

# New research on the Gravettian site cluster of Grub-Kranawetberg, Austria: Research history, key findings and first results of fieldwork between 2021 and 2025

Nový výzkum gravettské lokality Grub-Kranawetberg v Rakousku: historie výzkumu, klíčové poznatky a první výsledky terénního výzkumu v letech 2021 až 2025

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## KEYWORDS

Upper Palaeolithic – Gravettian – Middle Danube region – Austria – fieldwork

## ABSTRACT

The Grub-Kranawetberg site cluster is embedded in the rich Upper Palaeolithic landscape of the Middle Danube region. Here we present an updated list of the sites around the villages of Grub and Stillfried, summarise the setting of the Grub-Kranawetberg site cluster in the landscape and provide a detailed overview of the research history for the sites of Grub-Kranawetberg including an updated overview of the different excavation areas. This is followed by an overview of our new fieldwork activities since 2021 in the area including a surface survey on the Kranawetberg/Hönigsberg ridge and new fieldwork at both Grub-Kranawetberg I and Grub-Kranawetberg II. We summarise the findings of the surface survey and implications for understanding the extent and preservation of the archaeological deposits on the Kranawetberg/Hönigsberg ridge. The excavation at Grub-Kranawetberg I in 2021 produced a small assemblage of lithic artefacts and faunal remains, which is presented here for the first time. Overall, the lithic typology, the use of raw material and the faunal spectrum correspond well to previous excavations at the site. We also present our fieldwork and some preliminary results at the new site of Grub-Kranawetberg II, east of Grub-Kranawetberg I, which has been under excavation since 2022. We also discuss our new findings since 2021 in light of previous fieldwork at the site complex, compare them to the other sites in the region and discuss the Grub-Kranawetberg sites in the broader Middle Danube region context.

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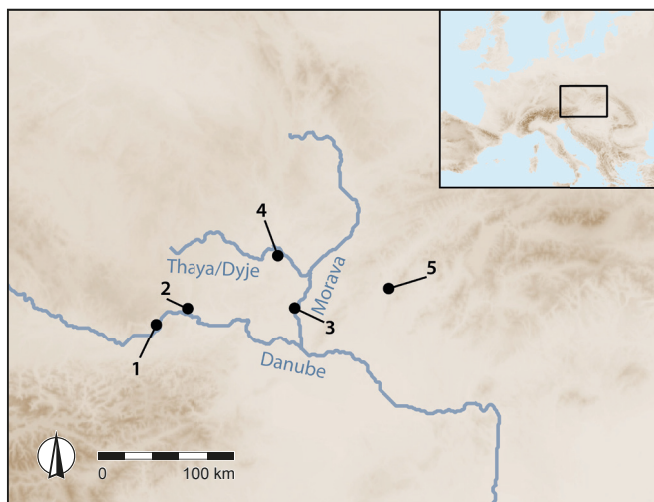
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## 1. Introduction

The Middle Danube region in Central Europe is well known for its rich Upper Palaeolithic archaeological record, from the first appearance of modern humans in the region and the responses of human groups to the climatic downturn towards the Last Glacial Maximum (LGM), to human behavioural adaptations to cope with LGM conditions as well as the time after the LGM with rising temperatures and moisture levels.

The region has provided important data from a number of key sites for the discussion of modern human dispersal into and within Europe, the Neanderthal–modern human replacement and potential horizontal cultural transmission between the last Neanderthal and first modern human populations and the climatic



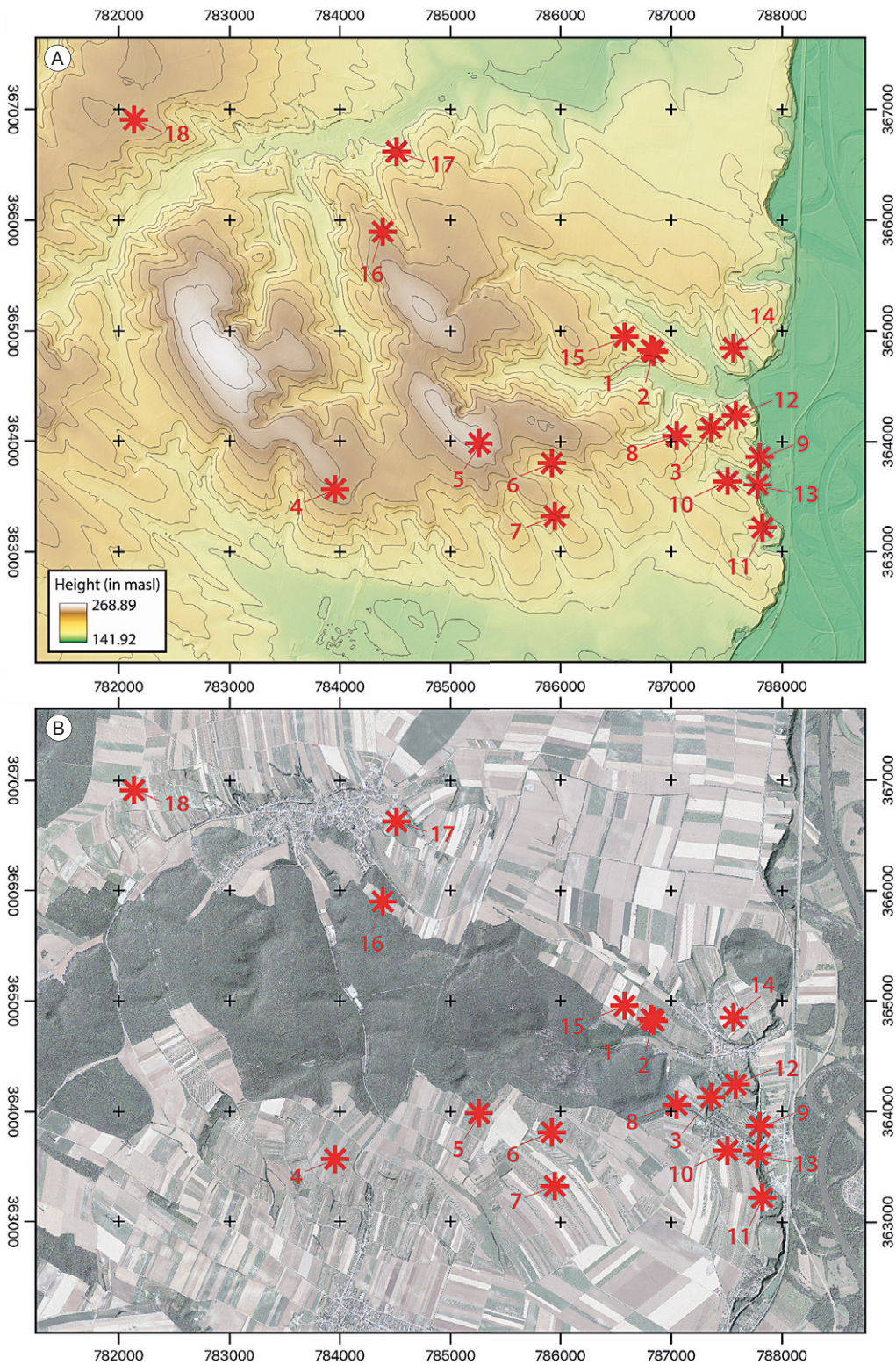
**Fig. 1.** Location of Stillfried-Grub microregion (3) and other microregions in the Middle Danube region and mentioned in the text. 1 – Willendorf microregion; 2 – Krems microregion; 3 – Stillfried-Grub microregion; 4 – Pavlov – Dolní Věstonice – Milovice microregion; 7 – Moravany microregion. Inset map shows European map and extent of main map. Map background (both for map and inset map): digital terrain model (DTM) of Europe (using WGS84/UTM grid system [northern hemisphere] [EPSG code 32600] as coordinate reference system). DTM source: GTOPO30 HYDRO 1k dataset from U.S. Geological Survey Earth Resources Observation and Science (EROS) Center, <https://doi.org/10.5066/F77P8WN0>. GIS and map by P. R. Nigst.

**Obr. 1.** Poloha mikroregionu Stillfried-Grub (3) a dalších mikroregionů ve středním Podunají zmíněných v textu. 1 – Mikroregion Willendorf; 2 – mikroregion Krems; 3 – mikroregion Stillfried-Grub; 4 – mikroregion Pavlov – Dolní Věstonice – Milovice; 7 – mikroregion Moravany. Vložená mapa zobrazuje mapu Evropy a rozsah zkoumaných regionů. Pozadí mapy (pro mapu i vloženou mapu): digitální model terénu (DTM) Evropy (s použitím souřadnicového systému WGS84/UTM [severní polokoule] [kód EPSG 32600] jako souřadnicového referenčního systému). Zdroj DTM: datová sada GTOPO30 HYDRO 1k z Centra pro pozorování a vědu o zemských zdrojích (EROS) americké geologické služby, <https://doi.org/10.5066/F77P8WN0>. GIS a mapa P. R. Nigst.

context of the various Early Upper Palaeolithic assemblages within the region, be they Bohunician or Aurignacian collections.

The region has also provided a wealth of information for the Mid-Upper Palaeolithic of Central Europe and human adaptations and responses to climatic and environmental change and associated variations in density and distribution of resources, nutrients and moisture. The number of stratified sites dated to the Mid-Upper Palaeolithic of the region is higher than for the Early Upper Palaeolithic and the Late Upper Palaeolithic (e.g. Svoboda et al. 1996). However, this picture changes when

also including surface collections (e.g. Škrdla 2017a; 2017b). Mid-Upper Palaeolithic site distribution includes a number of microregions with site clusters that have shaped much of how we currently conceive human occupation between 35,000 and 20,000 cal BP in the region. These include (but are not limited to) the microregions of Willendorf (e.g. Felgenhauer 1959; Haesaerts et al. 1996; Nigst et al. 2008; 2014), Pavlov – Dolní Věstonice – Milovice (e.g. Svoboda et al. 1996; 1999; 2011; 2019; Svoboda ed. 2005; Chlachula et al. 2025), Krems (e.g. Einwögerer 2000; Einwögerer et al. 2006; Neugebauer-Maresch 2008), Moravany



**Fig. 2.** Map showing the location of Palaeolithic sites (1–18) in the Stillfried-Grub region on top of a digital terrain model (A) and an orthophoto (B).  
 1 – Grub-Kranawetberg I;  
 2 – Grub-Kranawetberg II;  
 3 – Stillfried-Steinschlägetalier;  
 4 – Ollersdorf-Heidenberg;  
 5 – Stillfried-Alte Kirchenried;  
 6 – Stillfried-Hirschsprung;  
 7 – Mannersdorf-Zwiefelhap;  
 8 – Stillfried-Kirchenberg;  
 9 – Stillfried-Keller Klotz;  
 10 – Stillfried-Museumsgasse;  
 11 – Stillfried-Ziegelei; 12 – Stillfried-Wagneracker; 13 – Stillfried-Profil Binder; 14 – Grub-Sonnberg;  
 15 – Stillfried-Hönigsberg;  
 16 – Ebenthal-Jägerwald;  
 17 – Ebenthal-Sandbergen;  
 18 – Ebenthal-Weintaläcker (Parzellen 2229/2 and 2231). Sources: Aerial images/orthophotos in (B): Land Niederösterreich; elevation, hillshade and 1-metre contour lines calculated from a digital terrain model with 1-metre resolution in (A): Land Niederösterreich; coordinate reference system for (A) and (B): MGI/Austria GK M34 [EPSG code 31259]. GIS and graphic by P. R. Nigst.

**Obr. 2.** Mapa zobrazující umístění paleolitických lokalit (1–18) v oblasti Stillfried-Grub na digitálním modelu terénu (A) a ortofotosnímku (B).  
 1 – Grub-Kranawetberg I;  
 2 – Grub-Kranawetberg II;  
 3 – Stillfried-Steinschlägetalier;  
 4 – Ollersdorf-Heidenberg;  
 5 – Stillfried-Alte Kirchenried;  
 6 – Stillfried-Hirschsprung;  
 7 – Mannersdorf-Zwiefelhap;  
 8 – Stillfried-Kirchenberg;  
 9 – Stillfried-Keller Klotz;  
 10 – Stillfried-Museumsgasse;  
 11 – Stillfried-Ziegelei; 12 – Stillfried-Wagneracker; 13 – Stillfried-Profil Binder; 14 – Grub-Sonnberg;  
 15 – Stillfried-Hönigsberg;  
 16 – Ebenthal-Jägerwald;  
 17 – Ebenthal-Sandbergen;  
 18 – Ebenthal-Weintaläcker (parcel č. 2229/2 a 2231). Zdroje: Plošné snímky/ortofoto v (B): Land Niederösterreich; výškové, kopcovité a vrstevnicové linie v délce 1 m vypočítané z digitálního modelu terénu s rozlišením 1 m v (A): Land Niederösterreich; souřadnicový referenční systém pro (A) a (B): MGI/Austria GK M34 [kód EPSG 31259]. GIS a grafika P. R. Nigst.

(e.g. Hromada, Kozłowski eds. 1995; Polanská, Hromadová 2015; Hromadová et al. 2021), and Stillfried-Grub (e.g. Antl-Weiser et al. 2010; Nigst, Antl-Weiser 2012; Antl, Bosch 2015; Nigst et al. 2024; Bosch et al. 2025a) (see Fig. 1).

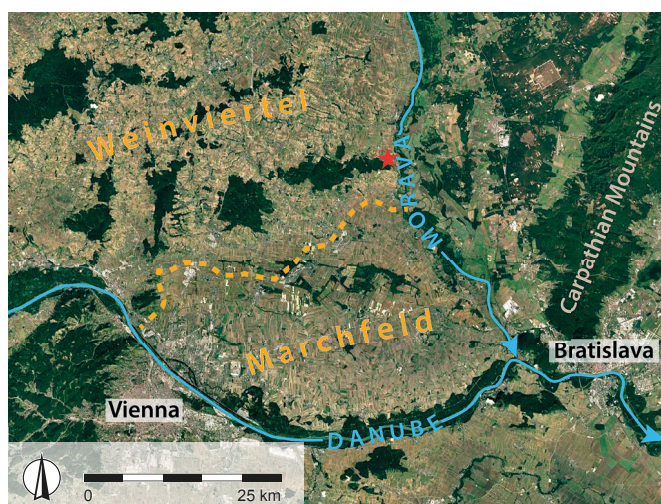
In this paper, we focus on the Grub-Kranawetberg site cluster in the Stillfried-Grub region, which is known for Upper Palaeolithic finds since the 19th century. In the Stillfried-Grub region more than 18 Upper Palaeolithic sites are known to date (Fig. 2). Sites in the microregion include those explored in recent excavations at Grub-Kranawetberg I (1993 to 2011 and in 2021; Antl-Weiser 2008; Antl-Weiser et al. 2010), Grub-Kranawetberg II (since 2022) and Ollersdorf-Heidenberg (2017, 2018 and 2022; Bosch et al. 2025a), but also Stillfried-Steinschlägeratelier (Felgenhauer 1980) excavated longer ago. About 13 sites are known only from surface collections.

The specific goals of this paper are: (1) presentation of the setting of the Grub-Kranawetberg site cluster; (2) detailed research history and summary of the previous work within the site cluster; (3) introduce for the first time the new site Grub-Kranawetberg II, which up to now has only been mentioned in unpublished reports to the Austrian Federal Monuments Authority; (4) present the results of our research since 2021 at the Grub-Kranawetberg site cluster including our survey in 2021, our excavation at Grub-Kranawetberg I in 2021 and our fieldwork at Grub-Kranawetberg II since 2022.

## 2. Setting of the Grub-Kranawetberg site complex

The Grub-Kranawetberg site complex is located approximately 30 km northeast of Vienna, close to the Morava (March) River valley, which forms the Austrian-Slovak border. The site complex occupies a position on the southeastern margins of the gently undulating hills defining the so-called Weinviertel region of northeastern Austria and where these hills meet the Morava valley and the Marchfeld plain, which is bounded by the Danube River to the south and the Morava River to the east (Fig. 3).

The archaeological occurrences of the Grub-Kranawetberg site complex comprising Grub-Kranawetberg I, Grub-Kranawetberg II



**Fig. 3.** Map showing the location of the Grub-Kranawetberg site complex (red star) close to the Morava valley, rolling hills of the Weinviertel region, the Marchfeld plain and Danube valley. Dashed line: boundary between the Marchfeld plain and rolling hills of Weinviertel. Background image: satellite image from Google Earth Pro, image by Landsat/Copernicus. Graphic by P. R. Nigst.

**Obr. 3.** Mapa znázorňující polohu komplexu nalezišť Grub-Kranawetberg (červená hvězda) v blízkosti údolí Moravy, zvlněného reliéfu regionu Weinviertel, Marchfeldské nížiny a údolí Dunaje. Přerušovaná čára: hranice mezi Marchfeldskou nížinou a pahorky Weinviertelu. Obrázek na pozadí: satelitní snímek z Google Earth Pro, snímek pořízený programem Landsat/Copernicus. Grafika P. R. Nigst.

and the surface finds to the west of them (Fig. 4) are found to the west of the village of Grub (cadastral community: Grub an der March, market town: Angern an der March, administrative district: Gänserndorf). They are situated on a ridge running west-northwest to east-southeast towards the village of Grub. The eastern half of the ridge is part of cadastral community of Grub an der March and has the field name Kranawetberg (also Kranawettberg or Kranebitter), while the western part belongs to the cadastral community of Stillfried and is known by the field-name Hönigsberg.

