottery sherds dated to the Ha B and Ha C (?) stages.

A geophysical survey (*Pašteka/Mikuška 2021*) has been carried out in two areas in the northern parts of the Veľký Tribeč hillfort and partly beyond the enclosure and covered an area of about 1 ha in total (Fig. 14). Visualisations of the magnetometric data revealed anomalies representing various archaeological features and contexts, including a burnt feature, probably a furnace. It is worth noting that the detection of various settlement features is an important result within the hillfort, since settlement features are only rarely detectable within hillforts located in forested areas.

A massive *rampart of the hillfort* (*Bisták/Lieskovský 2020b*) was made of quarry stone. Its reported height of 0.5 to 1 m from the inside (*Jansák 1929*, 17) is correct but rather misleading, since the height from the outer side reaches up to 4 to 7 m and the width of the wall is 20 to 26 m. The northern rampart is widened on the outer side by a lower rampart or a 'step' of 6 to 10 m in width. Yet it is unclear whether it was part of the fortification system or an evidence of two phases of building the fortification. The rampart is open in several places. In the early 20th century, four old openings in the fortification were reported (*Odescalchi 1922*, 14, 15, fig. 1; 2). All of them are clearly visible on the visualisations of ALS data: on the north-western side there is a semi-pincer gate (a tangential entrance with a single wall inturned, creating a short passageway between two terminals), and simple entrances are on the north-eastern, south-western, and

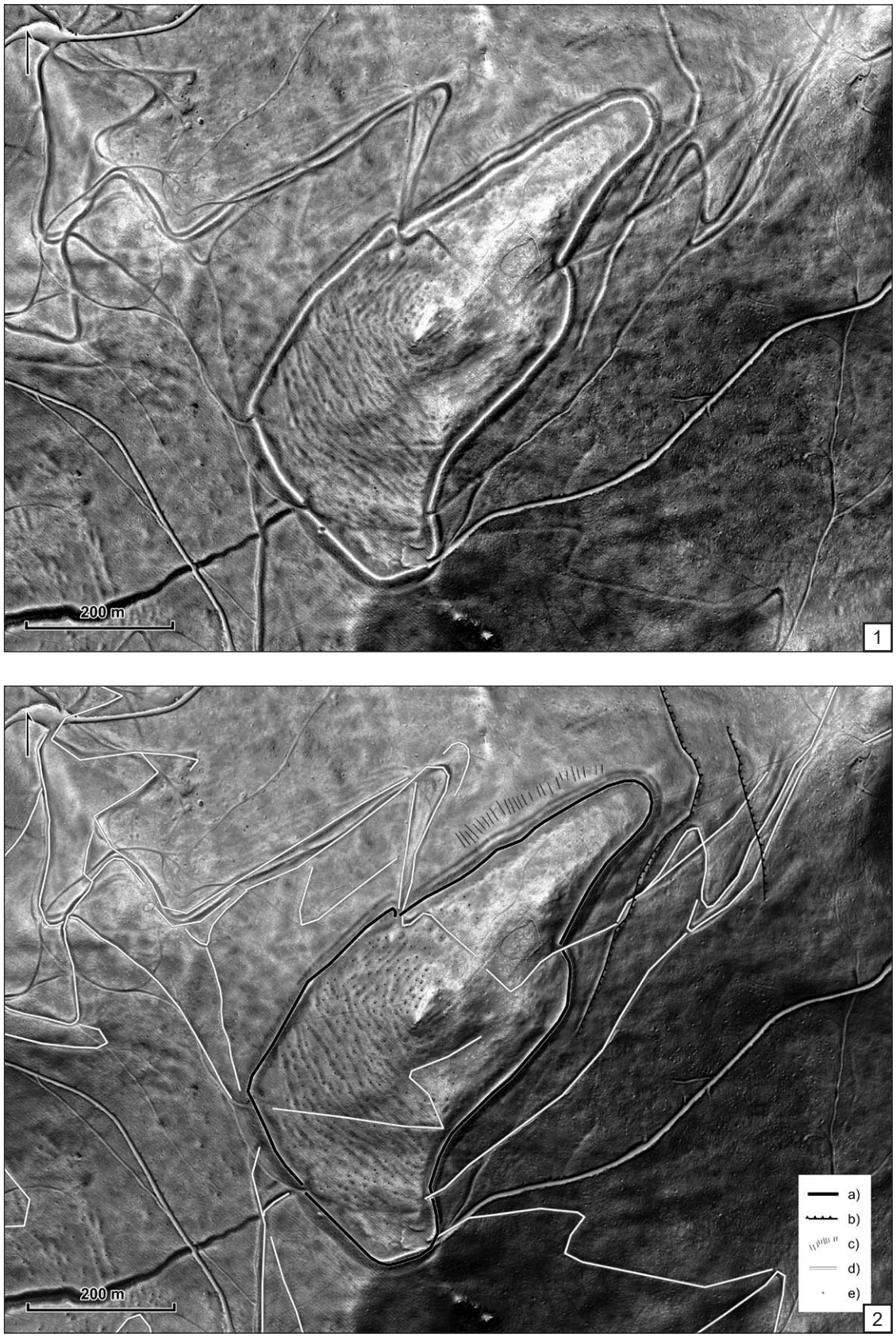

Fig. 13. DEM of Veľký Tribeč hillfort with clearly visible elements of fortification and inner structure. Legend: a – fortification of the hillfort; b – ramparts I–II; c – cross-ditches; d – prehistoric (?) roads; e – enclosed area; g – settlement terrace. Source GCCA SR; interpretation P. Bisták; visualisation T. Lieskovský.