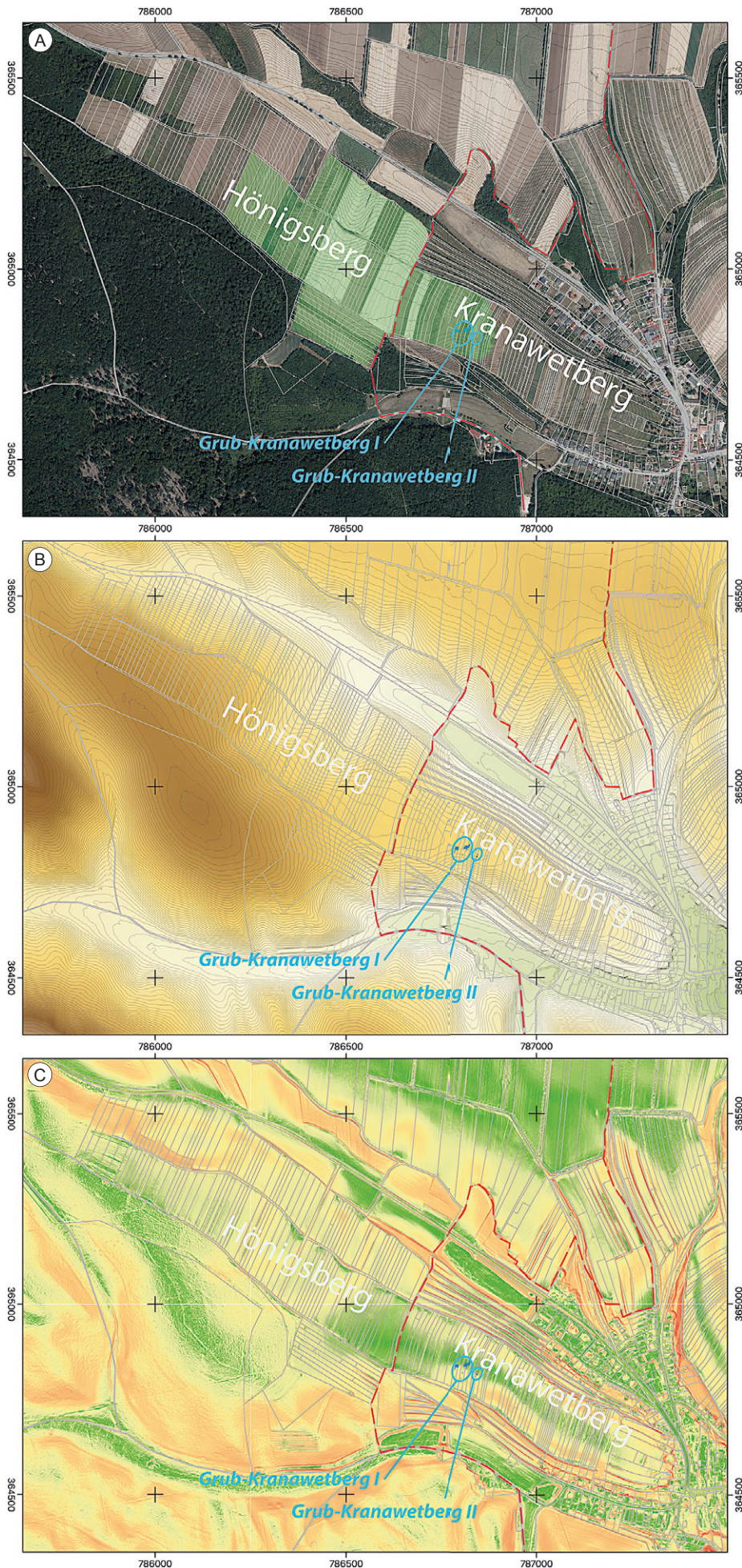
The ridge is approximately 1,200 m long, 180–200 m wide and its height varies between about 210 m (in its western part), about 200 m (in its central part) and around 180 m (in its eastern part). Due to its position, the site complex today offers a clear view to the east, overlooking the Morava valley and plain to the Carpathian Mountains. The views to the south, west and north are blocked by neighbouring ridges/hills.

At present, the majority of the ridge is under agricultural use. Only limited areas along its southern flank are covered by forest or consist of disused field terrace systems, which are now overgrown with dense vegetation, including mature trees (Fig. 4a). The terraced fields on the northern flank remain partly in cultivation. The top of the ridge supports a mosaic of viticulture, arable fields for a variety of crops, and areas of fallow land. Vineyards are concentrated predominantly on the eastern part of the ridge, whereas crop production is more characteristic of the western part. Fallow plots are primarily distributed in the central part of the ridge, indicating a patchwork pattern of land management.

The valleys north and south of the Kranawetberg/Hönigsberg ridge are dry valleys today. At present, the Morava River, a tributary of the Danube, is the nearest watercourse, flowing at a distance of roughly 1.5 km from the sites. The distance of the sites to the Morava during Marine Isotope Stages 3 and 2 remains unknown.

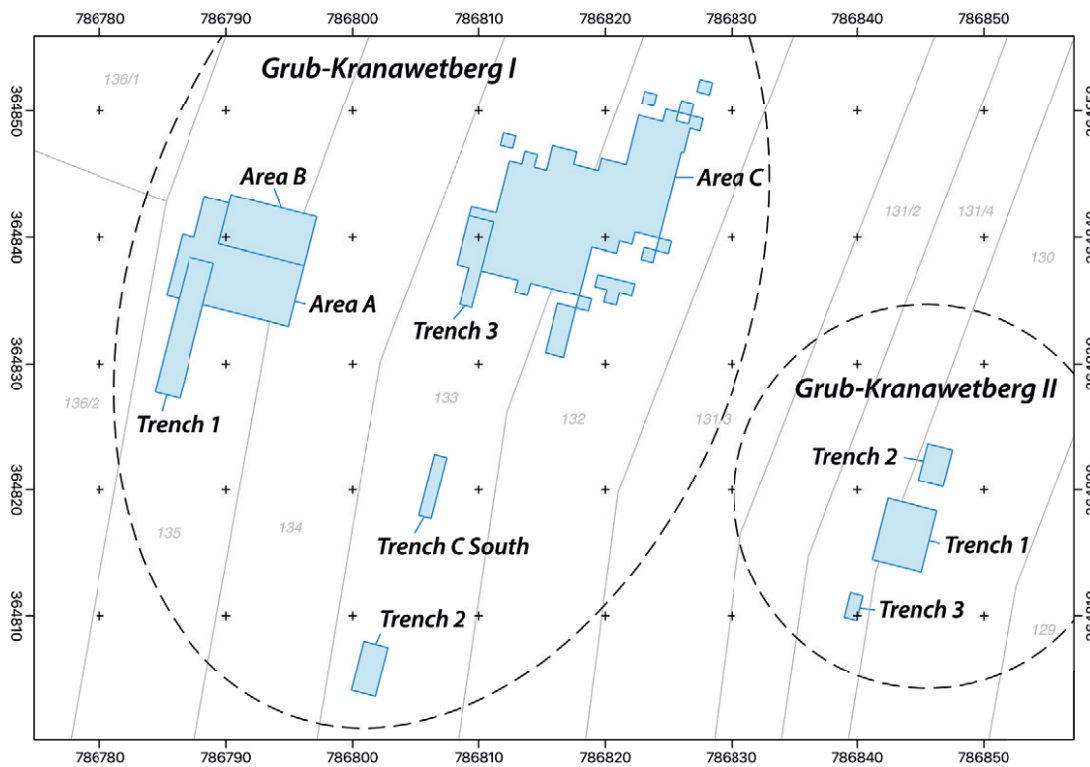
The two sites Grub-Kranawetberg I and II are located next to each other on the central part of the Kranawetberg/Hönigsberg ridge (Fig. 4). Excavated between 1993 and 2021, Grub-Kranawetberg I is comprised of Trench 1, 2, C South and 3, as well as Area A, B and C (Fig. 5). Grub-Kranawetberg II to the east and under excavation since 2022 is currently comprised of three trenches (Trench 1–3).

The top sedimentary deposits of the Kranawetberg/Hönigsberg ridge, on which the Grub-Kranawetberg site complex is located, are formed by loess-like sediments, mostly silt or sandy silt. Their maximum thickness at Grub-Kranawetberg I was estimated by a geoelectrical survey in 1997 to approximately 20 m (Antl, Verginis 1998). Later, in 2012, percussion drilling at Grub-Kranawetberg I showed a thickness of loess-like sediments of 11.54 m, overlying Neogene sediments (Antl, Peticzka 2012). Our own borings at Grub-Kranawetberg I in 2021, despite being limited to a maximum depth of 5.5 m (Antl-Weiser et al. 2024a; 2024b), are consistent with these results. At Grub-Kranawetberg II the maximum thickness documented thus far through borings is around 5.3 m (Bosch et al. 2025b). The above estimations of the minimum thickness of the loess-like sediment cover are valid only for the specific part of the ridge where the sites of Grub-Kranawetberg I and II are located, i.e. its central part. It is likely there is some variation in the thickness of the Pleistocene loess cover across the 1,200 m long Kranawetberg/Hönigsberg ridge. We should also note that in some areas towards the west of the ridge medium to coarse gravel-sized clasts appear on the surface, which might indicate that agricultural activities at times cut into non-loess-like deposits. The underlying sediments probably date to the Pannonian (Neogene).



**Fig. 4.** Map showing the location of the sites of Grub-Kranawetberg I and II (blue), the field-walking survey area (green, only shown in A), two parts of the ridge called Hönigsberg and Kranawetberg, and the boundary between the cadastral communities of Stillfried and Grub an der March (red dashed line) on a map of the cadastral boundaries (grey) and a satellite image (A), digital elevation model (B) and slope angles (C). Sources: Cadastral map (Digitale Katastralmappe): Bundesamt für Eich- und Vermessungswesen; areal images/orthophotos: Land Niederösterreich; digital elevation model: with 1 m resolution: Land Niederösterreich; hillshade calculated from a digital terrain model with 1 m resolution: Land Niederösterreich; coordinate reference system: MGI/Austria GK M34 (EPSG code 31259). GIS and graphics by P. R. Nigst.

**Obr. 4.** Mapa znázorňující umístění lokalit Grub-Kranawetberg I a II (modrá), oblast terénního povrchového průřezu (zelená, zobrazena pouze v A), dvě části hřebenu Hönigsberg a Kranawetberg a hranici mezi katastrálními obcemi Stillfried a Grub an der March (červená přerušovaná čára) na mapě katastrálních hranic (šedá) a satelitním snímku (A), digitálním modelu reliéfu (B) a na úhlech sklonu (C). Zdroje: Katastrální mapa (Digitale Katastralmappe): Bundesamt für Eich- und Vermessungswesen; plošné snímky/ortofoto: Land Niederösterreich; digitální model reliéfu: s rozlišením 1 m: Land Niederösterreich; stín kopce vypočítaný z digitálního modelu terénu s rozlišením 1 m: Land Niederösterreich; souřadnicový referenční systém: MGI/Austria GK M34 (kód EPSG 31259). GIS a grafika P. R. Nigst.



**Fig. 5.** Location of trenches excavated at the sites of Grub-Kranawetberg I and II on a cadastral map. Source cadastral map: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vienna, Austria. Coordinate reference system: MGI/Austria GK M34 (EPSG code 31259). GIS and Graphic by P. R. Nigst.

**Obr. 5.** Umístění sond vykopaných v lokalitách Grub-Kranawetberg I a II na katastrální mapě. Zdroj katastrální mapy: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vídeň, Rakousko. Souřadnicový referenční systém: MGI/Austrie GK M34 (kód EPSG 31259). GIS a grafika P. R. Nigst.

Regarding a reconstruction of the palaeorelief, especially in terms of elevation and slope gradient and orientation, we currently have limited information; however, the orientation and dip of the exposed deposits in the excavation trenches of Grub-Kranawetberg I and Grub-Kranawetberg II suggest that during the Gravettian occupations slope gradient and orientation were slightly different than the present-day terrain. For example, at Grub-Kranawetberg I, Trench 3 and Area C, the terrain at the time of human occupation sloped slightly towards the north(east) (cf. Antl 2013): AH 4 in Trench 3 (squares A7 to B10) was encountered 1.4 to 1.5 m below the surface (Antl-Weiser 1996a), while in the 2021 excavation (square P20/P21), AH 4 was observed at a depth of 2.15 to 2.2 m below the top surface (Antl-Weiser et al. 2024b).

### 3. Research history

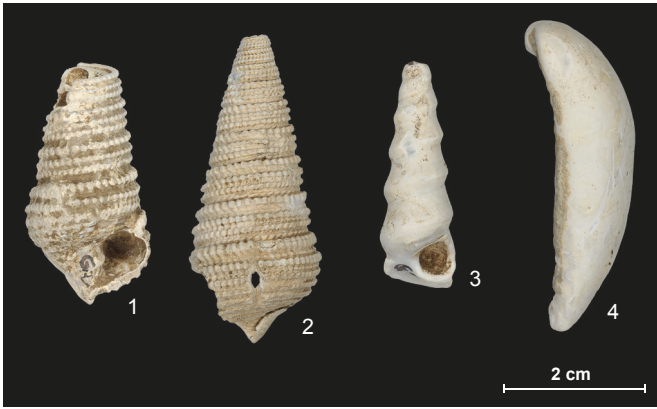
The first Palaeolithic finds reported in the Stillfried-Grub microregion were those collected by M. Much in 1879 (Much 1881) in the village of Stillfried, though not in the Kranawetberg site cluster (Much 1881; see also Weiser 1978; Antl-Weiser 1996a). Nevertheless, they are the reason Stillfried-Grub has been known since then as a Palaeolithic find region.

To our knowledge the first records of Palaeolithic finds from the Grub-Kranawetberg site cluster are surface finds recovered on the Kranawetberg/Hönigsberg ridge and reported in the 1930s by Moßler (1935). These finds include a blade, flake and burin (Weiser 1978). The exact location of Moßler's finds on the ridge remains unknown.

Since the 1970s, more systematic surface collection efforts have been undertaken with varying intensity. These collections have proceeded intermittently, alternating between periods of heightened activity, reduced engagement, and occasional inactivity. Both professional archaeologists and local collectors, including F. Felgenhauer, W. Neugebauer, O. Lienhart, I. Peter and H. Preisl, have collected surface finds along the Kranawetberg/Hönigsberg ridge (Weiser 1978; Antl-Weiser 1996a). The survey work of W. Neugebauer in 1972 and the following years

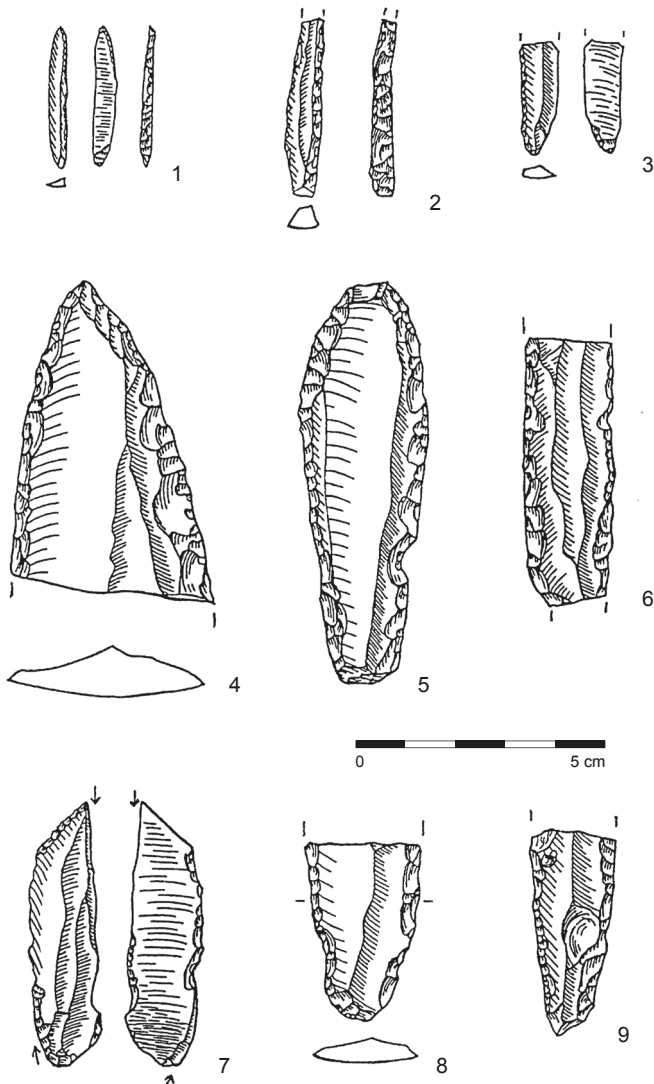
established that the lithic surface finds on Kranawetberg continue to the east into the area of the ridge called Hönigsberg, which belongs to the village of Stillfried. Beginning in 1975, O. Lienhart collected numerous lithics on Hönigsberg ridge, mainly just west of the Kranawetberg/Hönigsberg divide, but also some finds further east on the Kranawetberg ridge. In 1978, F. Felgenhauer collected surface materials, among others, on the northern end of the field just south of the Grub-Kranawetberg I site, i.e. on cadastral parcel 82/8 (cadastral territory: Grub an der March). Until 2018, the fieldwalking of I. Peter produced a large collection of lithic artefacts collected on Kranawetberg between Grub-Kranawetberg I and the Kranawetberg/Hönigsberg divide to the west. Herbert Preisl began fieldwalking on the Kranawetberg/Hönigsberg ridge in 1993 and has continued his efforts to the present. While some of these surface collection assemblages remain in private ownership, others are housed in the local 'Stillfried – Zentrum der Urzeit' museum. In addition, surface finds on the entire Kranawetberg/Hönigsberg ridge have been collected by W. Antl-Weiser as part of the fieldwork at Grub-Kranawetberg I.

These surface collections are predominantly composed of lithic artefacts, though faunal remains are also represented (Weiser 1978; Antl-Weiser 1996a). Among the surface collection are Miocene shells used as personal ornaments. They are attributed to the bivalve *Anadara diluvia*, the gastropods *Mesohalina margaritacea* (Fig. 6: 1, 2), *Turritella gradata* (Fig. 6: 3), *Amalda glandiformis*, *Conus* sp., *Terebralia duboisi*, and *Cypreidae* indet. (Fig. 6: 4), and the scaphopod *Fissidentalium badense* (Bosch et al. 2026). Lithics include blades, flakes, and a number of formal tools including various burins, endscrapers, fragmented Gravette points, microgravette points, backed bladelets and retouched blades (Weiser 1978; Antl-Weiser 1996a) (Fig. 7). Most of the lithics are congruent with an attribution to the Upper Palaeolithic in general and to the Gravettian in particular (Heinrich 1974; Weiser 1978; Antl-Weiser 1996a), but the vast majority of the lithic artefacts (n > 5,000) collected by I. Peter remain unstudied.