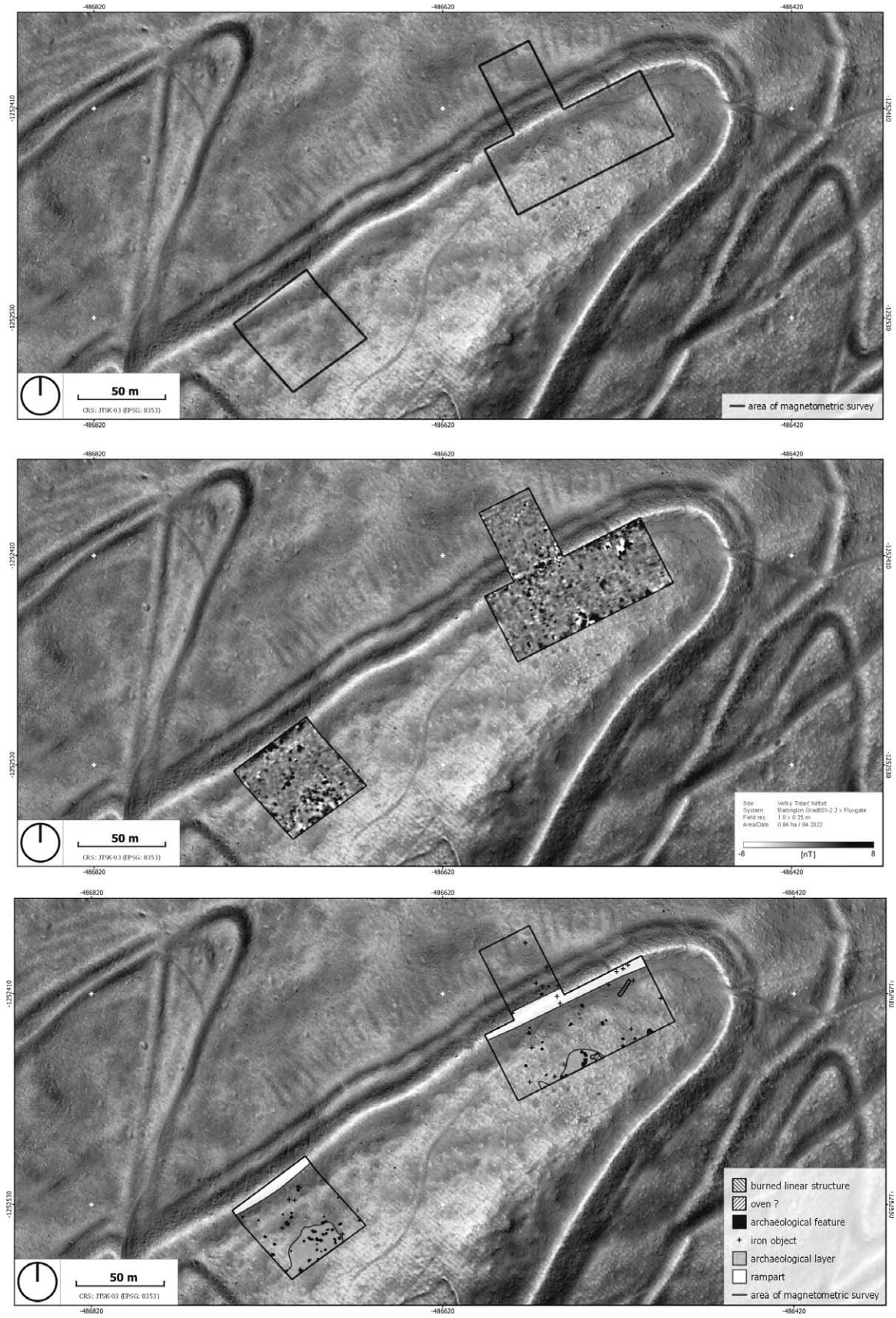

Fig. 14. Geomagnetic survey areas in the Veľký Tribeč hillfort, with results and interpretation. Author M. Felcan.

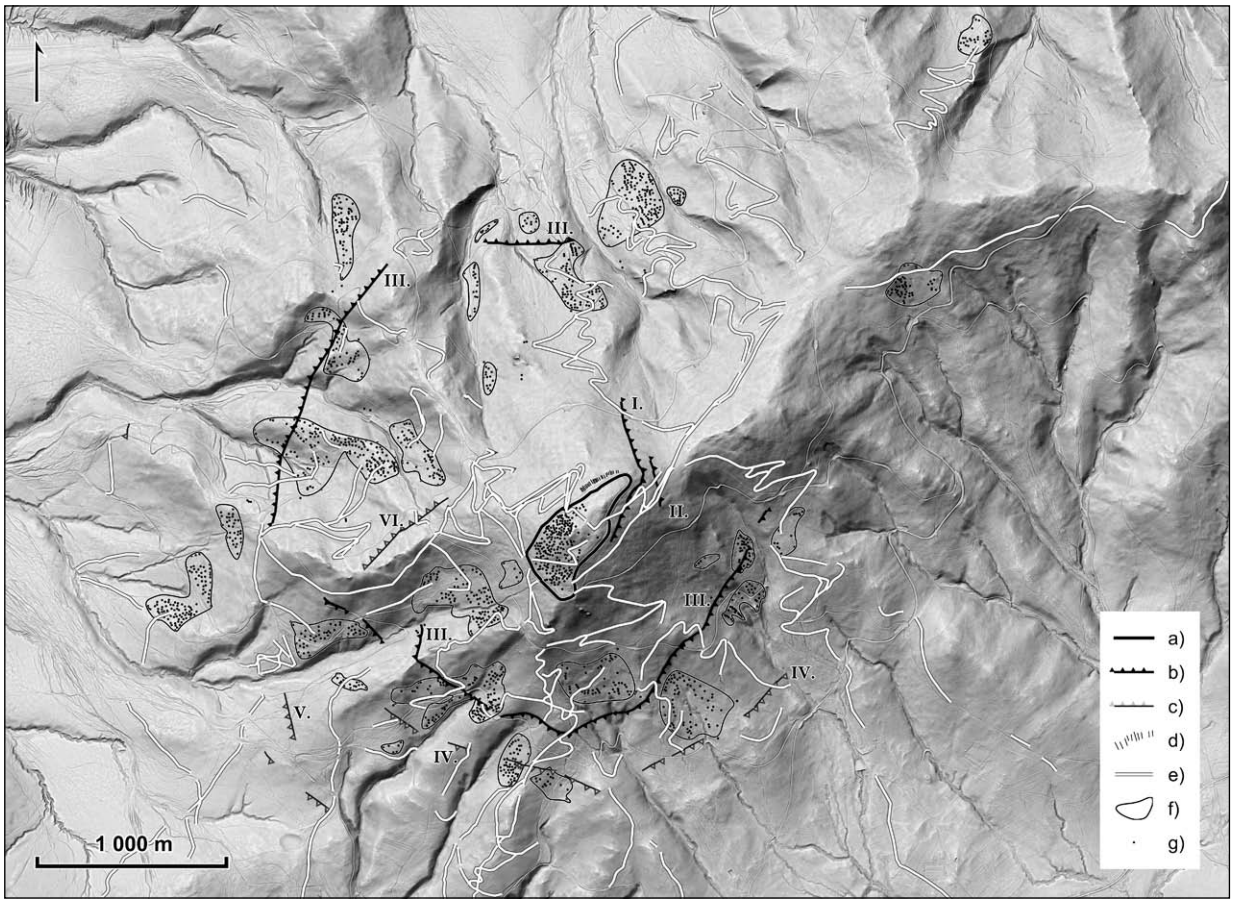

Fig. 15. Veľký Tribeč hillfort and its surroundings. Legend: a – hillfort rampart; b – ramparts I–III; c – less noticeable rampart-like structures IV–VI; d – cross-ditches; e – prehistoric (?) roads; f – areas with artificial terraces; g – settlement terrace. Source GCCA SR; interpretation P. Bisták; visualisation T. Lieskovský.

south-eastern side each (*Bisták/Lieskovský 2020b*).[9] The geophysical survey carried out in two parts of the northern rampart indicated that the survey areas of the rampart were unburned (Fig. 14).

The exceptional and newly recognised structure was a *system of 27 short cross ditches* stretched along the outer side of the northern rampart in a length of approximately 218 m (Fig. 13: c; 15: d; *Bisták/Lieskovský 2020b*). The ditches are located on a gentle slope at a right angle to the rampart, about 9 to 15 m from the edge of the lower rampart. The lengths of individual ditches vary from 14 to 27 m, and their widths are from about 1 to 3 m. The distances between the ditches are approximately 3 to 7 m. In the terrain, they are hardly visible; only the westernmost four ditches can be recognised at present. Such structures along the walls of fortified sites are rare and are little known in the current state of research. Some examples were documented in Bohemia, such as at the Late Bronze Age hillfort Hradišťský vrch near Písek, the Late Bronze and Early Iron Age hillfort Luhov, or the La Tène oppidum Třísov. In the Hradišťský vrch hillfort, similar structures comprised of low walls, verified by excavation, situated also at a right angle to the rampart along its edge on a gentle slope, and are interpreted in association with a defence of the hillfort (*Hlásek/Fröhlich 2019*, 135, 136, fig. 4).

In addition to the massive rampart of the hillfort, *numerous lines of ramparts and ditches* (Fig. 15) were identified near and farther from the hillfort. First, the hillfort was protected from the east and southeast by two additional ramparts. The already known and more visible *rampart I* (*Borzová/Borza 2019*, 114) was located closer to the fort and is preserved at a length of about 768 m. The newly detected *rampart II* is preserved as a less conspicuous terrain undulation at a distance of 60 m east of rampart I.

Another conspicuous line, *rampart III* comprising several segments, leads to the southeast, south, west, and north of the hillfort at a distance of 620 to 1,590 m. The sections of the rampart are interrupted

[9] In recent decades, another opening in the south rampart was gapped by a forest road.