**Fig. 6.** Grub-Kranawetberg site complex, surface finds by local collectors: Selection of fossil mollusc taxa. 1, 2 – *Mesohalina margaritacea*; 3 – *Turritella gradata*; 4 – *Cypraeidae* indet. Photo by A. Kurzawska; graphic by M. D. Bosch and P. R. Nigst.

**Obr. 6.** Lokalita Grub-Kranawetberg, povrchové nálezy místních sběratelů: výběr fosilních taxonů měkkýšů. 1, 2 – *Mesohalina margaritacea*; 3 – *Turritella gradata*; 4 – *Cypraeidae* indet. Foto A. Kurzawska; grafika M. D. Bosch a P. R. Nigst.



**Fig. 7.** Grub-Kranawetberg site complex, surface finds from the Kranawetberg/Hönigsberg ridge: Selection of lithics. 1 – Microgravette point; 2, 3 – fragments of backed bladelets; 4 – fragment of retouched pointed blade; 5, 6, 8, 9 – bilaterally retouched blades; 7 – burin. Drawing by W. Antl-Weiser (after Antl-Weiser 1996a).

**Obr. 7.** Lokalita Grub-Kranawetberg, povrchové nálezy ze hřebenu Kranawetberg/Hönigsberg: výběr kamenných artefaktů. 1 – Mikrogravetový hrot; 2, 3 – fragmenty čepelek s otupeným bokem; 4 – fragment retušované čepele s hrotem; 5, 6, 8, 9 – oboustranně retušované čepele; 7 – rydlo. Kresba W. Antl-Weiser (podle Antl-Weiser 1996a).

Due to their nature, most of these surface collections were unsystematic and we lack detailed spatial information. For some collections we have information on which part of the ridge they originate, but we rarely know the collection origin at the cadastral parcel or sub-parcel level. However, in the westernmost part of Kranawetberg and on Hönigsberg, the surface finds occur on top of the ridge (or on the slope to the north), while surface finds further east on Kranawetberg occur on the south-facing slope (Antl-Weiser 1996a; Nigst et al. 2024).

### 3.1 Grub-Kranawetberg I – fieldwork between 1993 and 2011

The next phase of research at the Grub-Kranawetberg site cluster began in 1993 and lasted (with interruptions in 2003, 2006 and 2008) until 2011. In this time window, W. Antl-Weiser directed excavations at the site of Grub-Kranawetberg I, which in publications prior to 2022 is labelled as Grub-Kranawetberg.

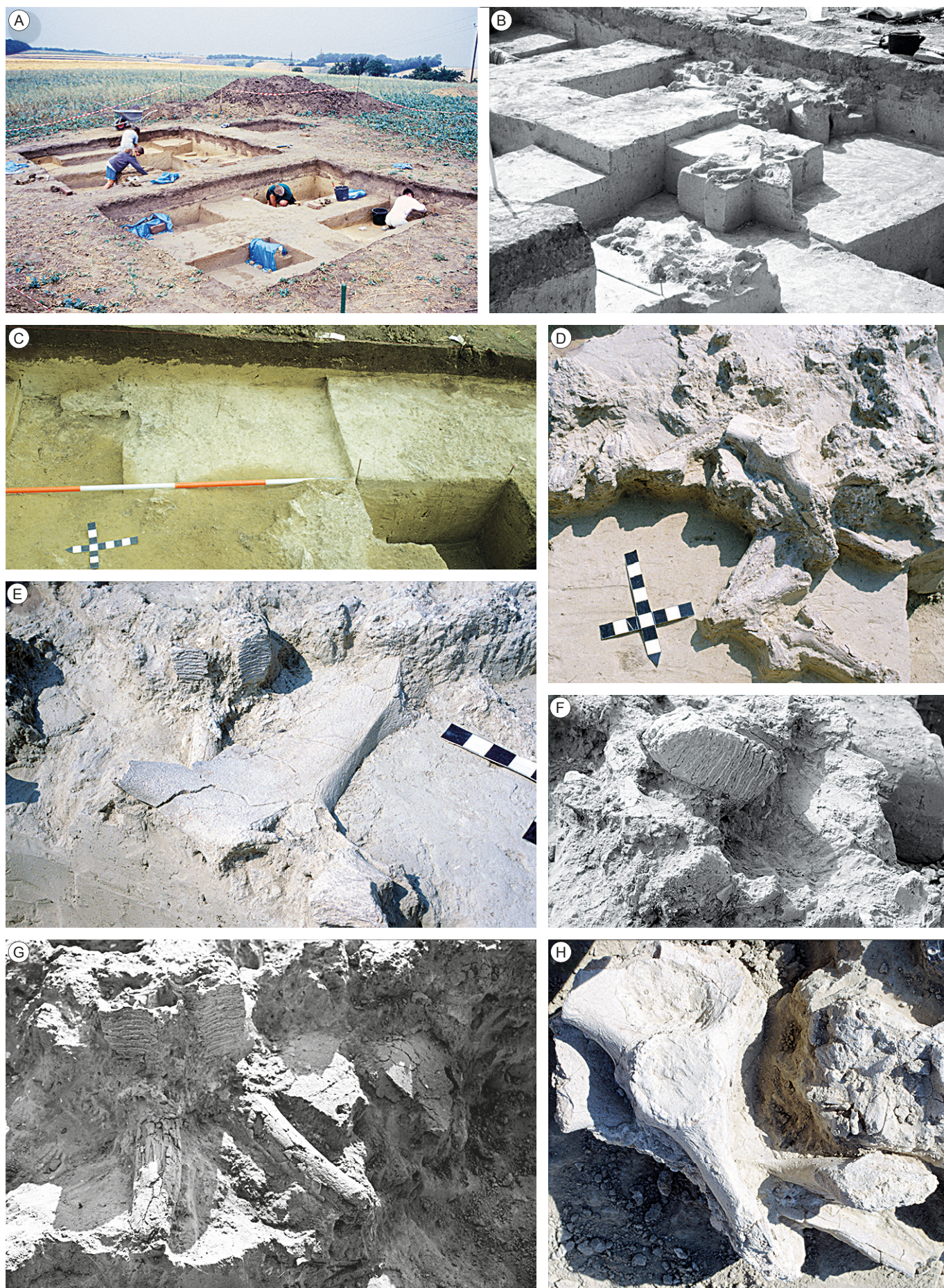
After turning a vineyard into farmland in spring 1993, large-sized remains of *Mammuthus primigenius* and lithic artefacts were exposed and a local collector (H. Preisl) reported these finds to W. Antl-Weiser. Soon after, a rescue excavation under Antl-Weiser's direction was launched. Trench 1 (10 × 2 m) provided an archaeological horizon with abundant highly fragmented large mammal bone remains, many of which showed traces of exposure to fire at varying intensity (Antl-Weiser 1994; 1995; 1996a; Bosch et al. 2012). In addition, remains of *Mammuthus primigenius*, including a molar, a fragmentary tusk and the spine of a vertebra, were recovered at the northern end of Trench 1. Two lithics were also recovered: a flake and, at a higher elevation and thus not associated with the faunal remains and representing a second, upper archaeological horizon, a retouched blade fragment (Antl-Weiser 1996a). In the southern two metres of Trench 1, the archaeological horizon was already destroyed by agricultural activities and, hence, no finds were recovered.

From 1994, a multi-year excavation by the Natural History Museum Vienna (Prehistoric Department) co-funded by the Austrian Science Fund [FWF] began, extending Trench 1 to the north and east (Area A, B), excavating Trench 2 and starting Trench 3 and Area C (Fig. 5; Tab. 1).

In Trench 1 and Area A and B altogether an area of about 93 m<sup>2</sup> was excavated until 1995 (Fig. 5; Tab. 1). As mentioned for Trench 1 above, this work exposed two archaeological horizons.

**Fig. 8.** Grub-Kranawetberg I, bone accumulation (Trench 1, Area A and B). A – view of the 1994 excavation (Area A; viewing direction towards northwest). B – Large faunal remains of *Mammuthus primigenius* in the lower archaeological horizon in Area A (excavation 1994; viewing direction towards southeast). Note the small distance between the top of the faunal remains and the bottom of the humic top soil. C – View of excavation 1993 in Trench 1 (northern part of Trench 1) while exposing faunal remains (highly fragmented in situ partly due to burning). Please note how close the archaeological horizon with the large faunal remains is to the humic top soil and agricultural activity (ploughing). D – Innominate of *Coelodonta antiquitatis* and thoracic vertebrae of *Mammuthus primigenius*. E – Innominate of *Mammuthus primigenius* overlying a partial skull of the same species. F – Upper molar of *Mammuthus primigenius*. G – *Mammuthus primigenius* partial skull after removal of the innominate shown in E. H – Innominate of *Coelodonta antiquitatis*. Photo by W. Antl-Weiser, Museum of Natural History Vienna.

**Obr. 8.** Grub-Kranawetberg I, akumulace kostí (sonda 1, oblast A a B). A – pohled na výzkum z roku 1994 (oblast A; směr pohledu na severozápad). B – pozůstatky velké fauny druhu *Mammuthus primigenius* ve spodním archeologickém horizontu v oblasti A (sonda 1994; směr pohledu na jihovýchod). Všimněte si malé vzdálenosti mezi horní částí vrstvy s faunou a spodní částí humózní ornice. C – pohled na výzkum z roku 1993 v sondě 1 (severní část sondy 1) s odkrytými pozůstatky fauny (vysoce fragmentované in situ, částečně kvůli spálení). Všimněte si, jak blízko je archeologický horizont s velkou faunou humózní ornici a zemědělské orbě. D – pánev druhu *Coelodonta antiquitatis* a hrudní obratle druhu *Mammuthus primigenius*. E – pánev druhu *Mammuthus primigenius* překrývající část lebky stejného druhu. F – horní stolička druhu *Mammuthus primigenius*. G – část lebky *Mammuthus primigenius* po odstranění pánve zobrazené na obrázku E. H – pánev druhu *Coelodonta antiquitatis*. Foto: W. Antl-Weiser, Naturhistorisches Museum, Vídeň.



**Fig. 8.** Grub-Kranawetberg I, bone accumulation (Trench 1, Area A and B). See the previous page.

**Obr. 8.** Grub-Kranawetberg I, akumulace kostí (sonda 1, oblast A a B). Viz předchozí strana.

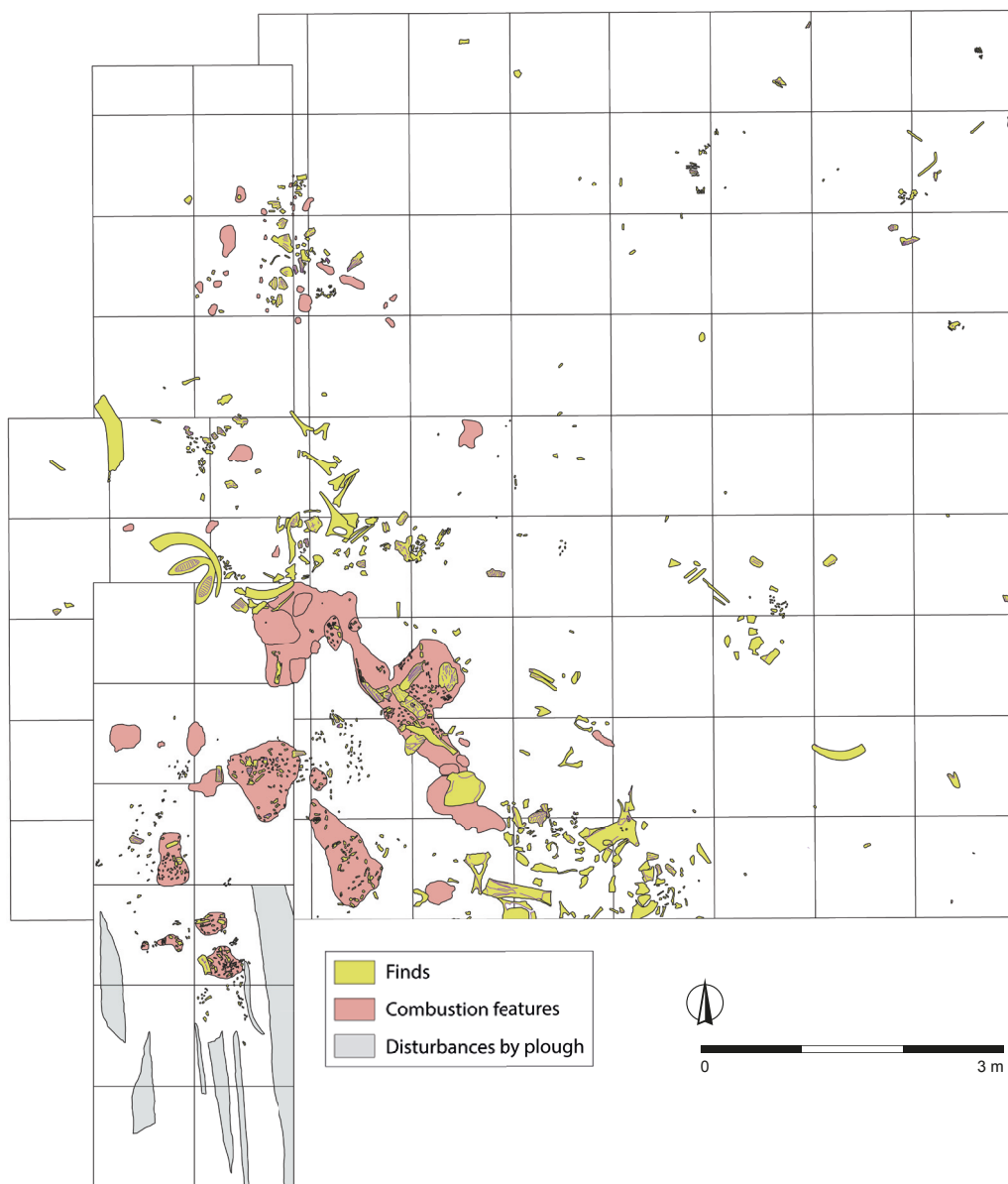
The upper archaeological horizon is a faint horizon of a few lithic artefacts, while the lower one presents an accumulation of large faunal remains (Fig. 8, 9), most notably the remains of the two megafaunal taxa, *Mammuthus primigenius* and *Coelodonta antiquitatis*, associated with a low number of lithics, stones and red ochre. While the upper archaeological horizon remains undated due to a lack of suitable material (bone or charcoal), the lower archaeological horizon is radiocarbon dated to 30,000–29,000 cal BP (charcoal; Tab. 2).

Based on the large faunal remains in the lower archaeological horizon, this area of the site has been labelled ‘bone accumulation’ (also ‘bone clusters’ or ‘dump zone’; ‘Knochenanhäufung’ or ‘Knochenhaufen’ in German) in publications (e.g. Antl-Weiser 1994; 1995; 1996a; 1996b; 2008; Antl-Weiser et al. 1997; 2010; Bosch et al. 2012; 2017). Besides *Mammuthus primigenius* and *Coelodonta antiquitatis*, a number of other taxa have been identified in the lower archaeological horizon, specifically *Rangifer tarandus*, *Equus* sp., *Megaloceros giganteus*, *Canis lupus*, *Ursus* cf. *arctos*, and *Lepus* cf. *timidus* (Fladerer 1997; Antl, Fladerer 2004; Bosch et al. 2012; 2017). The presence of butchery marks on remains of both megafaunal species indicates a human-accumulated assemblage. The absence of carnivore gnawing further suggests that

hunter-gatherers had first access to meat-rich skeletal elements. Evidence of interaction between humans using the eastern part of the site with Trench 3 and Area C and the faunal remains is demonstrated by the rearticulation of a left upper first molar of *Mammuthus primigenius* recovered in Trench 3 / Area C with its corresponding right first upper molar retrieved from the bone accumulation (Bosch 2009; 2012; Bosch et al. 2012). Additional characteristics of the deposit include multiple indications of fire, such as patches of burned sediment and numerous thermally altered faunal remains. The variation in bone colouration, together with reddened burned silty sediment, indicates exposure to a wide spectrum of fire temperatures including temperatures > 600°C. These findings support the interpretation that fire was deliberately employed as a strategy for waste disposal (Bosch et al. 2012; 2017).

Trench 2 (4 × 2 m) about 20 m to the southeast of Trench 1 (Fig. 5; Tab. 1) was excavated in 1994 to test for the presence of archaeological horizons in this area after bones were found on the surface by H. Preisl. The fieldwork in Trench 2, however, yielded no evidence of archaeological material.

In 1995, about 20 m to the northeast of Trench 1, a test trench (Trench 3; 9 × 2 m) was excavated (Fig. 5; Tab. 1). At a depth of



**Fig. 9.** Grub-Kranawetberg I, bone accumulation (Trench 1, Area A and B): Distribution of finds and fire features. GIS and graphic by P. R. Nigst.

**Obr. 9.** Grub-Kranawetberg I, akumulace kostí (sonda 1, oblast A a B): Rozložení nálezů a prvků ohnišť. GIS a grafika P. R. Nigst.

Site	Trench	Year(s) of excavation	Area (in m <sup>2</sup> )	Evidence of archaeological remains	Number of archaeological horizons	
Grub-Kranawetberg I	'Bone accumulation'	Trench 1	1993	20	Yes	2
		Area A	1994	43	Yes	2
		Area B	1995	30	Yes	2
	'Campsite'	Trench 2	1994	8	No	-
		Trench 3	1995, 1996	20	Yes	1
		Area C	1996–2002, 2004–2005, 2007–2011, 2021	160	Yes	5
		Trench C South	1996	5	Yes	1
Grub-Kranawetberg II	Trench 1	2022–present	20	Yes	5	
	Trench 2	2023–present	7	Yes	3	
	Trench 3	2024–present	2	Yes	2	

**Tab. 1.** Trenches excavated at Grub-Kranawetberg I and II and their year(s) of excavation, area, and number of archaeological horizons. Area: is rounded to closest m<sup>2</sup>. Numbers given for Grub-Kranawetberg II in columns area and number of archaeological horizons are preliminary as fieldwork is ongoing.

**Tab. 1.** Sondy vykopané v Grub-Kranawetberg I a II a rok(y) výzkumu, plocha a počet archeologických horizontů. Plocha: zaokrouhlena na nejbližší m<sup>2</sup>. Čísla uvedená pro Grub-Kranawetberg II ve sloupcích a počty archeologických horizontů jsou předběžné, protože terénní práce stále probíhají.

1.4 m to 1.5 m below the surface an archaeological horizon rich in lithic artefacts (e.g. backed bladelets), faunal remains (e.g. molar and tusk fragments of *Mammuthus primigenius* and a fragmentary *Canis lupus* skull), charcoals and red ochre were discovered.

Trench C South with an area of 5 × 1 m is located about 10 m south of Trench 3 and 10 m north of Trench 2 (Fig. 5 and Tab. 1). It was excavated in 1996 to test for the presence of any archaeological horizons. Excavation showed areas affected by combustion, and it should be noted that it remains unclear whether this combustion is related to anthropogenic activities or represents a natural fire. Only one lithic artefact, a chip, was recovered from the entire trench.

In 1996, Trench 3 was extended by 1 m to the north and in the same year Area C, to the north and east of Trench 3, was started as a 7 × 4 m excavation trench. Until 2011, Area C was extended significantly, resulting in excavated area of about 160 m<sup>2</sup> (Fig. 5). This part of the Grub-Kranawetberg I site has been labelled in publications as the 'campsite' (e.g. Antl-Weiser et al. 1997; Antl-Weiser 2008; Antl, Fladerer 2004; Bosch et al. 2012; 2017) or 'dwelling structures' (e.g. Antl-Weiser et al. 2010).

The excavated sequence in this part of the site is up to about 4.5 m deep and contains four archaeological horizons. The four archaeological horizons are labelled (from bottom to top) AH 4, AH 3, AH 2 and AH 1 (Antl-Weiser 2008; 2016; 2019; Antl-Weiser et al. 2010). In addition, there are a few finds occurring a few centimetres below AH 4 in yellowish sandy silt, and since 2021 these are labelled AH 5 (Antl-Weiser et al. 2024b). Both AH 4 and AH 3 are associated with dark to light brownish bioturbated horizons, which are interpreted as anthropogenic soil formations or anthrosols (for AH 4 see Schilt et al. 2017) and probably hint at high occupation intensity. Explorations of occupation duration and of the degree to which AH 3 and AH 4 represent palimpsests are ongoing. AH 4 and AH 3 are radiocarbon dated to 30,000–28,200 cal BP (Tab. 2). The upper archaeological horizons, AH 2 and AH 1, are not associated with anthrosols and seem to be indicative of a much lower occupation intensity. AH 2 is radiocarbon dated to 26,900–25,600 cal BP (Tab. 2).

AH 4 is present more or less in the entire excavation surface of Trench 3 and Area C, while AH 3 is confined to the eastern part of Area C (e.g. Antl-Weiser 2016). AH 2, AH 1 and AH 5 are limited to the northeastern part of Area C.

AH 4: Two combustion features (CF I and CF II) and several small pits are documented (Antl-Weiser 2008; Nigst, Antl-Weiser 2012) in AH 4. CF I, an oval structure approximately 1.3 × 0.7 m, shows evidence of at least four burning phases

underlined by reddish sediment and stacked at more or less the same place, with sterile silt deposits in between (Antl-Weiser 2008; Nigst, Antl-Weiser 2012). CF II, approximately 1 m in diameter, is a pit structure with relatively steep borders around the perimeter. The yellowish sandy silt below has a reddish burnt colour.

Numerous small pits were observed around both CF I and CF II (Antl-Weiser 2008; Nigst, Antl-Weiser 2012). These small pits with different shapes and depths are confined to the surroundings of the two combustion features, i.e. a radius of about 2.5 m around the centre of the combustion features (Antl-Weiser 2008; 2016; Nigst 2006; Nigst, Antl-Weiser 2011; 2012).

The spatial distribution of piece-plotted finds around the combustion features has only been studied in detail for the western area around CF I. Philip R. Nigst (2006; Nigst, Antl-Weiser 2011; 2012) suggested that the pattern is congruent with a dwelling structure around CF I. No spatial analyses have yet been conducted for the area east of CF I and the area around CF II.

Faunal remains are abundant and mostly highly fragmented and of a rather small size. Taxa documented so far include *Mammuthus primigenius*, *Rangifer tarandus*, *Equus* sp., *Coelodonta antiquitatis*, *Canis lupus*, and *Lepus* cf. *timidus* (Fladerer 1997; Antl, Fladerer 2004; Antl-Weiser et al. 2010). *Mammuthus primigenius*, *Rangifer tarandus* and *Equus* sp. dominate in terms of NISP, MNE and MNI. A zooarchaeological analysis made it possible to connect the lower archaeological horizon of the bone accumulation of Trench 1 / Area A and B to AH 4 of Trench 3 / Area C by a re-articulation of the left upper first molar and the matching right upper first molar of an 8–10-year-old *Mammuthus primigenius* individual (Bosch 2009; 2012; Bosch et al. 2012).

Ivory specimens are a special feature of the AH 4 faunal remains. Worked ivory pieces include two pins, six pendants and > 260 beads of various shapes as well as ivory pieces representing the production process of the beads (Antl-Weiser 1999; 2019; Antl, Bosch 2015; Bosch et al. 2026). The bead types exhibit a relatively standardised range of sizes and shapes, yet display considerable diversity in the degree of final smoothing and modification (Antl-Weiser 1999; Bosch et al. 2026). Similarly, the extent of use-wear traces varies substantially, likely reflecting differences in the duration, intensity and type of use. Indicators of on-site production include ivory blanks and ivory rod fragments bearing multiple equidistant circular incisions (Antl, Bosch 2015; Bosch et al. 2026).

Additional personal ornaments are represented by shell beads, all made from Miocene shells including bivalves (4 taxa), gastropods (8 taxa) and scaphopods (1 taxon) (Bosch et al. 2026).

Trench/Area	Area	AH	Feature	Square	Laboratory number	14C age	14C SD	δ13C	Pretreatment	Material	Material detail	References	cal BP 1 sigma range	cal BP 2 sigma range
Trench 1 and Areas A, B	Area B	Lower AH		B1/B2	GrA-9062	25220	250	-	ABA	Charcoal	Indet.	Antl, Fladerer 2004	29792–29226	30020–29028
Trench 3 and Area C	Area C	AH 2		N19	OxA-18319	21800	280	-23,849	ABA	Charcoal	Indet.	Antl-Weiser 2019	26357–25853	26903–25604
	Area C	AH 3			GrA-28183	24780	140	-	ABA	Charcoal	Indet.	Antl-Weiser et al. 2010	29146–28877	29216–28744
	Area C	AH 3			GrA-28184	25640	160	-	ABA	Charcoal	Indet.	Antl-Weiser et al. 2010	30110–29816	30204–29325
	Area C	AH 3			GrA-28185	25010	150	-	ABA	Charcoal	Indet.	Antl-Weiser et al. 2010	29506–29052	29793–28888
	Area C	AH 4	Hearth I, second layer in hearth	E10	GrA-9066	24830	230	-	ABA	Charcoal	Indet.	Antl, Fladerer 2004	29228–28783	29746–28629
	Area C	AH 4	Pit/post hole	C9	GrA-9065	24930	240	-	ABA	Charcoal	Indet.	Antl, Fladerer 2004	29488–28814	29848–28722
	Area C	AH 4		C9	GrA-9063	24620	230	-	ABA	Charcoal	Indet.	Antl, Fladerer 2004	29120–28685	29262–28226
	Area C	AH 4		J15	VERA-364	25300	90	-	ABA	Charcoal	Indet.	Antl, Fladerer 2004	29783–29321	29893–29246
	Trench 3	350 cm below surface		A10	VERA-365	26700	120	-25,5	ABA	Charcoal	Indet.	Antl-Weiser et al. 2010	31078–30904	31149–30772

Tab. 2. Grub-Kranawetberg I: Radiocarbon ages. Calibration curve: IntCal20 (Reimer et al. 2020), calibrated with the R package rcarbon 1.5.0 (Crema, Bevan 2021).

Tab. 2. Grub-Kranawetberg I: radiokarbonové stáří. Kalibrační křivka: IntCal20 (Reimer et al. 2020), kalibrováno pomocí R package rcarbon 1.5.0 (Crema, Bevan 2021).

Human remains are represented by two deciduous teeth: a right first lower molar and a left lateral upper incisor (Antl-Weiser, Teschler-Nicola 2001; Teschler-Nicola et al. 2004). Based on their characteristic morphology, dimensions, and degree of attrition, Teschler et al. (2004) suggest that both teeth could have originated from the same individual.

Lithics are the most abundant find category, erratic flint the dominant raw material unit. Among tool types, backed bladelets of various types are most frequent and include microgravette points and fragments thereof. Other represented tool types are endscrapers, burins, borers, retouched blades and flakes (Antl, Fladerer 2004; Antl-Weiser 2008; Antl-Weiser et al. 2010).

AH 3: In contrast to AH 4, we have not been able thus far to identify any features such as combustion features or pits in AH 3. The fauna is highly fragmentary and dominated by remains attributed to *Mammuthus primigenius*, *Rangifer tarandus*, and *Equus* sp. (Antl-Weiser 2008; Antl-Weiser et al. 2010). Although no ivory beads have been documented thus far, numerous personal ornaments are made from Miocene shells including bivalves (3 taxa), gastropods (5 taxa) and scaphopods (1 taxon) (Bosch et al. 2026). Lithic artefacts are mainly made from radiolarites and various cherts (Antl 2013; Antl, Fladerer 2004; Antl-Weiser 2008; Antl-Weiser et al. 2010). Formal tools are dominated by backed bladelets including microgravette points and other types (Antl 2013; Antl-Weiser et al. 2010).

AH 2 and AH 1: While the lithic materials of AH 2 and AH 1 have not yet been studied in detail, there are preliminary faunal studies for AH 2 from square N19. AH 2 faunal remains from N19 are scarce but include specimens assigned to *Mammuthus primigenius*, *Rangifer tarandus*, *Canis lupus* and bird remains that have not been more precisely identified to date (Wagner 2023).

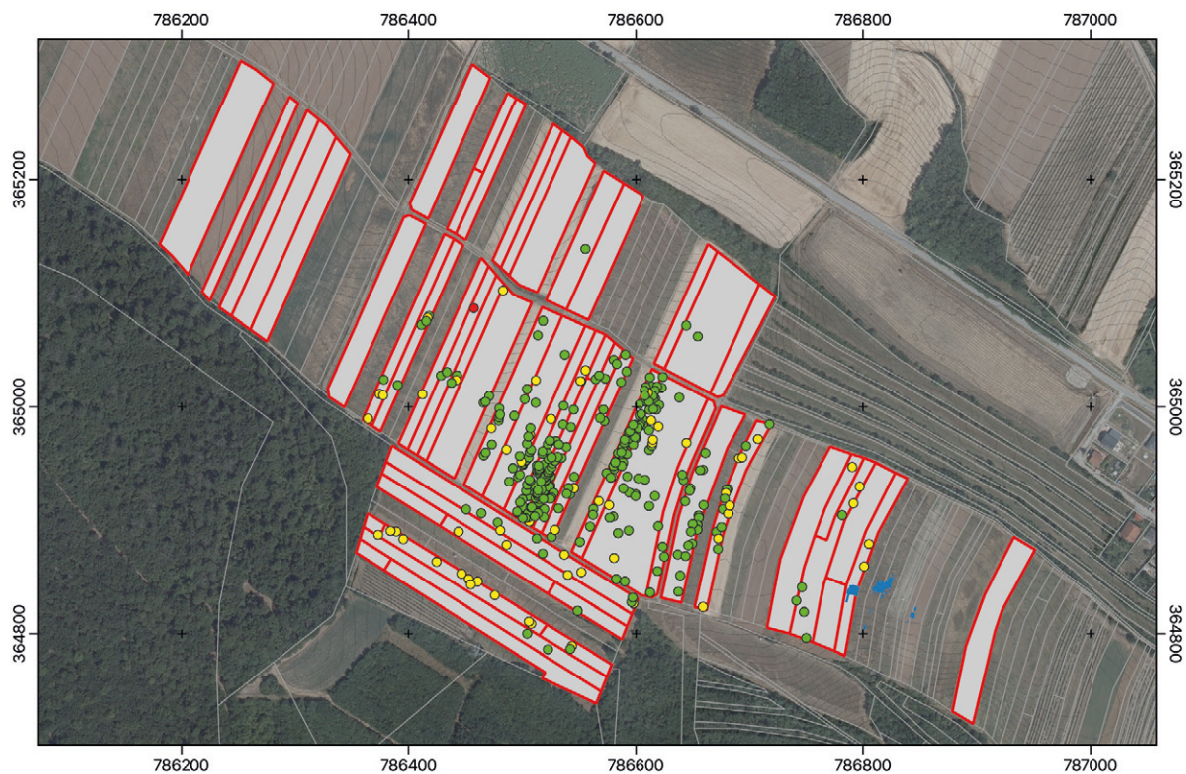
### 3.2 New fieldwork in 2021: Fieldwalking survey of the Kranawetberg/Hönigsberg ridge and excavation at Grub-Kranawetberg I

In 2021, W. Antl-Weiser, M. D. Bosch and P. R. Nigst re-launched fieldwork efforts at the Grub-Kranawetberg site complex with a survey (fieldwalking for surface collection) of the western and central parts of the Kranawetberg/Hönigsberg ridge and an excavation at Grub-Kranawetberg I.

The fieldwalking survey conducted in September 2021 over six days covered 55 cadastral parcels with a total of 126,097 m<sup>2</sup> of the Kranawetberg/Hönigsberg ridge (Fig. 10). The fieldwalking survey was the first at the Grub-Kranawetberg site complex using GNSS-tracking and recorded spatial information for each of the recovered finds allowing a detailed analysis of the spatial distribution of finds (Nigst et al. 2024). During the survey we only collected lithic artefacts and faunal remains including shells; we did not collect clearly Holocene archaeological material.

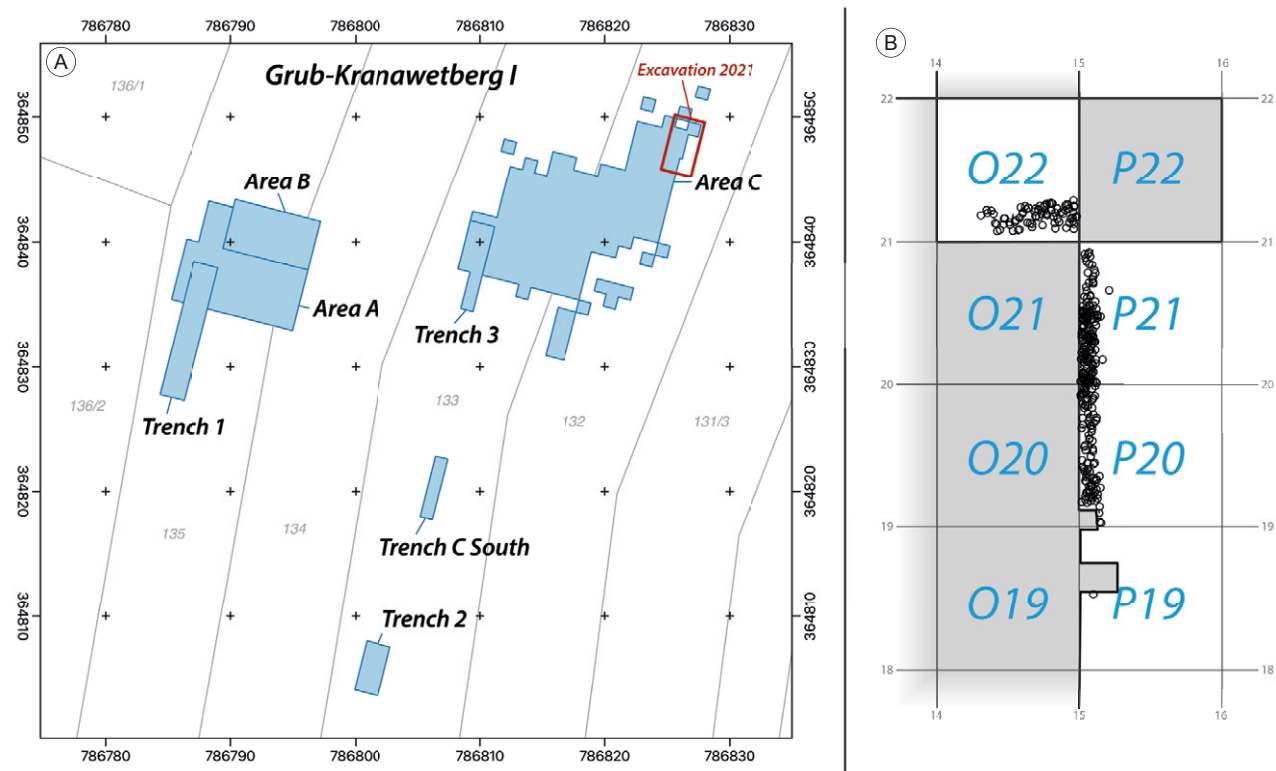
The excavation at Grub-Kranawetberg I was limited to the north-eastern corner of Antl-Weiser’s excavation Area C (Fig. 11). The intention was to expose the old sections and re-new the sections as necessary to (i) collect new samples for palaeoenvironmental reconstruction and site formation studies; (ii) collect a small new sample of lithics, faunal remains and charcoals; and (iii) conduct a new analysis of the exposed sections from a litho- and pedostratigraphic point of view and study sedimentary dynamics in detail.