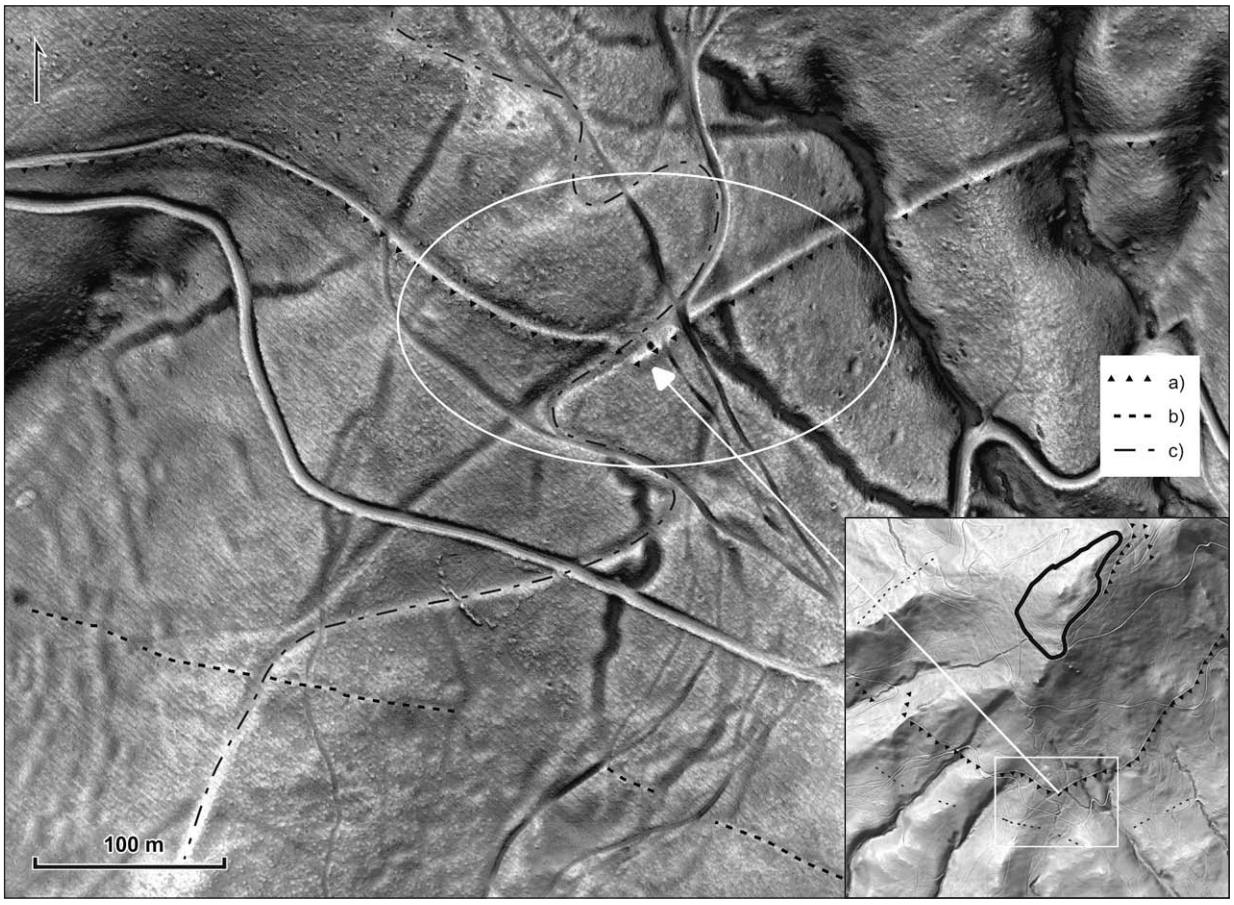

Fig. 16. Semi-pincer gate in the outer rampart III south of the Veľký Tribeč hillfort. Legend: a – rampart III; b – rampart IV; c – route of the prehistoric (?) road. Source GCCA SR; interpretation P. Bisták; visualisation and graphics T. Lieskovský.

by longer gaps without visible traces of the wall. The length of the visible segments is 4,620 m altogether and the total length, including gaps, is about 6,300 m. The rampart is located at a height of 460 to 622 m above sea level, it is enclosing an area of approximately 2,500 m in diameter, and its segments are within a distance of about 600 to 1,500 m from the Veľký Tribeč hillfort. The rampart in its south part opens in a semi-pincer gate creating a gap of 6 m (Fig. 16), the same type as in the hillfort rampart itself. The character of rampart III is varied. It is mainly made up of a stone embankment up to a height of 1 m and a width of 5 to 7 m at the base, while in the northwest part the wall is actually a strip of stones approximately 30 to 50 cm high, and in the northern part it is a stone and earth embankment up to 1 m high and 10 to 11 m wide at the base. The rampart is not dated at present. However, it was disturbed by later structures, especially recent roads, but also by some artificial terraces (Fig. 16).

Even at a longer distance from the hillfort, there is another segmented rampart, the less conspicuous *rampart IV* (at altitudes of 472–507 m and about 205–480 m south of rampart III). The length of the visible segments is 1,053 m and the total length including gaps is 2,370 m. A segment of this line is in one place opened for the road leading from the semi-pincher gate in rampart III and in another place, it is disturbed by a few artificial terraces. However, rampart IV has not been verified by field survey. Other more distant segmented ramparts – ramparts V and VI – have not been verified in the field as well. Their association with the hillfort must remain open.

In the wider surroundings of the Veľký Tribeč hillfort, 1,494 *artificial terraces* of oval to nearly oblong shape were identified in 29 concentrations. Some terraces also occur as single structures or in pairs outside the concentrations. Most of the terraces are located at a distance of up to 2.4 km from the summit of the hillfort, and only a single cluster of 35 terraces is located at a distance of 3.5 km. The areas of these concentrations range from 1 to 16.4 ha. Their total area is about 113 ha.

The areas with terraces are usually on gentle to moderate slopes around the springs of streams; the terraces are usually at a distance of up to about 220 m from the water source. Most of the terraces reach