We exposed about 9.5 m of sections: We pushed back and excavated 0.75 m of the northern section in O22 by 0.25 m and 2 m of the eastern section in P21 and P20 by 0.2 m. We exposed about 3.5 m of sections in the archaeologically sterile sediments overlying the archaeology-bearing deposits and studied them in



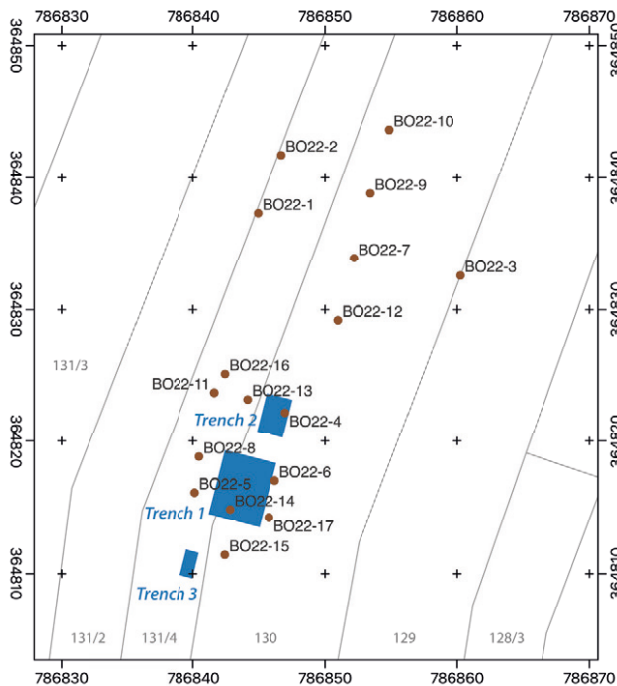
**Fig. 10.** Grub-Kranawetberg site cluster, survey 2021. Map showing the spatial distribution of finds (green: lithics, yellow: fauna, red: shell) in relation to the cadastral map (source cadastral map: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vienna, Austria). Surveyed cadastral parcels are shown in grey with red outlines. Trenches of Grub-Kranawetberg I and II are shown in blue for reference. Coordinate reference system: MGI/Austria GK M34 [EPSG code 31259]. GIS and graphic by P. R. Nigst.

**Obr. 10.** Lokalita Grub-Kranawetberg, průzkum 2021. Mapa znázorňující prostorové rozložení nálezů (zelená: artefakty, žlutá: fauna, červená: mušle) ve vztahu ke katastrální mapě (zdroj katastrální mapy: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vídeň, Rakousko). Zaměřené katastrální parcely jsou zobrazeny šedě, odlehle lokality červeně. Příklad Grub-Kranawetberg I a II jsou pro referenci zobrazeny modře. Souřadnicový referenční systém: MGI/Austria GK M34 [kód EPSG 31259]. GIS a grafika P. R. Nigst.



**Fig. 11.** Grub-Kranawetberg I: A – Location of the 2021 excavation area (dark red outline) at the northeastern corner of Area C. Basemap: Cadastral map. Source cadastral map: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vienna, Austria. Coordinate reference system: MGI/Austria GK M34 (EPSG code 31259). B – Enlarged 2021 excavation area in local grid. Finds piece-plotted during 2021 excavation are shown as black circles; previously excavated squares are shown in grey. Grid: 1 m. GIS and graphic by P. R. Nigst.

**Obr. 11.** A – poloha oblasti výzkumu z roku 2021 (tmavě červený obrys) v severovýchodním rohu oblasti C. Podkladová mapa: Katastrální mapa. Zdroj katastrální mapy: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vídeň, Rakousko. Souřadnicový referenční systém: MGI/Austria GK M34 (kód EPSG 31259). B – zvětšená oblast výzkumu z roku 2021 v lokální síti. Nálezy zakreslené během výzkumu v roce 2021 jsou zobrazeny jako černé kruhy; dříve vykopané čtverce jsou zobrazeny šedě. Síť: 1 m. GIS a grafika P. R. Nigst.



**Fig. 12.** Grub-Kranawetberg II: Map showing the location of the borings BO22-01 to BO22-17 (red) and the excavated Trench 1, 2 and 3 (blue) on the cadastral parcel 131/4 and 130. Source cadastral map: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vienna, Austria. Coordinate reference system: MGI/Austria GK M34 (EPSG code 31259). GIS and graphic by P. R. Nigst.

**Obr. 12.** Mapa znázorňující umístění vrtů BO22-01 až BO22-17 (červená) a vykopaných sond 1, 2 a 3 (modrá) na katastrální parcely 131/4 a 130. Zdroj katastrální mapy: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vídeň, Rakousko. Souřadnicový referenční systém: MGI/Austria GK M34 (kód EPSG 31259). GIS a grafika P. R. Nigst.

detail. Similarly, we exposed about 3 m of section in the archaeologically sterile sediments underlying the archaeology-bearing deposits and studied and sampled them. For the latter we used square O19, which had already been excavated to a deeper level during the 1995 to 2011 fieldwork campaigns.

### 3.3 New fieldwork at Grub-Kranawetberg II since 2022

In 2022, W. Antl-Weiser, M. D. Bosch and P. R. Nigst were joined by T. B. Viola and started new fieldwork to the east of the known site of Grub-Kranawetberg I. At this new site, Grub-Kranawetberg II, we conducted a survey campaign between May and July 2022 using boring (hand augers and percussion drilling) for prospection. After locating potentially interesting areas on cadastral parcel 130 and 131/4 of the village of Grub by means of boring, we started excavating Trench 1 in August 2022 (Tab. 1; Fig. 5, 12). In 2023, 2024 and 2025, excavation continued in Trench 1 and in 2023 we started exploring the area north of Trench 1 in a new trench (Trench 2). Trench 3, to the southwest of Trench 1, has been under excavation since 2024.

## 4. First results of fieldwork activities since 2021

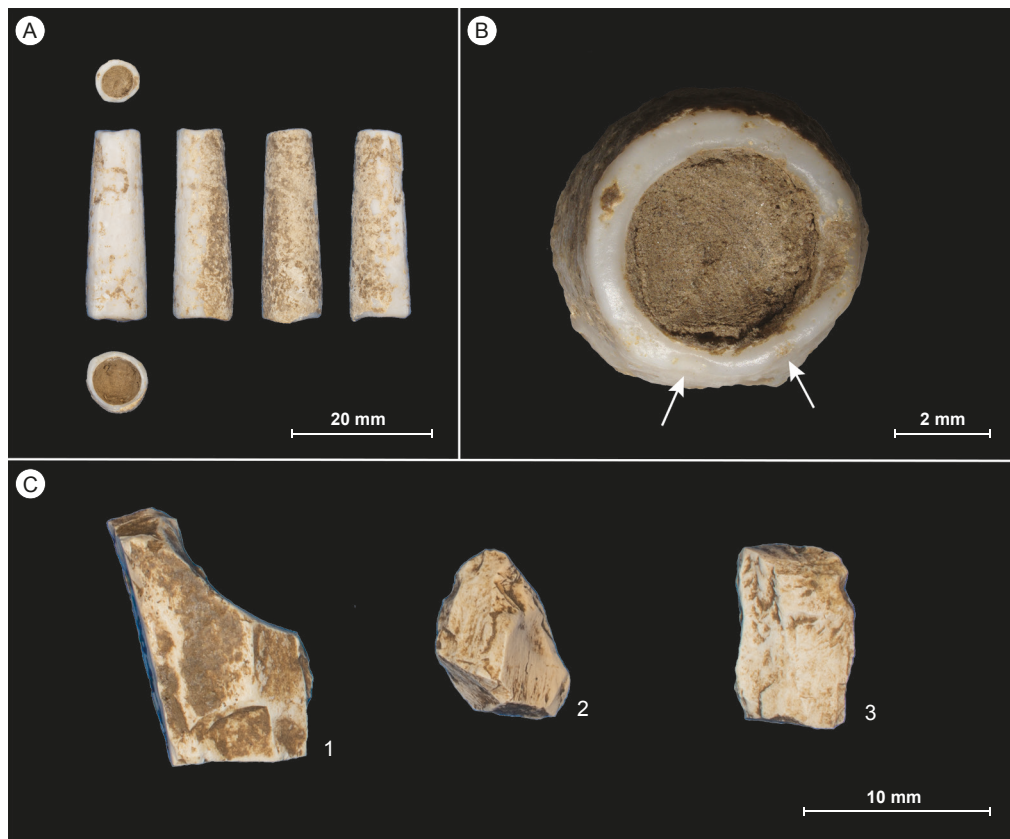
### 4.1 Fieldwalking survey in 2021

During our fieldwalking survey we collected 359 finds, which were individually labelled and their position recorded with GNSS equipment. The finds comprise 290 lithic artefacts and 69 faunal remains (Nigst et al. 2024). In our study, we demonstrated that the state of the surveyed fields did not drive the number of finds per cadastral parcel and did not bias the find density per cadastral parcel.



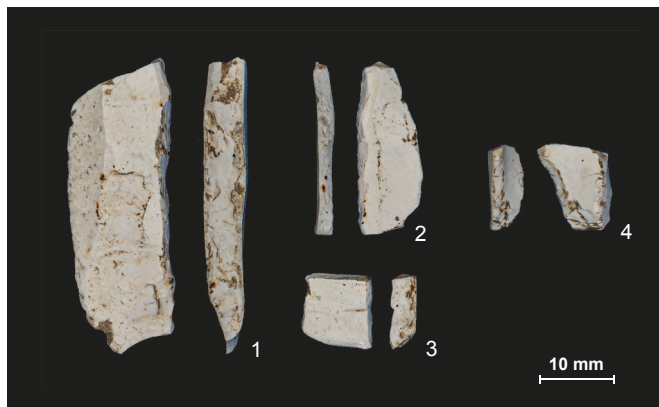
**Fig. 13.** Grub-Kranawetberg site cluster, survey 2021: Map showing the spatial distribution of finds in relation to the slope (green [flat] to red [steep]); slope calculated from a digital terrain model with 1 m resolution; source: Land Niederösterreich) and elevation (1-metre contour lines; contour lines calculated from a digital terrain model with 1-metre resolution. Source digital terrain model: Land Niederösterreich). Surveyed cadastral parcels are shown in grey with red outlines. All cadastral parcel boundaries are shown as light grey lines (source cadastral map: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vienna, Austria). Trenches of Grub-Kranawetberg I and II are shown in blue for reference. Coordinate reference system: MGI/Austria GK M34 [EPSG code 31259]. GIS and graphic by P. R. Nigst.

**Obr. 13.** Lokalita Grub-Kranawetberg, průzkum 2021: mapa znázorňující prostorové rozložení nálezů ve vztahu ke svahu (zelená [plochý] až červená [strmý]); svah vypočtený z digitálního modelu terénu s rozlišením 1 m; zdroj: Land Niederösterreich) a nadmořské výšce (vrstevnice o šířce 1 m; vrstevnice vypočtené z digitálního modelu terénu s rozlišením 1 m; zdroj: Land Niederösterreich). Zaměřené katastrální parcely jsou zobrazeny šedě s červenými obrysy. Všechny hranice katastrálních parcel jsou zobrazeny světle šedými čarami (zdroj katastrální mapy: Digitale Katastralmappe, Bundesamt für Eich- und Vermessungswesen, Vídeň, Rakousko). Sondy Grub-Kranawetberg I a II jsou pro referenci zobrazeny modře. Souřadnicový referenční systém: MGI/Austria GK M34 [kód EPSG 31259]. GIS a grafika P. R. Nigst.



**Fig. 14.** Grub-Kranawetberg site cluster, survey 2021: Pleistocene faunal remains. A – *Fissidentalium badense* (GK-2-71) (Photo and graphic by M. D. Bosch and P. R. Nigst). B – Enlarged apical view of the *Fissidentalium badense* (GK-2-71) with the two notches highlighted (arrows) (Photo by A. Kurzawska; graphic by M. D. Bosch and P. R. Nigst). C – Fragments of mammoth ivory: 1 – GK-4-61b; 2 – GK-3-41; 3 – GK-1-40. Photo and graphic by M. D. Bosch and P. R. Nigst.

**Obr. 14.** Grub-Kranawetberg, průzkum 2021: pozůstatky pleistocenní fauny. A – *Fissidentalium badense* (GK-2-71) (Foto a grafika M. D. Bosch a P. R. Nigst). B – zvětšený apikální pohled na *Fissidentalium badense* (GK-2-71) se dvěma zvláštními zářezy (šipky) (Foto A. Kurzawska; grafika M. D. Bosch a P. R. Nigst). C – fragmenty mamutí slonoviny: 1 – GK-4-61b; 2 – GK-3-41; 3 – GK-1-40. Foto a grafika M. D. Bosch a P. R. Nigst.



**Fig. 15.** Grub-Kranawetberg site cluster, survey 2021: Selected retouched tools. 1 – Backed blade (GK-2-81); 2 – backed bladelet fragment (GK-5-14); 3 – backed blade (GK-2-32); 4 – backed piece (GK-2-46). Photo and graphic by M. D. Bosch and P. R. Nigst.

**Obr. 15.** Grub-Kranawetberg, průzkum 2021: vybrané retušované nástroje. 1 – Čepel s otupeným bokem (GK-2-81); 2 – fragment čepele s otupeným bokem (GK-5-14); 3 – čepel s otupeným bokem (GK-2-32); 4 – otupený bok (GK-2-46). Foto a grafika M. D. Bosch a P. R. Nigst.

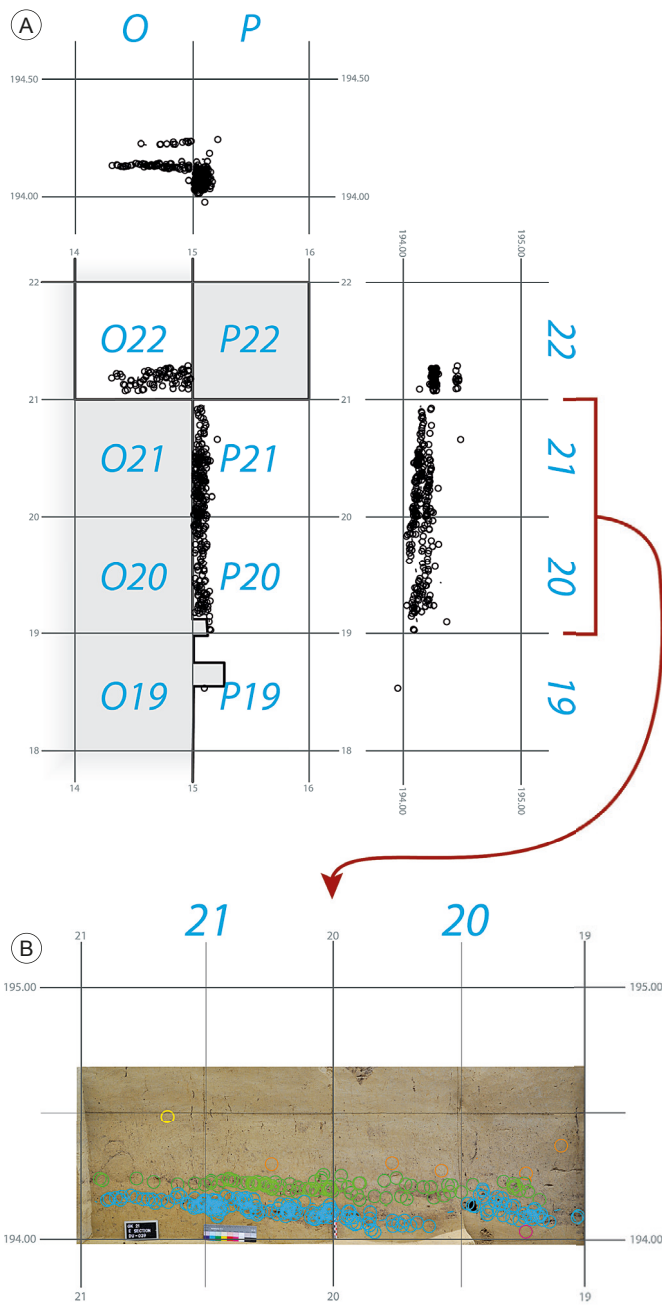
The detailed spatial recording of the finds during the field-walking allowed spatial analysis and showed interesting patterns with regard to the position of the finds in relation to the slope. In the eastern part, finds (mainly lithics) did not occur at the top of the hill/ridge but rather on the southward slope (Fig. 13). On the other hand, in the western part finds were concentrated on top of the hill/ridge or the shallow northern-facing slope, a pattern congruent with the observations described by Antl-Weiser (1996a). These differences in the spatial distribution of finds in relation to the slope angle suggests that in the western area destruction of the archaeological horizon(s) through agricultural activities is much more severe.

The faunal remains (n = 69) collected include the following taxa: *Mammuthus primigenius*, *Bos* sp., *Capreolus capreolus*, *Sus scrofa*, *Lepus* sp. and *Fissidentalium badense* (Nigst et al. 2024). About 45 specimens could only be assigned to body-size classes or remained unidentifiable. Only a handful of remains could be assigned to the Pleistocene, comprising three *Mammuthus primigenius* ivory fragments (Fig. 14C: 1–3) and an anthropogenically modified scaphopod (*Fissidentalium badense*) fragment (Fig. 14A, B), while the remaining faunal assemblage is probably rather recent.

The lithic assemblage (n = 290) is dominated by flakes, but cores, core tablets, crested blanks, blades, bladelets and chips are also represented (Nigst et al. 2024). About 18% of the lithic assemblage exhibits some retouch including retouched blades and bladelets, retouched flakes, splintered pieces and various backed pieces (on bladelet and blade blanks) (Fig. 15). Overall, the typological characteristics are congruent with an attribution to the Gravettian in line with previously collected materials (see above in section 3 and for further discussion in Nigst et al. 2024) as well as the excavations at Grub-Kranawetberg I and II.

#### 4.2 Grub-Kranawetberg I: first results of 2021 fieldwork

The sequence exposed in 2021 in the northeastern corner of the Area C excavation is similar to what has been described earlier for Trench 3 and Area C (Antl-Weiser et al. 2010). We documented five archaeological horizons (AH 5 to AH 1) in a sequence of about 5.5 m of sandy silt deposits (about 4.45 m exposed through excavation, a further 1.05 m explored through boring with a hand-auger). The archaeology can be found at a depth of 1.75 to 2.25 m below the surface (i.e. absolute height 194.00–194.50 m). Two archaeological horizons, AH 4 and AH 3, are associated with dark brownish horizons congruent with an interpretation as anthrosols, as was shown for AH 4 about 10 m to the southwest of our 2021 observations by Schilt et al. (2017). The deposits bearing AH 5 to AH 1 are affected by some



**Fig. 16.** Grub-Kranawetberg I, Area C, 2021 excavation: A – Excavation area in local grid. Finds piece-plotted during 2021 excavation are shown as black circles; previously excavated squares are shown in grey. Grid: 1 m. B – Vertical distribution of piece-plotted finds projected on section photos. Colours: Yellow: AH 1, Orange: AH 2, Green: AH 3, blue: AH 4, purple: AH 5. Local excavation grid. GIS and graphic by P. R. Nigst.

**Obr. 16.** Grub-Kranawetberg I, oblast C, výzkum 2021: A – výzkum v lokální síti. Nálezy zaznamenané během výzkumu v roce 2021 jsou zobrazeny jako černé kruhy; dříve vykopané čtverce jsou zobrazeny šedě. Síť: 1 m. B – vertikální rozložení nálezů zaznamenaných na fotografiích profilů. Barvy: žlutá: AH 1, oranžová: AH 2, zelená: AH 3, modrá: AH 4, fialová: AH 5. Místní síť výzkumu. GIS a grafika P. R. Nigst.

post-depositional processes typical for periglacial environments including solifluction leading, among others, to the undulation of AH 4 and AH 3 (piece-plotted finds) and the dark brown anthrosol horizons associated with them, as can be seen along the eastern section documented in P20 and P21 (Fig. 16B).

We piece-plotted 387 finds in five archaeological horizons (AH) (Tab. 3); the material recovered from wet-sieving is not yet fully studied and, therefore, we focus here on the piece-plotted finds. Only one lithic artefact was recovered from the lowermost AH 5. The overlying AH 4 and AH 3 are much richer, with 184 and 185 finds, respectively. AH 2 is poorly represented with six finds, including five lithic artefacts and one charcoal. The same is true for AH 1 (n finds = 9) with four lithic artefacts, one stone and four charcoals.

The sole lithic artefact in AH 5 was recovered from yellowish sandy silt about 5 cm below the dark brownish anthrosol associated with AH 4. The lithic artefact is a fragmented flake with no modification/retouch (Fig. 17: 8). It is made on erratic flint with no remaining natural surface.

AH 4 comprises 93 lithic artefacts, 21 faunal remains, 61 charcoals, six pieces of red ochre and three stones. The fauna recovered in AH 4 amounts to 21 pieces comprising two specimens of *Mammuthus primigenius* (both tusk fragments), one specimen assigned to ungulate size class 4–5, one to size class 2 and 17 unidentified specimens (Tab. 4). The majority of the fauna is burned (61.9%, n = 13) including two specimens that are calcined and 12 specimens that are carbonised (Tab. 5). The majority of the lithics are flakes (n = 52). There are 23 chips, seven blades (Fig. 18: 1-3, 5, 9-11), one bladelet (Fig. 18: 4), five burin spalls or burin bladelets and five pieces classified as shatter (Tab. 6). Four lithics (4.3%) are thermally altered (Tab. 7) and ten specimens carry parts of the cortex/natural surface (Tab. 7). With 66.7% (n = 62), a larger part of the lithic artefacts of AH 4 are fragmented (Tab. 7). There is only one modified lithic artefact (edge retouch). The majority (64.5%, n = 60) of lithic artefacts are made from erratic flint (Fig. 18: 2–13). Cherts make up 29% (n = 27) (Fig. 18: 1), while only a few pieces are made of radiolarite (Tab. 8).

In AH 3 we piece-plotted 54 lithic artefacts, 30 faunal remains, 83 charcoals, nine pieces of red ochre and nine stones (Tab. 3). Among the lithic artefacts, two specimens were thermally altered (Tab. 7) and five specimens have remnants of cortex or other natural surfaces (Tab. 7). With 30 pieces, more than half of the lithic artefacts are fragmented (Tab. 7). The assemblage is comprised of 19 flakes, 23 chips, one blade (Fig. 19: 8), four bladelets (Fig. 19: 1–4), one burin spall (Fig. 19: 5), one core (Fig. 19: 6), one core tablet (Fig. 19: 7) and four specimens classified as shatter (Tab. 6). There are seven lithic artefacts that are retouched, five of which have simple edge retouch, while two bladelets are backed (Fig. 19: 1, 2). Both backed bladelets are made of radiolarite with potential Carpathian or northern Alpine origin. All together there are 40 lithic artefacts made of radiolarite, two specimens of erratic flint, 11 specimens of chert and one lithic artefact of an unknown raw material (Tab. 8).

AH	No. lithics	No. fauna	No. charcoal	No. red ochre	No. stone	No. total
AH 1	4	0	4	0	1	9
AH 2	5	0	1	0	0	6
AH 3	54	30	83	9	9	185
AH 4	93	21	61	6	3	184
AH 5	1	0	0	0	0	1

**Tab. 3.** Grub-Kranawetberg I, Area C, excavation 2021: Piece-plotted find categories per archaeological horizon (AH).

**Tab. 3.** Grub-Kranawetberg I, oblast C, výzkum 2021: kategorie nálezů vykreslených v grafu podle archeologického horizontu (AH).



**Fig. 17.** Grub-Kranawetberg I, Area C, excavation 2021: Selection of lithic artefacts of the AH 1 (1–2), AH 2 (3–7) and AH 5 (8). 1 – GK21-394, flake, medial fragment, radiolarite (potential source: Danube); 2 – GK21-303; flake, complete, erratic flint (potential source: Moravian Gate); 3 – GK21-24, flake, distal fragment, radiolarite (potential source: northern Alpine); 4 – GK21-7, flake, distal fragment, erratic flint (potential source: Moravian Gate); 5 – GK21-3, bladelet, distal fragment, erratic flint (potential source: Moravian Gate); 6 – GK21-30, burin spall/bladelet, complete, erratic flint (potential source: Moravian Gate); 7 – GK21-8, blade, medial fragment, erratic flint (potential source: Moravian Gate); 8 – GK21-116, flake, medial fragment, erratic flint (potential source: Moravian Gate). Photo by C. Bieber; graphic by S. Kasemann.

**Obr. 17.** Grub-Kranawetberg I, oblast C, výzkum 2021: výběr kamenných artefaktů z AH 1 (1, 2), AH 2 (3–7) a AH 5 (8). 1 – GK21-394, úštěp, mediální fragment, radiolarit (potenciální zdroj: Dunaj); 2 – GK21-303; odštěpek, celý, eratický pazourek (potenciální zdroj: Moravská brána); 3 – GK21-24, úštěp, distální fragment, radiolarit (potenciální zdroj: severní Alpy); 4 – GK21-7, úštěp, distální fragment, eratický silicit (potenciální zdroj: Moravská brána); 5 – GK21-3, čepel, distální fragment, eratický silicit (potenciální zdroj: Moravská brána); 6 – GK21-30, rydlový úštěp/čepel, celá, eratický silicit (potenciální zdroj: Moravská brána); 7 – GK21-8, čepel, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána); 8 – GK21-116, úštěp, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána). Foto C. Bieber; grafika S. Kasemann.

	AH 4	AH 3
<b>Species</b>	<b>No.</b>	<b>No.</b>
Mammuthus primigenius	2	–
Equus sp.	–	1
UNG4-5	1	–
UNG3	–	2
UNG2	1	–
NID	17	27
<b>Total</b>	<b>21</b>	<b>30</b>

**Tab. 4.** Grub-Kranawetberg I, Area C, excavation 2021: Taxonomic classification of piece-plotted fauna in AH 3 and AH 4.

**Tab. 4.** Grub-Kranawetberg I, oblast C, výzkum 2021: taxonomická klasifikace fauny ze zaznamenaných oblastí AH 3 a AH 4.

AH	No. flakes	No. chips	No. blade	No. bladelet	No. burin spall/bladelet	No. core	No. core tablet	No. shatter	No. lithics
1	2	1	0	0	0	0	0	1	4
2	2	0	2	0	1	0	0	0	5
3	19	23	1	4	1	1	1	4	54
4	52	23	7	1	5	0	0	5	93
5	1	0	0	0	0	0	0	0	1

**Tab. 6.** Grub-Kranawetberg I, Area C, excavation 2021: Basic categories of lithics in AH 1 to AH 5.

**Tab. 6.** Grub-Kranawetberg I, oblast C, výzkum 2021: základní kategorie kamenné industrie v AH 1 až AH 5.

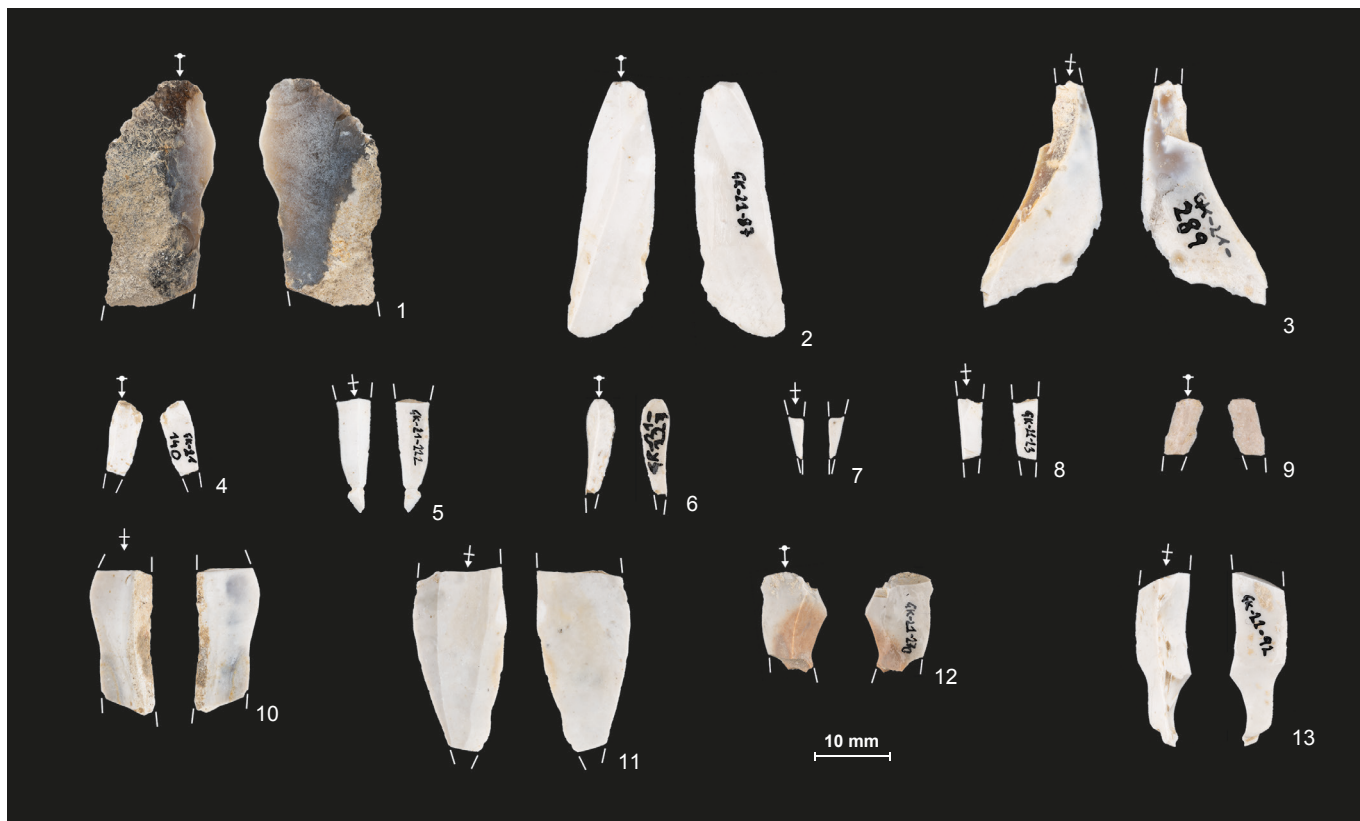
Burning stage	AH 4		AH 3	
	Number	Percentage	Number	Percentage
0 - unburned	8	38.1	16	53.3
Carbonised	11	52.4	8	26.7
1 - spot (<1/2) burnt	2	9.5	1	3.3
2 - slight carbonization (>1/2)	6	28.6	4	13.3
3 - fully black	3	14.3	3	10.0
Calcined	2	9.5	6	20.0
4 - calcined spot (<1/2)	1	4.8	–	0.0
5 - very calcined (>1/2)	1	4.8	4	13.3
6 - fully calcined = white	–	0.0	2	6.7
<b>total</b>	<b>21</b>	<b>100.0</b>	<b>30</b>	<b>100.0</b>

**Tab. 5.** Grub-Kranawetberg I, Area C, excavation 2021: Burning exposure of piece-fauna in AH 3 and AH 4.

**Tab. 5.** Grub-Kranawetberg I, oblast C, výzkum 2021: stopy působení ohně na zvířecích kostech v AH 3 a AH 4.

We collected 30 faunal specimens in AH 3 comprising one specimen assigned to *Equus* sp., two specimens assigned to ungulate size class 3 and 27 unidentified specimens (Tab. 4). The majority of the fauna is unburned (53.3%, n = 16). Among the burned specimens are six specimens that are calcined and eight specimens that are carbonised (Tab. 5).

The assemblage of AH 2 comprises five lithic artefacts (Fig. 17: 3–7) – two flakes, two blades and one burin spall (Tab. 6) – and one charcoal (Tab. 3). The lithics show no thermal alteration (Tab. 7). Four lithics are fragmented (Tab. 7). The lithic assemblage includes one blade with intense edge retouch. One lithic specimen is made from radiolarite of northern Alpine origin;



**Fig. 18.** Grub-Kranawetberg I, Area C, excavation 2021, AH 4: Selection of lithic artefacts. 1 – GK21-37, blade, proximal fragment, chert (potential source: Danube), remains of natural surface deriving from riverine environments; 2 – GK21-87, blade, complete, erratic flint (potential source: Moravian Gate); 3 – GK21-289, blade, complete, erratic flint (potential source: Moravian Gate); 4 – GK21-140, bladelet, proximal fragment, erratic flint (potential source: Moravian Gate); 5 – GK21-222, blade, distal fragment, erratic flint (potential source: Moravian Gate); 6 – GK21-227, burin spall, proximal fragment, erratic flint (potential source: Moravian Gate); 7 – GK21-137, burin spall, medial fragment, erratic flint (potential source: Moravian Gate); 8 – GK21-23, burin spall, medial fragment, erratic flint (potential source: Moravian Gate); 9 – GK21-274, blade, proximal fragment, erratic flint (potential source: Moravian Gate); 10 – GK21-43, blade, medial fragment, erratic flint (potential source: Moravian Gate), remains of natural surface deriving from moraine environments; 11 – GK21-240, blade, medial fragment, erratic flint (potential source: Moravian Gate); 12 – GK21-270, burin spall, proximal fragment, erratic flint (potential source: Moravian Gate); 13 – GK21-92, burin spall, distal fragment, erratic flint (potential source: Moravian Gate). Photo by C. Bieber; graphic by S. Kasemann.

**Obr. 18.** Grub-Kranawetberg I, oblast C, výzkum 2021, AH 4: výběr kamenných artefaktů. 1 – GK21-37, čepel, proximální fragment, rohovec (potenciální zdroj: Dunaj), zbytky přirozeného povrchu pocházející z říčního prostředí; 2 – GK21-87, čepel, celá, eratický silicit (potenciální zdroj: Moravská brána); 3 – GK21-289, čepel, celá, eratický silicit (potenciální zdroj: Moravská brána); 4 – GK21-140, čepel, proximální fragment, eratický silicit (potenciální zdroj: Moravská brána); 5 – GK21-222, čepel, distální fragment, eratický silicit (potenciální zdroj: Moravská brána); 6 – GK21-227, rydlový úštěp, proximální fragment, eratický silicit (potenciální zdroj: Moravská brána); 7 – GK21-137, rydlový úštěp, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána); 8 – GK21-23, rydlový úštěp, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána); 9 – GK21-274, čepel, proximální fragment, eratický silicit (potenciální zdroj: Moravská brána); 10 – GK21-43, čepel, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána), zbytky přirozeného povrchu pocházejícího z morénového prostředí; 11 – GK21-240, čepel, mediální fragment, eratický silicit (potenciální zdroj: Moravská brána); 12 – GK21-270, rydlový úštěp, proximální fragment, eratický silicit (potenciální zdroj: Moravská brána); 13 – GK21-92, rydlový úštěp, distální fragment, eratický silicit (potenciální zdroj: Moravská brána). Foto C. Bieber; grafika S. Kasemann.

AH	Thermal alteration				Natural surface				Fragmentation			
	Yes		No		Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	1	25.0	3	75.0	0	0.0	4	100.0	1	25.0	3	75.0
2	1	20.0	4	80.0	0	0.0	5	100.0	4	80.0	1	20.0
3	2	3.7	52	96.3	5	9.3	49	90.7	30	55.6	24	44.4
4	4	4.3	89	95.7	10	10.8	83	89.2	62	66.7	31	33.3
5	0	0.0	1	100.0	0	0.0	1	100.0	1	100.0	0	0.0

**Tab. 7.** Grub-Kranawetberg I, Area C, excavation 2021: Basic categories of lithics in AH 1 to AH 5.

**Tab. 7.** Grub-Kranawetberg I, oblast C, výzkum 2021: tepelná změna, přirozený povrch / kůra a fragmentace kamenných artefaktů v AH 1 až AH 5.