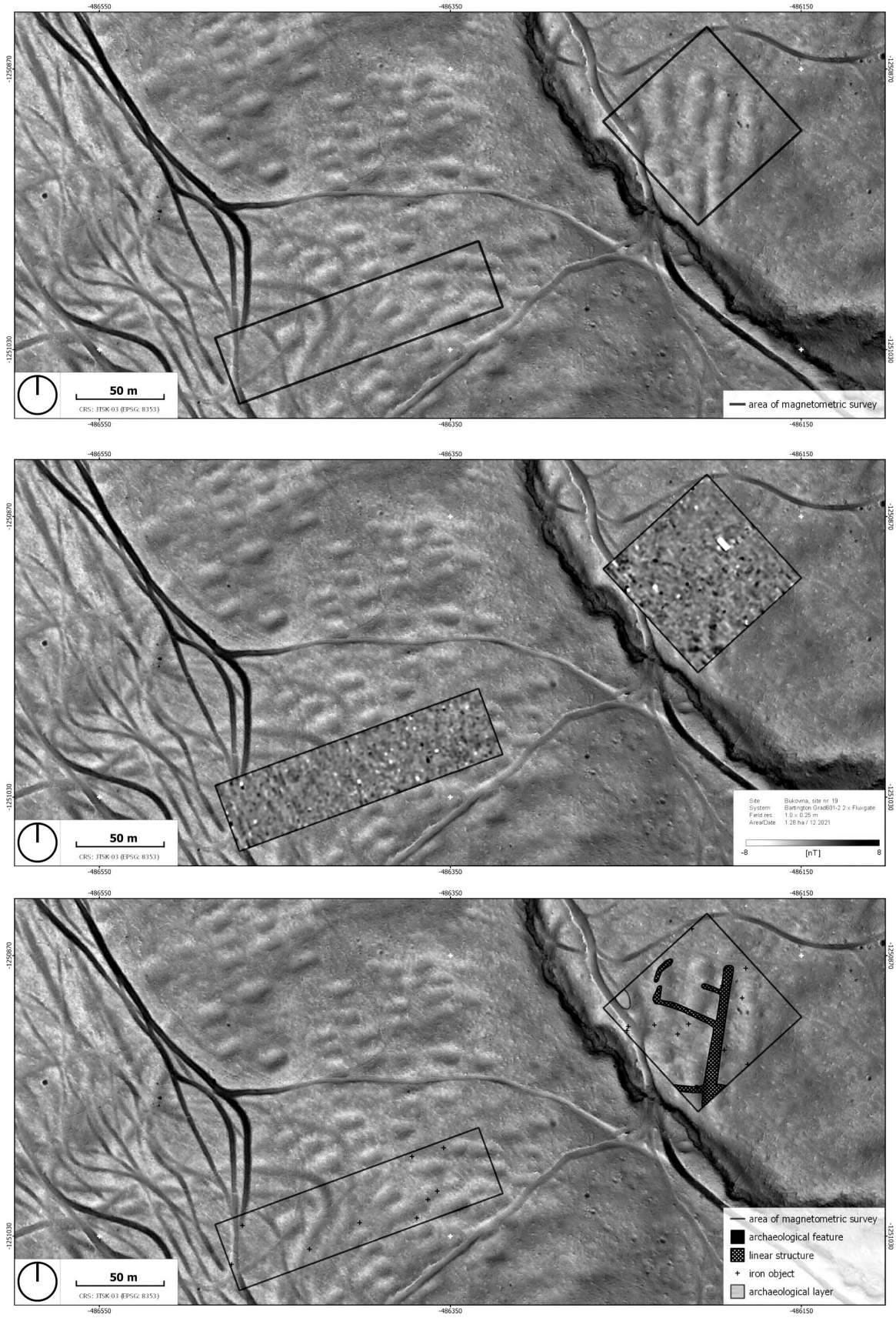

Fig. 17. Geomagnetic survey areas in the surroundings of the Veľký Tribeč hillfort, with results and interpretation. Author M. Felcan.

an area of 25 to 60 m² (Fig. 6). They are frequently ordered in long lines, roughly tracing contour lines or slightly diverging from them. Their layout indicates urbanistic planning and the construction of the assumed settlements. A similar layout of the terraces is visible in the southwest part of the Veľký Tribeč hillfort and also in and around several fortified hilltop settlements from the Late Bronze and Iron Ages, such as Molpír near Smolenice (*Felcan/Pašteka/Stegmann-Rajtár 2020*), Ostražica near Nižná or Tupá Skala near Vyšný Kubín (*Felcanová/Felcan/Lieskovský 2021*, 107–131).

By now, the terraces had been verified by a field survey in 17 concentrations, and 15 of them yielded rather sporadic finds of pottery sherds and small fragments of clay daub. Clay daub finds might indirectly suggest that buildings were once built in these areas. Due to the insignificant character of these artefacts, they cannot be dated more precisely than in the 'prehistory'. Therefore, two metal detector surveys were carried out to specify the dating of the use of sites with terraces. Together, five terrace concentrations and their close vicinities on the western and northern slopes of the Veľký Tribeč (cadastral communities of Kovarce and Nitrianska Streda) have been surveyed. Altogether, 116 metal artefacts were acquired that date to several eras: the Late Bronze Age, the La Tène and Roman periods, the Middle Ages, and the Modern Era. The Late Bronze Age metal finds were discovered in each of these areas, whereas finds from the other eras were recorded only in some of the sites (except for the Modern Era finds). In the current state of cleaning and conservation, 21 artefacts can be dated to the Late Bronze Age (Urnfield period) with certainty. All the artefacts were scattered in the sites with terraces, either found on the terrace platforms or apart from them. Some of the bronze artefacts are preserved intact (or almost intact): a socketed axe, two socketed chisels, two arrows, two decorated tweezers, and a sandglass-shaped pendant (Fig. 12: 2–7). Moreover, every area has yielded scraps broken from bronze artefacts that represent a typical phenomenon of the Late Bronze Age settlements (e.g. *Parma et al. 2017*, 66–80) and hoards (e.g. *Salaš 2005*). In the survey areas, at least 11 of these scraps were found: several fragments of sickles, knife (?) blades, and single fragments of a chisel, a socketed axe, a bracelet, a chain, and a cone. The character of some finds allows only general dating to the Late Bronze Age (arrows: *Gedl 2014*, esp. 43; sickles: *Furmánek/Novotná 2006*; a tweezers with narrow, slightly widened arms: *Gedl 1988*, 28, 29, pl. 3; 4), but in some cases, a more precise dating is possible, namely the double Y-ribbed decoration on one of the chisels and the Y-ribbed combined with the double V-ribbed decoration on the other one,[10] in the stages Ha A2 and Ha B1 (*Mozsolics 1985*, 36; *2000*, 58, 59, 66, 78, 79, pl. 56: 2; 74: 6; 96: 16, 17; 97: 5; *Salaš 2005*, 41; *Tarbay 2015*, esp. 317), and of a few finds more likely rather to later than earlier stages of the Urnfield period (a socketed axe: e.g. *Říhovský 1992*, 198, 199; *Salaš 2005*, 40, 41; a tweezers with triangle-shaped arms: *Gedl 1988*, 22, 23, pl. 2; a pendant: *Ožďáni/Žebrák 2017*, 254–256, pl. II: 8; *Puš 1978*, 46–49, fig. 1; 2).[11]

Furthermore, at least two fragments of metal plano-convex ingots that frequently occur in the Late Bronze Age sites (see *Parma et al. 2017*, 92) were recovered in two areas. Additionally, in four out of five areas, lumps of metalworking by-products (18 to 20[12] pieces) were also found scattered throughout the areas. Although without metallographic analyses they cannot be dated to a certain period in multiperiod sites, they could indicate local metal production activities or, in case they are dated to the Urnfield period, only storage of the metal material at the sites (e.g., *Parma et al. 2017*, 80–94; *Salaš 2005*, 126–129). However, the dating of the finds and sites will be evaluated in detail and refined after cleaning and conserving all the finds from the surveys.

It is interesting to note that the geophysical survey at one of these sites (Fig. 17) has revealed almost no anomalies that could be interpreted as archaeological features within the survey area. It can possibly be explained by the fact that the survey was carried out only in a small part of the terrace concentration that could have been without archaeological structures such as buildings or other features. On the other hand, there is also the possibility that some of the features were not detected by the survey, as they were shallow and already eroded. However, there is an interesting linear anomaly (Fig. 17: bottom) that can be interpreted as some kind of enclosure.

One of the metal detector surveys also yielded an important find in a site with terraces. The windthrow located on a terrace platform revealed a line of 15 clay loom weights (either intact or fragmented) which were in a position reflecting their original functional arrangement on a vertical warp-weighted

[10] The second chisel was cleaned after submission of the paper but still before finishing the editing process.

[11] Although some finds cannot be dated more precisely than to a time span of the Late Bronze and the Early Iron Ages, no find is dated solely to the Early Iron Age, and therefore such a dating is unlikely.

[12] Two pieces are either metal lumps or scraps.

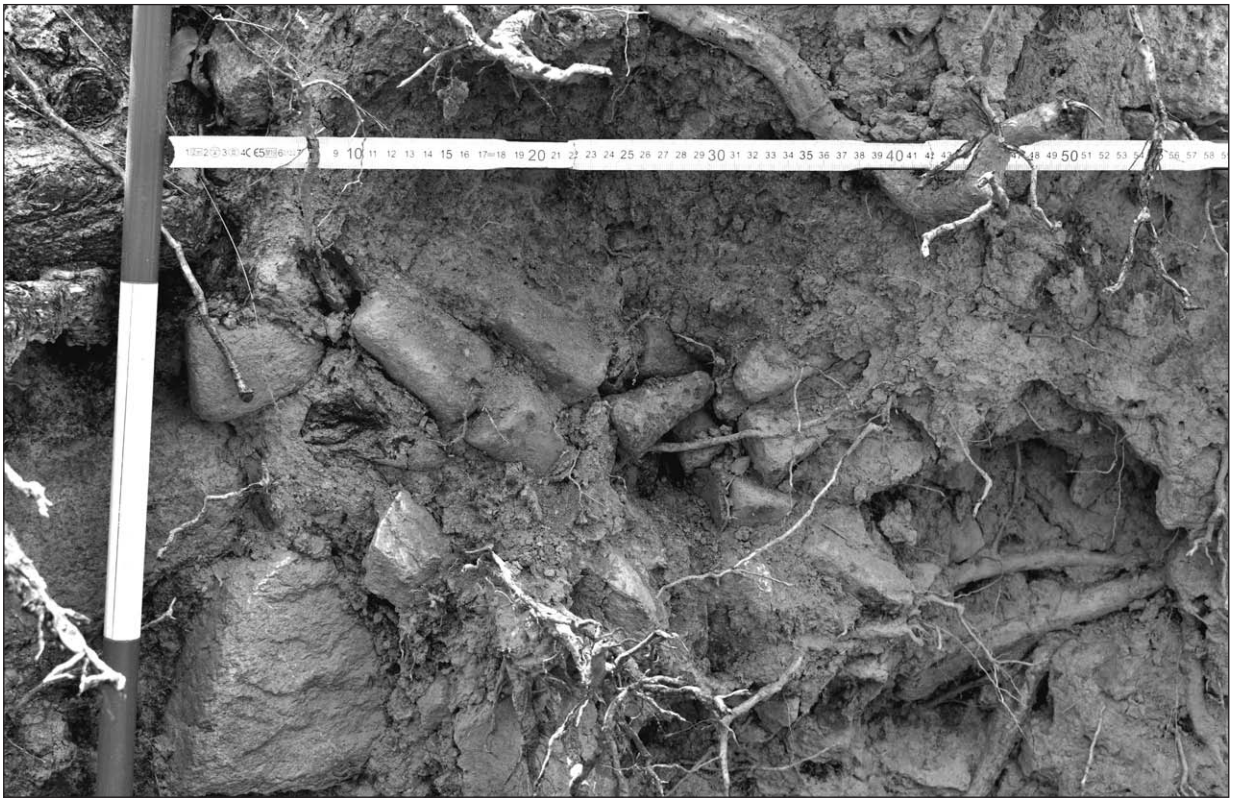

Fig. 18. Find of clay loom weights in situ discovered in a wind-throw on one of the terraces west of the Veľký Tribeč hillfort, cadastral community of Kovarce. Photo P. Kmeťová.

Fig. 19. Collection of 14 out of 15 clay loom weights discovered in a wind-throw in the cadastral community of Kovarce, after cleaning (15th loom weight is too fragmentary). Photo P. Kmeťová.

loom (Fig. 18). The truncated pyramid-shaped loom weights were slim and of a low weight (81.1–219.5 g, an average weight 144.3 g; Fig. 19) indicating that they were used for the weaving of fine textiles (see *Grömer 2016*, 107–117). All of the loom weights were fired, mostly at low temperatures, but one was fired at a high temperature (based on different surface hardness). Since clay loom weights in general were usually used unfired and preserve only due to a secondary burning,[13] it is likely that the building where the loom once stood was destructed by the fire. Therefore, the situation presented is direct evidence that a terrace was once used as a platform for a building where textiles were produced. From the same wind-throw also pottery sherds and fragments of clay daub from the bottom of a fireplace or an earthen floor were collected. These sherds date the situation to the Urnfield period in general.

The surroundings of the Veľký Tribeč hillfort are also covered by a dense network of *roads and hollow ways* of the earlier (prehistoric?) level.[14] Some of the roads lead through the entrances of the hillfort and entrances in other ramparts in its surroundings, along or through the areas with terraces. Similar wide roads seem to also interconnect the terrace concentrations. Moreover, it seems that these roads respected the layout of the terraces. Therefore, it can be presumed that if at least some sites with terraces were contemporaneous with each other or with the hillfort, at least some of these roads might have originated in the Late Bronze Age. Nevertheless, it cannot be excluded that some of them were in use for a longer time after the end of the Late Bronze Age (and the very Early Iron Age?) habitation, for example during the later periods when the terrace concentrations have been used, or that some roads originated in the later periods. Ultimately, the roads connecting the sites were most likely of local importance, while the road leading through the hillfort (connecting the north-western and north-eastern gates) was probably inter-regional communication connecting the Žitava region (Požitavie) and the middle Nitra region.

DISCUSSION

In the current state of research, the function of a considerable part of anthropogenic relics discovered on the basis of ALS data cannot be reliably stated without further field research. Nevertheless, after verification of dozens of structures of similar character in the field, their function can be determined with high probability even without verification of all of them. For this reason, the anthropogenic relics identified in the Tribeč Mountains were divided into several groups according to their character. Although their functions are in some cases obvious or probable, there are still many questions open:

1. *Ramparts*. Are all the wall-like structures identified as ramparts the elements of fortification? The function as a fortification is recognised, for example, in two ramparts north of the Zobor hillfort, as well as in rampart III with the semi-pincher gate in the surroundings of the Veľký Tribeč hillfort. However, rampart III is not intact, and is detectable in only several separate segments. Was the rampart left 'open' intentionally or could not have been finished for some reason? Was its role to protect only the selected areas from a certain direction? Or was it enclosed, but only its certain segments have been preserved to the present time? And were the segments associated with the hillfort itself? These questions arise regarding the inconspicuous rampart IV and other wall-like relics in the surroundings of the Veľký Tribeč hillfort. Similar extensive linear earthworks have recently been documented in the surroundings of the Gradišče above Knežak hillfort in Southeast Slovenia which dates to the Late Bronze and Early Iron Ages. These earthworks are interpreted as the boundary of the territory of the hillfort community (*Laharnar/Lozić/Štular 2019*, 269, Fig. 2; 4). Several segments of wall-like structures were also recognised near the Žibrica hillfort in the area with artificial terraces. Was their use intended for protection or for another reason, for example, to stabilise the slope with terraces or a road?

2. *Small enclosed areas with smaller ramparts*. It is not clear what purpose the enclosed areas of small dimensions have served. Were they part of fortification systems of larger hillforts or rather individual units? Were they serving for a long-term or temporary habitation, or as stations for a watch?

[13] It should be noted that sometimes only a part of the originally present loom weights is preserved owing to a fire. The number of 15 loom weights, if they are the only preserved loom weights at the wind-throw/platform, is too low for the whole width of a loom, therefore most likely more loom weights were part of the loom originally (information and assumption by T. Štolcová, pers. comm. 2022).

[14] The wider and shallow hollow way, mainly as a single line, often forms serpentine line – see chapter *New knowledge acquired by recent archaeological research/Roads*.

3. *Artificial terraces*. Artificially formed terraces within some of the hillforts in the Tribeč Mountains were already known earlier. An excavation of one of the terraces at Žibrica hillfort has yielded evidence of levelling the ground of the horizontal platform. It is worth noting that the present terrace shape was formed by transformation processes, particularly erosion or later ground modifications, resulting in increased terrace width. The finds of pottery of settlement-like character, clay daub with prints of wooden constructions and animal bones indicate its function as a settlement terrace (*Felcan 2019*, 98–103, fig. 45; *Stegmann-Rajtár 2004*, 510–512, fig. 4). Similar terraced platforms have been documented and excavated, for example, within the Early Iron Age hillforts in Southeast Slovenia. They have been made from earthen mounds or hewn into bedrock and have served mainly for individual buildings, which also correspond to their small size (*Dular/Tecco Hvala 2007*, 83, 104–106). Linear earth terraces on the slope of the famously known Early Iron Age hillfort Burgstallkogel near Großklein in Styria, located already outside the hilltop plateau, were also artificially formed, supported by wood and stone construction, and contained buildings and pits (*Mele 2019*). In the case of 50 terrace concentrations outside of hillforts in the Tribeč Mountains, there are only more or less strong indications that they are remnants of settlements. First, the most important evidence is the collection of 15 loom weights in a position that reflects their original arrangement on a warp-weighted loom, found on one of the terraces in the surroundings of the Veľký Tribeč, and thus an indication of the existence of a building. Such a hypothesis is underlined by finds of clay daub with prints of wooden constructions from several terraces outside the Veľký Lysec and Malý Lysec hillfort (*Bisták/Borzová/Borza 2017*, 56), and by small fragments of clay daub found in areas with terraces, as well as metal artefacts and raw material from five terrace concentrations in the surroundings of the Veľký Tribeč, all representing a standard collection of finds acquired in settlements. Nevertheless, even if some terraces have served as platforms for buildings, it is unclear whether some of the others could not have been used for other activities, e.g., for cultivation of crops.