AH	Raw material units							
	Radiolarite		Flint		Chert		N/A	
	No.	%	No.	%	No.	%	No.	%
1	2	50.0	1	25.0	0	0.0	1	25.0
2	1	20.0	4	80.0	0	0.0	0	0.0
3	40	74.1	2	3.7	11	20.4	1	1.9
4	3	3.2	60	64.5	27	29.0	3	3.2
5	0	0.0	1	100.0	0	0.0	0	0.0

**Tab. 8.** Grub-Kranawetberg I, Area C, excavation 2021: Raw materials of lithic artefacts in AH 1 to AH 5.

**Tab. 8.** Grub-Kranawetberg I, oblast C, výzkum 2021: suroviny kamenných artefaktů v AH 1 až AH 5.

the remaining four pieces are erratic flint (Tab. 8). These were potentially sourced in the glacial moraines of southern Poland. However, no natural surfaces were preserved.

The small assemblage of AH 1 includes four lithic artefacts, one stone and four charcoals among the piece-plotted materials (Tab. 3). The lithic assemblage comprises two flakes (Fig. 17: 1, 2), one chip and one shatter (Tab. 6), none of which are modified, and one is fragmented (Tab. 7). One of the flakes and the chip are radiolarites (Tab. 8), which can potentially be sourced to the gravels of the Danube. The second flake is erratic flint that was potentially sourced in the moraines of the Saale and Elster glaciations in southern Poland. There were no remains of a natural surface on these pieces.



**Fig. 19.** Grub-Kranawetberg I, Area C, excavation 2021, AH 3: Selection of lithic artefacts. 1 – GK21-9, backed bladelet, radiolarite (potential source: Danube / old river gravels of Lower Austria); 2 – GK21-438, backed bladelet, radiolarite (potential source: Carpathian Mountains); 3 – GK21-419, bladelet, medial fragment, radiolarite (potential source: Carpathian Mountains); 4 – GK21-344, bladelet, medial fragment, radiolarite (potential source: northern Alpine); 5 – GK21-440, burin spall, medial fragment, (potential source: northern Alpine); 6 – GK21-414, core, flake and blade removals, radiolarite (potential source: northern Alpine); 7 – GK21-16, core tablet, complete, radiolarite (potential source: Danube/ old river gravels of Lower Austria); 8 – GK21-327, blade, proximal fragment, radiolarite (potential source: northern Alpine). Photo by C. Bieber; graphic by S. Kasemann.

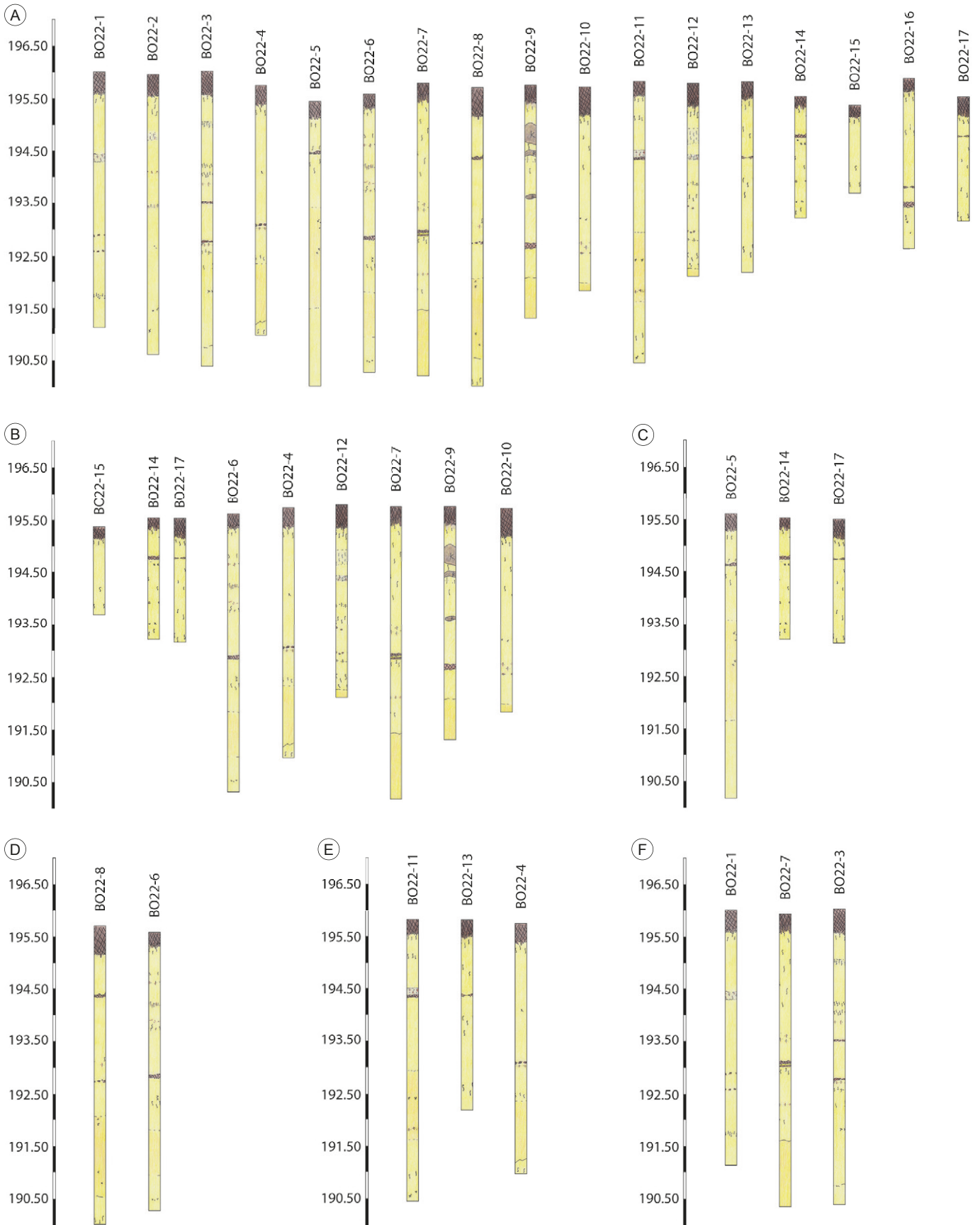
**Obr. 19.** Grub-Kranawetberg I, oblast C, výzkum 2021, AH 3: výběr kamenných artefaktů. 1 – GK21-9, čepel s otupeným bokem, radiolarit (potenciální zdroj: dunajské / staré říční štěrky Dolního Rakouska); 2 – GK21-438, čepel s otupeným bokem, radiolarit (potenciální zdroj: Karpaty); 3 – GK21-419, čepel, mediální fragment, radiolarit (potenciální zdroj: Karpaty); 4 – GK21-344, čepel, mediální fragment, radiolarit (potenciální zdroj: severní Alpy); 5 – GK21-440, rydlový ústěp, mediální fragment (potenciální zdroj: severní Alpy); 6 – GK21-414, jádro, negativy ústěpových a čepelových odběrů, radiolarit (potenciální zdroj: severní Alpy); 7 – GK21-16, odražená podložka jádra, celá, radiolarit (potenciální zdroj: Dunaj / staré říční štěrky Dolního Rakouska); 8 – GK21-327, čepel, proximální fragment, radiolarit (potenciální zdroj: severní Alpy). Foto C. Bieber; grafika S. Kasemann.

Sample-ID	AH	Taxon
GK21-18	AH 4	Conifer
GK21-38	AH 4	Conifer
GK21-42	AH 4	<i>Larix/Picea</i>
GK21-68	AH 4	<i>Pinus</i>
GK21-189	AH 4	<i>Larix/Picea</i>
GK21-190	AH 4	<i>Larix/Picea</i>
GK21-198	AH 4	<i>Pinus</i>
GK21-204	AH 4	Conifer
GK21-206	AH 4	<i>Pinus</i>
GK21-209	AH 4	<i>Larix/Picea</i>
GK21-232	AH 4	<i>Pinus</i>
GK21-244	AH 4	<i>Pinus</i>
GK21-268	AH 4	<i>Larix/Picea</i>
GK21-288	AH 4	<i>Pinus</i>
GK21-290	AH 4	<i>Larix/Picea</i>
GK21-291	AH 4	<i>Larix/Picea</i>
GK21-392	AH 4	<i>Larix/Picea</i>

While most analyses (including site formation studies, organic biomarker analysis, malacological and anthracological analyses, radiocarbon dating, etc.) are in progress, we can present here some initial results. Anthracological studies of the charcoals piece-plotted during our fieldwork for AH 4 at the present state of analysis suggest that the assemblage comprises exclusively conifers, with identified taxa including *Pinus* and *Larix/Picea* (Tab. 9).

**Tab. 9.** Grub-Kranawetberg I, Area C, excavation 2021: Identified taxa in sample of charcoals of AH 4.

**Tab. 9.** Grub-Kranawetberg I, oblast C, výzkum 2021: určené taxony ve vzorku uhlíku v AH 4.



**Fig. 20.** Grub-Kranawetberg II, boring survey 2022: A – Stratigraphic logs of borings BO22-1 to BO22-17. B – Stratigraphic logs of south–north transect of borings BO22-15, BO22-14, BO22-17, BO22-6, BO22-4, BO22-12, BO22-7, BO22-9 and BO22-10. C – Stratigraphic logs of west–east transect of borings BO22-5, BO22-14 and BO22-17. D – Stratigraphic logs of west–east transect of borings BO22-8 and BO22-6. E – Stratigraphic logs of west–east transect of borings BO22-11, BO22-13 and BO22-4. F – Stratigraphic logs of west–east transect of borings BO22-1, BO22-7 and BO22-3. For location of the borings please refer to Figure 12. Fieldrecord, drawing and graphic by P. R. Nigst.

**Obř. 20.** Grub-Kranawetberg II, vrtný průřez 2022: A – stratigrafické karotáže vrtů BO22-1 až BO22-17. B – stratigrafické karotáže jiho-severního transektu vrtů BO22-15, BO22-14, BO22-17, BO22-6, BO22-4, BO22-12, BO22-7, BO22-9 a BO22-10. C – stratigrafické karotáže západovýchodního transektu vrtů BO22-5, BO22-14 a BO22-17. D – stratigrafické karotáže západovýchodního transektu vrtů BO22-8 a BO22-6. E – stratigrafické karotáže západovýchodního transektu vrtů BO22-11, BO22-13 a BO22-4. F – stratigrafické karotáže západovýchodního transektu vrtů BO22-1, BO22-7 a BO22-3. Umístění vrtů viz obr. 12. Záznam z terénu, kresba a grafika P. R. Nigst.

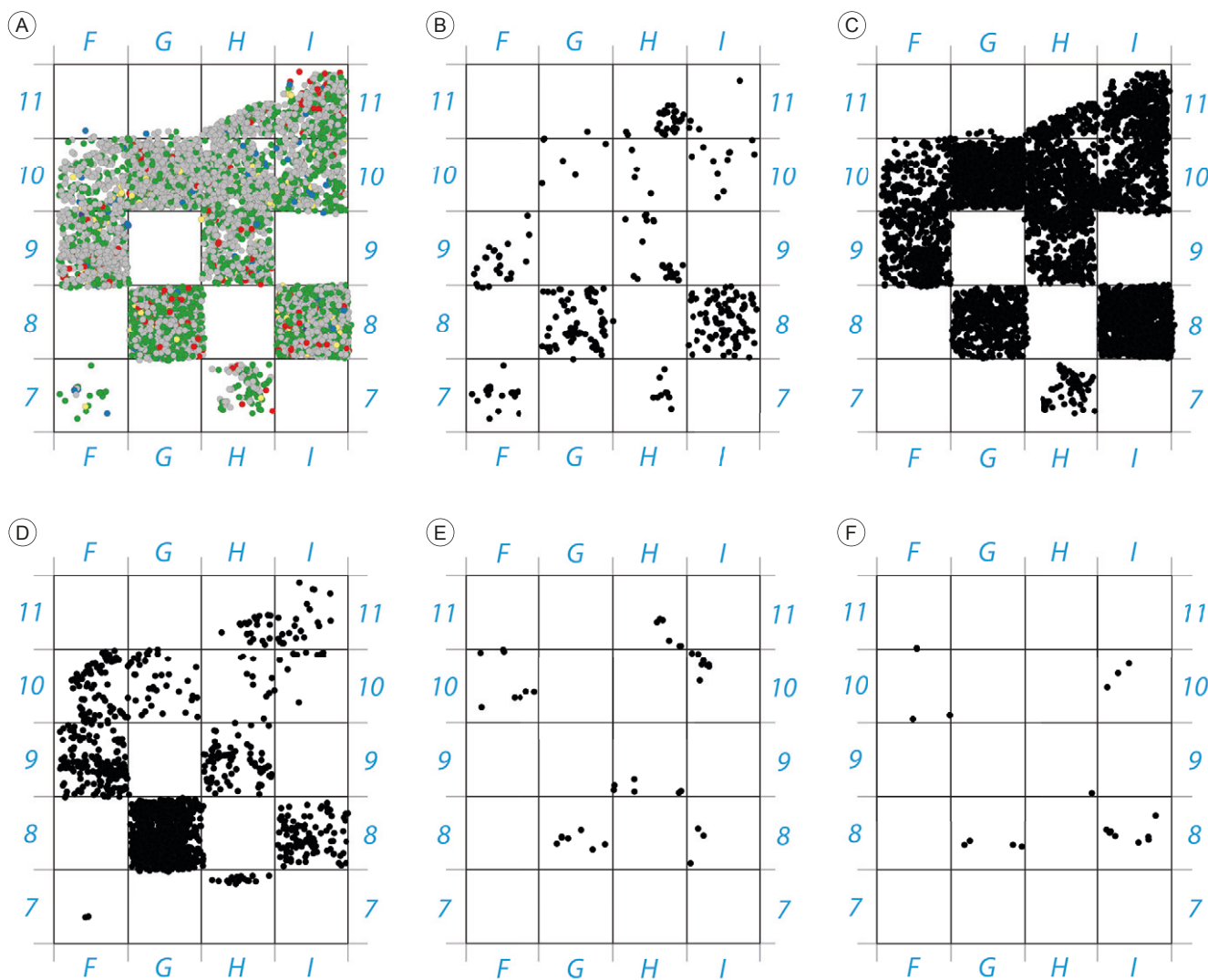
### 4.3 Grub-Kranawetberg II: first results from 2022–2025 fieldwork

The boring campaign comprising 17 borings conducted between May and July 2022 provided a look into the deposits of cadastral parcels 130 and 131/4 (Fig. 12). The boreholes ranged from 1.61 to 5.3 metres in depth below the surface (Fig. 20). All boring documented exclusively silt deposits, mostly sandy silt below the humic top soil. In borings BO22-03, -04, -05, -06, -07, -08, -09, -11, -13, -14, -16, and -17, light brownish sediments, in some cases containing charcoal fragments, were documented at various depths (Fig. 20). Two lithic artefacts were recovered from boring BO22-14 at a depth of 0.75 m below the surface and were associated with a light brownish horizon with a thickness of around 7 cm.

Trench 1 (5 × 4 m) (Fig. 12) was positioned based on the results of boring BO22-5, BO22-6, BO22-8, BO22-14, BO22-15 and BO22-17 showing light brownish horizons (Fig. 20) and has been under excavation since 2022. In addition, two more trenches, Trench 2 and Trench 3 (Tab. 1; Fig. 5, 12), were started north and south of Trench 1.

Here we focus on Trench 1 because it has been under excavation for four years now and has therefore provided more information. The northern end of Trench 1 is affected by an ice wedge, which is visible in the find distribution in square F11 to I11 (Fig. 21). The deposits are affected by post-depositional processes including solifluction; the degree and extent of this post-depositional alteration of the deposits containing the archaeological horizons is currently under study.

The sequence in Trench 1 documented thus far is 2.3 m deep. The entire exposed sequence comprises sandy silt and includes (at a depth of 1.15–1.35 m below the surface) two light to dark brownish horizons interpreted as anthrosols, like those associated with AH 4 and AH 3 at Grub-Kranawetberg I (Schilt et al. 2017). The two light to dark brownish horizons in the Trench 1 sequence are also associated with two of the five archaeological horizons documented in Trench 1 up to now, AH Luc and AH Michi. A detailed geoarchaeological study is in progress. From bottom to top, the following archaeological horizons have been observed thus far: AH Kristof, AH Morgan, AH Luc, AH Michi and AH Chase.



**Fig. 21.** Grub-Kranawetberg II, Trench 1 (excavation 2021–2024): Spatial distribution of piece-plotted (i.e. > 5 mm) finds. A – All finds (green: lithic, yellow: fauna, blue: stone, grey: charcoal, red: ochre, purple: shell) in all archaeological horizons. B – AH Chase find distribution. C – AH Michi find distribution. D – AH Luc find distribution. E – AH Morgan find distribution. F – AH Kristof find distribution. Please note that not all squares are excavated completely. Squares F11, G11, H11 and I11 are in part affected by an ice wedge. Squares are 1 × 1 m. GIS and graphic by P. R. Nigst.

**Obr. 21.** Grub-Kranawetberg II, sonda 1 (výzkum 2021–2024): Prostorové rozložení nálezů (tj. > 5 mm). A – všechny nálezy (zelená: kamenné artefakty, žlutá: fauna, modrá: kámen, šedá: uhlíky, červená: barvivo, fialová: mušle) ve všech archeologických horizontech. B – rozložení nálezů AH Chase. C – rozložení nálezů AH Michi. D – rozložení nálezů AH Luc. E – rozložení nálezů AH Morgan. F – rozložení nálezů AH Kristof. Upozorňujeme, že ne všechny čtverce jsou vykopány kompletně. Čtverce F11, G11, H11 a I11 jsou částečně ovlivněny ledovým klínem. Čtverce mají rozměry 1 × 1 m. GIS a grafika P. R. Nigst.