A surface survey with collecting artefacts in the surroundings of the Žibrica hillfort, as well as metal detector surveys in the settlement agglomeration around the Veľký Tribeč hillfort, revealed the fact that the finds are found not only in the areas of terraces and their close vicinity where they were most likely transported by erosion, but even in a larger distance from them. Such a situation can refer either to the existence of structures not preserved in the terrain in the form of microrelief but preserved under the surface (see *Borzová/Borza/Bisták 2014*), or, more likely, that the living space for performing various activities was much larger and included an entire surrounding landscape (see *Neustupný 1986*).

4. *Mounds*. The function of the mounds can be identified with the help of a geophysical survey combined with trenching. In some cases, however, the function can remain unclear even after trenching (see *Borzová/Gogová/Wiedermann 2007*). It should also be stressed that even if all identified mounds in the Tribeč Mountains were burial mounds of the same age as the hillforts and settlements around them, their number would still be very low compared to the density of habitation.

Undoubtedly, a disadvantage of the data acquired by ALS as well as by geophysical survey is their disability to date the discovered structures. This is because they capture all human and natural interventions preserved in the irregularities of a land surface for the last several thousand years, resulting in a dense intertanglement of various structures from different times. The earlier structures are often more or less covered or literally 'erased' by later structures. The resulting image can be best compared to a palimpsest, which is frequently used to characterise the archaeological landscape (*Gojda 2000*, 55). In most cases of horizontal superposition of the relics, it is possible to determine at least their relative dating. In this context, the situation in Panský les site (Štitáre cadastral community) near the Žibrica hillfort is a good example of multiple horizontal stratigraphies (Fig. 11). Based on the mutual spatial distribution of both areas, it is assumed that the later field system had erased the relics of most of the settlement terraces, of which some are preserved only in the marginal parts of the area. After the field system ceased to be used, the 'lynchets' were used for embedding the lime kilns and were also disturbed by later yet undated roads.

The surface finds collection can rarely yield some chronologically significant artefacts. More detailed information on site dating can be acquired mainly using intrusive archaeological research methods. The realised surveys with metal detectors have revealed that the terrace concentrations had been used for habitation already in the Urnfield and Hallstatt periods, but some of them had been used also in the later periods: in the La Tène and Roman periods, and also in the Middle Ages and Modern Era; however, in the latter two rather as a hunting area or for similar purposes. Therefore, it is not yet clear whether some of the terraces were built in some of these later periods. In this respect, it is worth noting the occurrence

of superpositions of some of the terraces with the ramparts in the surroundings of the Veľký Tribeč hillfort (Fig. 16). Moreover, the question of dating terrace settlements in association with each other, as well as with nearby hillforts, arises. It is not yet clear whether all the terraced areas/settlements were contemporary or moving in time and space.

Regarding the contemporaneity of the existence of terraced settlements with the near hillfort, only the same age of the Žibrica hillfort with Panský les settlement and most likely also with a terraced site to west to north of the hillfort was corroborated, and most likely also the Zobor hillfort with a terraced settlement north of it.

It must also be stressed that the small enclosed areas with smaller ramparts are undated yet; therefore, the possibility of their origin in different eras must also be considered.

Additionally, dating of communications is a complex and rather complicated subject, and without detailed analyses and further research remains only a hypothesis (see *Martínek et al. 2013*; *Vletter 2019*).

Another open question is related to prehistoric fields that are almost completely unknown at present in the territory of Slovakia (*Benediková et al. 2024*; *Hajnalová et al. 2023*). Although several hundred hectares of abandoned fields were identified in the area of interest either as fields separated by boundaries or as a ridge and furrow pattern, structures such as the so-called Celtic fields have not yet been recognised (see *Bisták 2022*, 150–153). A more detailed typology and evaluation of field boundaries and ridge and furrow fields will be an extremely time-consuming task for possible future research.

CONCLUSIONS

In conclusion, the use of ALS data in the research of relics of a fossil cultural landscape enables the identification and verification of even less conspicuous structures which are nearly imperceptible and are represented by only a slight difference in height (approximately 10 to 20 cm). Thanks to this method, a huge amount of previously unknown anthropogenic structures was discovered, part of which can be dated to the Urnfield and/or Hallstatt periods with different degrees of certainty.

The preliminary results of the research indicate that habitation at higher altitudes in the Tribeč Mountains in the Urnfield and Hallstatt periods, mainly within and close to hillforts, existed in a much larger extent than was previously assumed (cf. Fig. 1–5). Particularly surprising is the detection of extensive settlement agglomerations in the surroundings of the Veľký Tribeč and Žibrica hillforts, with hundreds of settlement terraces. Although the settlement terraces have also been recorded in the surroundings of other hillforts in the Tribeč Mountains, they are never of such a number and extent. Such a dense concentration of highland sites and terrace settlements in a mountainous region was not previously known; however, based on new, yet unpublished, ALS data from Slovakia, it seems that this situation probably only reflects the state of research and that the use of highland sites was, in fact, once more frequent. Yet, it is currently unclear whether the sites in the surroundings of a single hillfort were contemporary. It is also difficult to state whether people moved to mountainous sites after abandoning lowland settlements or whether mountainous sites existed at the same time as lowland ones.[15] Ultimately, it seems too early to speculate whether habitation in the mountains was the result of long-term settlement strategies or only temporary activities and whether it was caused by the need for better protection or other reasons.

The finds from the terraced areas, which we interpret as remains of settlements on steep land, date the first phase of habitation in the surroundings of the hillforts to the Late Bronze Age/Urnfield period (surroundings of the Veľký Tribeč and Zobor hillforts). It is not yet clear whether this phase was restricted solely to the Ha B stage (as in the Zobor hillfort; *Danielová 2017*) or started in the earlier stages of the Urnfield period. The trend of habitation in and around hillforts also persisted in the Early Iron Age (Ha C–Ha D1). At that time, the Žibrica hillfort and most likely also the Veľký Lysec and Malý Lysec hillfort became the new centres of the region. The current results of archaeological researches in the Tribeč Mountains indicate the correctness of the hypothesis (*Horňák 2019*, 93) on the use of very large fortified areas up to 15 ha in the Ha B stage (the Veľký Tribeč and Zobor hillforts), while in the Hallstatt period smaller hillforts with an area up to 5 ha were used (e.g. the Veľký Lysec and Malý Lysec, and Žibrica

[15] The present knowledge on sites known in lowlands in the surroundings of the Tribeč Mountains does not allow any clear indication for a rapid change of settlement strategies and abandonment of sites in a certain period due to movement to higher altitudes (see Fig. 1–4).

hillforts). However, this dimension criterion is valid only in the case of areas encircled by monumental ramparts around the hilltops, as is known from previous research. The latest researches revealed the existence of less noticeable fortifications near some of these smaller hillforts, and especially large settlement areas beyond the main fortified space (the Veľký Lysec and Malý Lysec, and Žibrica hillforts). To understand the settlement strategies in upland/mountainous sites, it will be necessary to take into consideration, along with further archaeological research, also the natural conditions and update the existing models of habitation (see *Blažová/Lieskovský 2011*; *Horňák 2019*; *Horňák/Stegmann-Rajtár 2008*; *Lofajová Danielová/Hajnalová/Šimunková 2024*; *Wiedermann 2003*).

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„High Hopes“: sídliskové stratégie v pohorí Tribeč (západné Slovensko)

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Súhrn

V pohorí Tribeč a v jeho bezprostrednom okolí sa nachádza pomerne veľká koncentrácia hradísk z obdobia popolnicových polí a z doby halštatskej, ale na základe doterajších poznatkov nie sú úplne vyjasnené ich vzájomné vzťahy a ani datovanie. Väčšina známych sídlisk a pohrebísk v zázemí hradísk sa nachádza v nižšie položenom území na úrodnejších pôdach Žitavskej a Nitrianskej pahorkatiny a Nitrianskej nivy (obr. 1–4). Vďaka najnovšiemu výskumu na základe vizualizácií dát leteckého laserového skenovania (LLS) však bolo získaných množstvo nových informácií, ktorých predbežné výsledky sú prezentované v tomto príspevku. V zalesnenom prostredí Tribeča sa od roku 2019 uplatňovala kombinácia cieleného prieskumu antropogénnych tvarov reliéfu a povrchového zberu, doplneného geofyzikálnym prieskumom. Len v centrálnej a juhozápadnej časti pohoria bolo na ploche 261 km^2 identifikovaných viac ako 11 500 antropogénnych reliktov. Z nich približne štvrtina môže súvisieť s obdobím popolnicových polí a s dobou halštatskou. Ide o nové systémy opevnení, terasovité úpravy terénu, mohylovité útvary a úvozové cesty (obr. 5).

Sieť opevnených areálov v Tribeči zahusťujú novo zistené opevnené areály (Podhorany-Mechenice, polohy Korytnice, Horanča, Pod Žibricou; Klátova Nová Ves, poloha Staré háje; Pažiť, poloha Chlmok; Krnča, poloha Brloh; Veľké Uherce, poloha Oselný vrch; Malá Lehota, poloha Noviny). Na základe LLS je pravdepodobné, že opevnené boli aj ďalšie dávnejšie známe lokality (Nitrianska Streda, poloha Hrdovická; Klátova Nová Ves-Sádok, poloha Okolie kostola). O viacerých známych opevnených areáloch priniesol diaľkový prieskum zeme doplnený terénnym prieskumom množstvo nových informácií (Zobor, Žibrica, Veľký a Malý Lysec, Veľký Tribeč, Tábor v Krnči, Šiance v Klátovej Novej Vsi).

Informácie o umelo upravených terasách v pohorí Tribeč boli v malej miere známe z okolia hradísk Zobor, Žibrica a Veľký Lysec. Na základe LLS sa ukázalo, že terasovito upravené svahy v pohorí Tribeč sa nachádzajú v areáloch hradísk, ale najmä v ich blízkom a širšom okolí (spolu 2665 terás, z toho 2127 mimo hradísk v 50 koncentráciách), kde vytvárajú v priestore ohraničené areály, ktoré je možné považovať za samostatné sídliskové komponenty (obr. 6). Najväčší takýto sídliskový areál sa nachádza na severných svahoch Žibrice a dosahuje rozlohu cca 25 ha. Rozloha ostatných

areálov je v rozmedzí od 0,5 ha do 12 ha. Terasy mimo hradísk vznikli vo väčšine prípadov veľmi pravdepodobne zahĺbením do svahu, čím boli vytvorené plochy o rozlohe 25–80 m^2, len v okolí Žibrice aj o rozlohe viac ako 500 m^2 (obr. 7). Zatiaľ ojedinele bolo zistené spevnenie čelnej steny terasy kamenným múrom (obr. 8). Ďalej bolo identifikovaných 36 mohylovitých útvarov, ktoré budú vyžadovať overenie v teréne. Rozlíšená bola tiež vrstva pravekých (?) ciest (311 úsekov v celkovej dĺžke 114,44 km), často spájajúcich hradiská s okolím (obr. 9).

Bližšie sme sa zaoberali situáciou v okolí hradísk Žibrica a Veľký Tribeč. V areáli hradiska Žibrica (HB3–HD1) je zaznamenaných 65 sídliskových terás a 337 v jeho okolí. Koncentrácie terás boli zistené až do vzdialenosti cca 1,5 km od hradiska (obr. 10; 11). Terénnym prieskumom boli overené skupiny terás južne, západne a severne od hradiska, pričom z areálov niektorých terás aj mimo nich bola získaná atypická a ojedinele aj typická halštatská keramika, hlinené tkáčske závažie, bronzová loďkovitá spona (obr. 12: 1) a ďalšie, zatiaľ nespracované nálezy z doby halštatskej (prieskum v r. 2023). Sídliskové areály hradiska spolu s osadami v jeho okolí, vymedzené terénnymi reliktami a výskytom nálezov, majú spolu rozlohu takmer 2 km^2 (193 ha).

Hradisko Veľký Tribeč, ktoré je datované len na základe povrchových zberov do stupňov HB3–HC1, spolu s okolím bolo skúmané viacerými metódami. Výsledky geofyzikálneho prieskumu v areáli hradiska naznačujú existenciu viacerých archeologických objektov (obr. 14). Prekvapujúcim zistením o dávnejšie známom systéme opevnenia hradiska je výskyt 27 priečnych priekop kolmých na vonkajšiu pätu valu hradiska v jeho severnej časti, identifikovaných na základe LLS (obr. 13). V okolí hradiska bola na základe LLS zistená výnimočne vysoká koncentrácia antropogénnych reliktov (obr. 15). Unikátnym zistením je niekoľko línií doteraz neznámych valov v okolí hradiska (II–VI). Najvýraznejší je val III s priemerom cca 2,5 km, ktorý je tvorený viacerými úsekmi s celkovou dĺžkou cca 4,62 km. V južnej časti vytvárajú dve jeho línie polokliešťovú bránu širokú cca 6 m (obr. 16). Ďalšie línie menej výrazných valov IV–VI neboli zatiaľ v teréne overené. V širšom okolí hradiska bolo na LLS identifikovaných spolu 1494 sídliskových terás, ktoré sú sústredené do 29 areálov. Väčšina z nich leží v okruhu do 2,4 km od vrcholovej kóty Veľkého Tribeča, s výnimkou jednej koncentrácie 35 terás vzdialenej 3,5 km. Doteraz vykonaný geofyzikálny prieskum magnetometrom v dvoch z týchto areálov nepreukázal prítomnosť archeologických objektov, až na jednu líniovú štruktúru (obr. 17). V piatich areáloch bol uskutočnený prieskum s detektorom kovov, z ktorého pochádzajú nálezy datované rámcovo do mladšej až neskorej doby bronzovej (obr. 12: 2–7). Počas prieskumu areálu na západných svahoch Veľkého Tribeča bol vo vývrate na jednej z terás objavený súbor 15 tkáčskych závaží (obr. 18; 19). Táto situácia naznačuje, že na terase stála stavba, v ktorej sa tkali textílie. Existenciu stavieb na terasách indikujú aj nálezy konštrukčnej mazanice z iných polôh.