Find category	AH Chase	AH Michi	AH Luc	AH Morgan	AH Kristof
Charcoal	78	2311	565	11	8
Fauna	6	152	19	2	1
Lithic	183	2022	582	18	6
Ochre	11	198	45	1	–
Shell	1	9	3	–	–
Stone	20	128	16	–	–
<b>Total</b>	<b>299</b>	<b>4820</b>	<b>1230</b>	<b>32</b>	<b>15</b>

**Tab. 10.** Grub-Kranawetberg II, Trench 1: Find categories of the piece-plotted objects (2021 to 2024 fieldwork).

**Tab. 10.** Grub-Kranawetberg II, sonda 1: kategorie zaznamenaných nálezů (terénní práce z let 2021 až 2024).

The absolute number of finds differs substantially between the five AHs, with AH Luc and AH Michi being the richest two archaeological horizons (Tab. 10). Figure 21 shows the spatial distribution of finds per archaeological horizon in Trench 1 based on piece-plotted data of the excavations in 2021–2024.

The AH Michi lithic assemblage is dominated by cherts and radiolarite as the raw material and retouched tools include backed bladelets, while the AH Luc assemblage shows a dominance of erratic flint as the raw material and microgravette points as the dominant tool type. The following taxa have been identified to date among the faunal remains of AH Michi and AH Luc: *Mammuthus primigenius*, *Equus* sp., *Rangifer tarandus* and cf. *Canis lupus*. These remains include a partial maxilla of an adult *Mammuthus primigenius* in AH Michi. The fossil shells used as personal ornaments comprise one bivalve and four gastropods.

## 5. Discussion

While research and analyses are ongoing, we can use the results obtained thus far to shed light on some questions regarding the different parts of the Grub-Kranawetberg site cluster. In particular, we can explore when in the Late Pleistocene the site cluster located on the Kranawetberg/Hönigsberg ridge was utilized by hunter-gatherers. All evidence to date points to an exclusively Upper Palaeolithic use; we have no evidence of any earlier – Lower or Middle Palaeolithic – use or hominin presence. When considering the evidence pointing towards the Upper Palaeolithic, one has to note that to date not all surface finds have been studied systematically, which is especially true for the Peter collection, which is available for research only since it was recently donated to the local museum in Stillfried. While we cannot rule out Early or Late Upper Palaeolithic presence on the ridge, we must stress the fact that most diagnostic finds, both from excavations as well as from surface collections, point towards a Mid-Upper Palaeolithic, i.e. Gravettian, use of the Kranawetberg/Hönigsberg ridge. The retouched tools from the various surface collections as well as our survey material and the excavated materials all are congruent with an attribution to the Gravettian.

To date we cannot differentiate specific phases of the Gravettian within the surface collection materials, in contrast to the excavation materials, where we see differences especially between Grub-Kranawetberg I AH 4 and AH 3 in terms of the retouched bladelet types and the major raw material units as mentioned above. Based on the excavation materials, one can propose the chrono-cultural positioning of the AH 4 and AH 3 assemblages of Grub-Kranawetberg I at the end of the Middle and the start of the Late Gravettian in the region, with fewer microgravette points and a greater number of other backed bladelets in the latter, congruent with patterns described for Moravia and Slovakia (cf. Polanská, Hromadová 2015; see also below).

However, we have to stress the fact that, despite the clear Gravettian signal from both surface as well as excavation collections, the Upper Palaeolithic occupations on the Kranawetberg/Hönigsberg ridge are likely a palimpsest of many occupations, potentially of different chronological positions or chrono-cultural attributions, even within the Gravettian. Currently, we cannot correlate any of the surface materials with specific excavation materials, either based on chrono-culturally diagnostic pieces or on raw material representation. We should also note here that most of the lithic artefacts collected on the surface, both in the older surveys as well as in our 2021 survey, are made on whitish patinated erratic flint, most probably of southern Polish origin (from secondary sources). Only a few lithic artefacts are made of radiolarite or chert varieties of probable regional origin. For example, among the collection of our survey in 2021, only 5.5% are radiolarites and 2.1% are cherts, while the vast majority (85.9%) of lithic artefacts can be assigned to whitish patinated erratic flint (Nigst et al. 2024). We should keep in mind that this low percentage of cherts and radiolarites in the surface-collected materials might also be (at least in part) an effect of better visibility of whitish patinated lithic artefacts during surface collection activities. Therefore, we should not use raw material representation in surface collections as an argument to connect surface materials to any specific archaeological horizons of the excavated areas of the site. Additionally, the spatial distribution of the surface materials speaks against a connection to GK I and/or GK II, as most of the surface material (at least in our 2021 survey) originates from areas west of the two excavated sites. It is most likely connected to another site(s) on the western part of the Kranawetberg/Hönigsberg ridge.

We can connect some of the areas excavated within Grub-Kranawetberg I. As mentioned above, a re-articulation of the left upper first molar and the matching right upper first molar of an 8–10-year-old *Mammuthus primigenius* individual allows us to correlate the lower archaeological horizon of the bone accumulation of Trench 1 / Area A and B to AH 4 of Trench 3 / Area C (Bosch 2009; Bosch et al. 2012).

At the present state of analysis, a correlation of the sequence of GK I and GK II is not possible. However, we should mention the fact that the two richest archaeological horizons at GK II – AH Luc and AH Michi – resemble AH 4 and AH 3 of GK I both in terms of the main retouched bladelet types as well as the major raw materials used, and this needs to be explored in greater detail in the future when radiometric, zooarchaeological and geoarchaeological data become available.

### 5.1 Other sites in the Stillfried-Grub microregion

While fieldwork activities in the last three decades have nearly entirely focused on the Grub-Kranawetberg site complex, many sites have been known in the Stillfried-Grub microregion for a long period of time (Fig. 2). One of those sites, Ollersdorf-Heidenberg, was also excavated recently by our team (Bosch et al. 2025a; see also Antl-Weiser et al. 2019a; 2019b; 2020a; 2020b), after it was originally a rescue excavation (Antl 1998; 2007; Antl-Weiser 2008). The only other excavated sites are Stillfried-Steinschlageratelier (Felgenhauer 1980) and Ebenthal-Weintaläcker (Cadastral parcels 2229/2 and 2231) (Szilasi, Draganits 2022). All of the other 13 sites are known from surface collections or observations during construction activities. Other sites like Stillfried-Museumsgasse go back to finds during house and cellar construction (Weiser 1978).

While most of the surface collections point to a Mid-Upper Palaeolithic or Gravettian attribution, there are also reports suggesting a potential (Late) Aurignacian presence at Stillfried-Alte

Kirchenried (Preis, Schmitsberger 2012b). The rescue excavation at Ebenthal-Weintaläcker (Cadastral parcels 2229/2 and 2231) was reported by Szilasi and Draganits (2022) to point towards an early phase of the Aurignacian, which seems congruent with the assessment of the surface finds from Spannberg-Hohes Eck just to the north reported by Preis and Schmitsberger (2012a). Those classifications as Aurignacian need re-assessment through detailed studies of the techno-typological characteristics and *chaînes opératoires*.

## 5.2 Putting the local Upper Palaeolithic record in a wider perspective

The excavated assemblages in the Stillfried-Grub microregion point towards a Mid-Upper Palaeolithic or Gravettian (Grub-Kranawetberg I, Grub-Kranawetberg II, Ollersdorf-Heidenberg, and Stillfried-Steinschlägeratelier) and Early Upper Palaeolithic or Aurignacian (Ebenthal-Weintaläcker) (Cadastral parcels 2229/2 and 2231) presence. To date, absolute-chronological ages are available only for Ollersdorf-Heidenberg and Grub-Kranawetberg I through the radiocarbon dating of high-quality conifer charcoals. For Grub-Kranawetberg II, charcoal identification and the radiocarbon dating of charcoal samples is in progress, while both Stillfried-Steinschlägeratelier and Ebenthal-Weintaläcker (Cadastral parcels 2229/2 and 2231) remain without absolute chronological age estimations.

Within Grub-Kranawetberg I, AH 4 and AH 3 of the ‘campsite’ area as well as the lower AH in the ‘bone accumulation’ area provided ages congruent with the end of the Middle Gravettian and the onset of the Late Gravettian in the region, i.e. between 30,000 and 28,000 cal BP (e.g. Lengyel et al. 2026), while AH 2 is dated to 26,900–25,600 cal BP and, hence, is slightly younger (Tab. 2). The ages of AH Anna and AH Viola at Ollersdorf-Heidenberg (Bosch et al. 2025a) as well as from the rescue excavations in 1998 (Antl-Weiser 2008; see also Bosch et al. 2025a) point to the same age window between 30,000 and 28,000 cal BP. These ages overlap with the established chronostratigraphic position of Willendorf II, AH 9 (Austria) (Haesaerts et al. 1996; Nigst et al. 2014), the age range of Trenčianske Bohuslavice, Layer A2-3 (Slovakia) (Wilczyński et al. 2020), Milovice IV 2021 excavation-AH II (Chlachula et al. 2025) and the Milovice IV 2009 excavation (Svoboda et al. 2011). According to the dated charcoal samples from the middle part of the brownish archaeological horizon, Pavlov VI is slightly older (Svoboda et al. 2009). The dating at the older excavations at Pavlov I, Dolní Věstonice I and II and the Moravany sites is more complex. Sites like Moravany nad Váhom-Podkovic (Hromádová et al. 2021) and Dolní Věstonice II, Unit A/K10 (Polanská, Novák 2014), seem to be younger.

## 6. Conclusion

The Grub-Kranawetberg site cluster is embedded in the rich Upper Palaeolithic landscape of the Stillfried-Grub microregion with a long research history. After a detailed description of the setting of the Grub-Kranawetberg site cluster and the research history, we present an overview of the new fieldwork since 2021 in the area, including a surface survey on the Kranawetberg/Hönigsberg ridge, new fieldwork at Grub-Kranawetberg I and Grub-Kranawetberg II. The latter site is described for the first time.

The archaeological data from the Grub-Kranawetberg site cluster fits well in the Middle and Late Gravettian record of the region. More detailed studies will be necessary on all aspects, starting with site formation processes, geoarchaeology, stratigraphy and chronology of the assemblages at both Grub-Kranawetberg I and Grub-Kranawetberg II. The rich lithic and faunal collections from the archaeological horizons at both

sites will provide data for detailed studies of the raw material economy, technological organisation and resource use.

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## CRediT authorship contribution statement

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T. Bence Viola: Funding acquisition, Formal analysis, Investigation, Project administration, Writing – review and editing.  
Marjolein D. Bosch: Conceptualisation, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Visualisation, Writing – review and editing.

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## Resumé

Oblast středního Podunají je důležitou oblastí pro porozumění chování lidí z období mladého paleolitu, zejména adaptací moderních lidí na klimatické změny vedoucí k poslednímu glaciálnímu maximu (LGM). Region se vyznačuje vysokou hustotou stratifikovaných lokalit z poloviny mladého paleolitu (MUP), datovaných přibližně mezi 35000 a 20000 cal BP. Klíčové mikroregiony, včetně Willendorfu, Pavlova-Dolních Věstonic, Krems a Moravan (obr. 1), poskytují kontext pro mikroregion Stillfried-Grub, který obsahuje více než 18 známých lokalit z období mladého paleolitu (obr. 2). V klastru Grub-Kranawetberg byly nedávné výzkumy zaměřeny především na dokumentaci nových lokalit a zpřesnění historie osídlení prostřednictvím systematického průzkumu a vykopávek.

Grub-Kranawetberg zahrnuje skupinu lokalit, které se nacházejí přibližně 30 km severovýchodně od Vídně na jihovýchodním okraji pahorkatiny Weinviertel s výhledem na údolí řeky Moravy (obr. 2, 3). Lokality skupiny Grub-Kranawetberg se nacházejí na hřebeni – přibližně 1200 m dlouhém a 180–200 m širokém – který se táhne od západu-severozápadu k východu-jihovýchodu. Tento hřeben je rozdělen do dvou katastrálních obcí: Stillfried-Hönigsberg na západě a Grub-Kranawetberg na východě (obr. 4).

Hřeben je pokryt sprašovými nebo písčity usazeninami. Geoelektrické průzkumy a vrty v Grub-Kranawetberg I (GK I) naznačují, že tyto sprašové sedimenty se liší svou mocností, v některých oblastech dosahují až 20 m a překrývají neogenní (panonské) sedimenty. V Grub-Kranawetberg II (GK II) vrty zdokumentovaly maximální mocnost sprašového krytu 5,3 m. Pozorování ve výkopových rýhách naznačují, že paleoreliéf z doby gravettien se lišil od moderního povrchu výraznou orientací svahů, která ovlivnila zachování a rozšíření archeologických materiálů.

Zájem o paleolit v oblasti Stillfried-Grub sahá až do konce 19. století, přičemž první zaznamenané nálezy z hřebene Kranawetberg se objevily ve 30. letech 20. století. Systematické povrchové sběry od 70. let 20. století, které provedli profesionální i amatérští sběratelé, zaznamenaly přes 5000 kamenných artefaktů, včetně rydel, škrabadel, hrotů Gravette/mikrogravette a čepelí s otupeným bokem (obr. 7). Mezi povrchovými nálezy jsou pozoruhodné miocenní mušle používané jako osobní ozdoby (obr. 6).

Grub-Kranawetberg I (1993–2011) (obr. 5, tab. 1): Vykopávky pod vedením W. Antl-Weisera začaly v roce 1993 jako záchranné operace poté, co hluboká orba odhalila pozůstatky mamutů a kamenné artefakty. Tyto víceleté kampaně identifikovaly dvě primární funkční zóny: (1) Akumulace kostí (sonda 1, oblasti A a B; obr. 8, 9): Spodní archeologický horizont datovaný do 30000–29000 cal BP (tab. 2), obsahující vysoké koncentrace pozůstatků megafauny (*Mammuthus primigenius* a *Coelodonta antiquitatis*) spolu s menšími taxony, jako je *Rangifer tarandus* a *Equus* sp. Stopy po řezání a absenci okusování od masožravců poukazují na akumulaci lidskou činností, zatímco ohněm načernalý sediment naznačuje, že lokalita byla využívána k likvidaci odpadu spalováním. (2) Takzvané „tábořiště“ (sonda 3, oblast C): Sekvence hluboká až 4,5 m obsahující čtyři primární archeologické horizonty (AH 1 až AH 4). AH 4 a AH 3 (datované 30000–28200 cal BP; tab. 2) jsou spojeny s tmavě hnědými antropogenními půdami (anthrosoly), což odráží vysokou intenzitu osídlení.

#### Klíčové nálezy v GK I:

- AH 4 objekty: Dva objekty zasažené působením ohně (možné ohniště?) (CF I a CF II) obklopené četnými malými jamkami. Prostorová analýza CF I naznačuje obytnou strukturu.
- Osobní ozdoby: více než 260 korálků z mamutoviny různých tvarů, špendlíky z mamutoviny a polotovary svědčící o výrobě na místě; navíc jsou zde korálky vyrobené z miocénních mušlí.
- Lidské ostatky: v AH 4 byly nalezeny dva mléčné zuby, pravděpodobně od stejného jedince.
- Kamenná industrie: dominuje zde eratický silicit a radiolarity, přičemž nejčastějšími typy nástrojů jsou čepelky s otupeným bokem a mikrogravetské hroty.

Výzkum byl obnoven v roce 2021 s cílem integrovat předchozí poznatky s moderními prostorovými záznamy a geoarcheologickými metodami.

Terénní průzkum 2021: Průzkum prováděný pomocí GNSS pokrýl 126 097 m<sup>2</sup> a bylo nalezeno 359 předmětů. Prostorové rozložení ukázalo, že artefakty ve východní oblasti hřebene se vyskytují primárně na jižním svahu, zatímco v západní oblasti jsou nálezy koncentrovány na vrcholu hřebene (obr. 10, 13). To naznačuje, že zemědělská destrukce archeologických vrstev je závažnější v západní části zkoumané oblasti hřebene. Soubor kamenných artefaktů (n = 290) je typologicky shodný s atribucí gravettien (obr. 14, 15).

Grub-Kranawetberg I (výzkum 2021): terénní výzkum v severovýchodním rohu oblasti C (obr. 11, 16) odhalil 5,5 m sekvenci, kde bylo vyčleněno pět archeologických horizontů (AH 1 až AH 5; obr. 17–19; tab. 3–9). AH 5 je nově identifikovaný horizont nacházející se pod antrosolem AH 4, kde byl nalezen jeden ústěp (obr. 17).

Grub-Kranawetberg II (výzkum od roku 2022): prospekce pomocí vrtů identifikovala nové naleziště GK II východně od GK I (obr. 12, 20). Výzkum v sondě 1 odhalil 2,3 metrovou sekvenci obsahující pět archeologických horizontů (zdola nahoru): AH Kristof, AH Morgan, AH Luc, AH Michi a AH Chase. AH Michi a AH Luc jsou nejbohatší horizonty (tab. 10). AH Michi je charakterizován rohovci a radiolarity s čepelkami s otupeným bokem, zatímco AH Luc se vyznačuje eratickými silicity a mikrogravetskými hroty. Fauna zahrnuje fragmenty maxily mamutů, pozůstatky sobů a koní. Na severním konci sondy 1 byl zdokumentován ledový klín, který ovlivnil rozložení nálezů (obr. 21).

Současný stav vědění naznačuje, že člověk využíval hřeben Kranawetberg/Hönigsberg výhradně v období mladého paleolitu. Žádné důkazy o dřívější přítomnosti hominidů nebyly zjištěny. Diagnostické nálezy z povrchových sběrů i vykopávek poukazují převážně na gravettien. Soubory AH 4 a AH 3 z GK I se nacházejí na přechodu mezi středním a pozdním gravettienem. Mezi nimi vidíme posun v typech retušovaných nástrojů a využívání surovin. Skupina lokalit Grub-Kranawetberg spolu s blízkými lokalitami, jako jsou Ollersdorf-Heidenberg a Stillfried-Steinschlägeratelier, podtrhuje intenzitu osídlení tohoto mikroregionu ve středním mladém paleolitu. Výzkum stále probíhá a současně úsilí se zaměřuje na antrakologickou analýzu, radiokarbonové datování a podrobné geoarcheologické studie s cílem objasnit procesy formování lokalit a dopady periglaciálního prostředí.

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