Predbežné výsledky výskumu naznačujú trend osídlenia vyšších polôh v pohorí Tribeč, najmä v blízkosti hradísk, v neskorej dobe bronzovej a dobe halštatskej v oveľa väčšej miere, ako bolo doteraz známe. Nálezy z terasovito upravených areálov, ktoré interpretujeme ako pozostatky sídlisk v svahovitom teréne, datujú prvú vlnu osídlenia v zázemí hradísk do mladšej až neskorej doby bronzovej (okolie hradísk Veľký Tribeč a Zobor). Tento trend pretrváva aj v dobe halštatskej, keď sa centrom regiónu stalo hradisko Žibrica (vrátane areálov terás mimo hradiska) a pravdepodobne aj hradisko Veľký a Malý Lysec. Doterajšie výsledky výskumov a prieskumov v Tribeči zatiaľ naznačujú správnosť hypotézy o využívaní obrovských opevnených areálov s rozlohou nad 15 ha v neskorej dobe bronzovej, kým v dobe halštatskej boli budované menšie hradiská s rozlohou do 5 ha. Toto veľkostné kritérium však platí len v prípade známych areálov s mohutnými valmi. Najnovšie výskumy preukázali pri niektorých z menších hradísk existenciu menej výrazných opevnení a najmä rozsiahlych sídelných areálov mimo opevnenia (Veľký a Malý Lysec, Žibrica). K pochopeniu stratégií osídľovania výšinných polôh bude nutné okrem ďalšieho archeologického výskumu zohľadniť aj environmentálne podmienky a aktualizovať existujúce modely osídlenia.

Obr. 1. Doteraz známe náleziská z obdobia popolnicových polí (BD až začiatok HA2) v širšom okolí pohoria Tribeč na výškopisnom modeli terénu. Legenda: a – sídliská; b – sídliská s neistým datovaním (napr. „BD?“); c – pohrebiská/mohyly; d – otázne pohrebiská/mohyly; e – hradiská; f – hradiská s neistým datovaním; g – skúmané územie. Lokality mapované podľa dostupnej literatúry. Autori P. Kmeťová a P. Bisták; grafické spracovanie T. Lieskovský.

Obr. 2. Doteraz známe náleziská z obdobia popolnicových polí (HA2–HB1) v širšom okolí pohoria Tribeč na výškopisnom modeli terénu. Legenda: a – sídliská; b – sídliská s neistým datovaním (napr. „HA2–HB1?“); c – pohrebiská/mohyly; d – otázne pohrebiská/mohyly; e – hradiská; f – hradiská s neistým datovaním; g – skúmané územie. Lokality mapované podľa dostupnej literatúry. Autori P. Kmeťová a P. Bisták; grafické spracovanie T. Lieskovský.

Obr. 3. Doteraz známe náleziská z obdobia prelomu popolnicových polí a doby halštatskej (HB3–HaC1, datovanie podľa *Veliačik/Romsauer 1992*) v širšom okolí pohoria Tribeč na výškopisnom modeli terénu. Legenda: a – sídliská; b – sídliská s neistým datovaním (napr. „neskorá doba bronzová“); c – pohrebiská/mohyly; d – otázne pohrebiská/mohyly; e – hradiská; f – hradiská s neistým datovaním; g – skúmané územie. Lokality mapované podľa dostupnej literatúry. Autori P. Kmeťová a P. Bisták; grafické spracovanie T. Lieskovský.

Obr. 4. Doteraz známe náleziská z doby halštatskej (HC2–HD1) v širšom okolí pohoria Tribeč na výškopisnom modeli terénu. Legenda: a – sídliská; b – sídliská s neistým datovaním (napr. „doba halštatská“); c – pohrebiská/mohyly; d – otázne pohrebiská/mohyly; e – hradiská; f – hradiská s neistým datovaním; g – skúmané územie. Lokality mapované podľa dostupnej literatúry. Autori P. Kmeťová a P. Bisták; grafické spracovanie T. Lieskovský.

Obr. 5. Nové náleziská v pohorí Tribeč a známe náleziská s datovaním do obdobia popolnicových polí a doby halštatskej na výškopisnom modeli terénu. Legenda: a – novozistené areály s terasami; b – známe sídliská; c – novozistené mohyly/mohylníky (?); d – známe pohrebiská/mohyly; e – novozistené hradiská; f – známe hradiská; g – skúmané územie. Známe lokality mapované podľa dostupnej literatúry. Autori P. Bisták a P. Kmeťová; grafické spracovanie T. Lieskovský.

Obr. 6. Koncentrácie terás na severozápadných svahoch Veľkého Tribeča. Zdroj ÚGKK SR; vizualizácia T. Lieskovský.

Obr. 7. Výrazné terasy severne od hradiska Žibrica. Foto P. Kmeťová.
Obr. 8. Terasa s kamennou čelnou stenou v areáli západne od hradiska na Veľkom Lysci a Malom Lysci. Foto P. Bisták.
Obr. 9. Praveká (?) cesta k západnej bráne hradiska Zobor. Zdroj ÚGKK SR; vizualizácia T. Lieskovský.
Obr. 10. Hradisko Žibrica a jeho okolie. Legenda: a – valové opevnenia hradiska Žibrica (I) a novozisteného hradiska (II); b – línie potenciálnych valov; c – praveké (?) cesty; d – sídlisková terasa; e – areály s umelými terasami; f – vodná nádrž. Zdroj ÚGKK SR; interpretácia P. Bisták; vizualizácia a grafické spracovanie T. Lieskovský.
Obr. 11. Štitáre, poloha Panský les. Legenda: a – sídlisková terasa; b – línie medzí zaniknutých polí; c – praveké (?) cesty; d – pozostatky vápenných pecí. Zdroj ÚGKK SR; interpretácia P. Bisták; vizualizácia a grafické spracovanie T. Lieskovský.
Obr. 12. Výber nálezov objavených počas prieskumov v pohorí Tribeč v roku 2022. 1 – Štitáre, poloha Panský les v blízkosti hradiska Žibrica, bronzová loďkovitá spona z povrchového zberu; 2–7 – Kovarce a Nitrianska Streda, východné a severné svahy Veľkého Tribeča, bronzové nálezy z prieskumu s detektormi kovov, 2 – závesok v tvare presýpacích hodín, 3, 4 – pinzety, 5 – dlátko s tuľajkou, 6 – hrot šípu? 7 – sekera s tuľajkou. Foto a grafické spracovanie P. Kmeťová.
Obr. 13. Hradisko Veľký Tribeč s dobre viditeľnými prvkami opevnenia a vnútornej štruktúry na digitálnom výškovom modeli. Legenda: a – opevnenie areálu hradiska; b – líniové valy I–II; c – priečne priekopy; d – praveké (?) cesty; e – ohradený areál; g – sídlisková terasa. Zdroj ÚGKK SR Bratislava; interpretácia P. Bisták; vizualizácia a grafické spracovanie T. Lieskovský.
Obr. 14. Oblasti magnetometrického prieskumu v priestore hradiska Veľký Tribeč, s výsledkami a interpretáciou. Autor M. Felcan.
Obr. 15. Okolie hradiska Veľký Tribeč. Legenda: a – opevnenie areálu hradiska; b – líniové valy I–III; c – nevýrazné valovité útvary IV–VI; d – priečne priekopy; e – praveké (?) cesty; f – areály s umelo upravenými terasami; g – sídlisková terasa. Zdroj ÚGKK SR Bratislava; interpretácia P. Bisták; vizualizácia a grafické spracovanie T. Lieskovský.
Obr. 16. Poloklieštová brána vo vonkajšom vale III južne od hradiska Veľký Tribeč. Legenda: a – val III; b – línia valu IV; c – trasa pravekej (?) cesty. Zdroj ÚGKK SR Bratislava; interpretácia P. Bisták; vizualizácia a grafické spracovanie T. Lieskovský.
Obr. 17. Oblasti magnetometrického prieskumu v okolí hradiska Veľký Tribeč s výsledkami a interpretáciou. Autor M. Felcan.
Obr. 18. Nález hlinených tkáčskych závaží in situ vo vývrate stromu na jednej z terás v okolí hradiska Veľký Tribeč, k. ú. Kovarce. Foto P. Kmeťová.
Obr. 19. Súbor 14 z 15 hlinených tkáčskych závaží objavených vo vývrate stromu v k. ú. Kovarce po očistení (15. závažie je v príliš fragmentárnom stave). Foto P. Kmeťová.

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