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Vztah člověk - zvíře:
Analýza zvířecího osteologického materiálu v antropologickém kontextu

Habilitační práce

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Obsah

Abstrakt / Abstract

Předkládaná habilitační práce analyzuje vztah člověka a zvířete na základě zpracování osteologického materiálu z antropologických kontextů, tj. z vybraných etnologických analogií recentních společností arktické Sibiře a archeologických situací pleistocénu a starého holocénu. Výběr těchto mobilních společností dokumentuje predomestikační stav; v případě současných společností jsou pak pes a sob jedinými domestikovanými zvířaty. Práce je postavena na souboru komentovaných prací, jejichž základem bylo osteologické určení živočišných taxonů, anatomický popis i záznam četnosti jejich výskytu. V detailu je pak sledován vliv tafonomických činitelů (včetně lidských manipulací se zvířecími těly), jsou popsány vybrané patologické projevy i distribuce částí těl uvnitř sídlišť či jejich bezprostředním okolí. Dále práce demostruje limity symbolické interpretace vztahu člověka a zvířat, pokud by probíhal bez znalosti potřebného kulturního rámce. Propojením těchto přístupů tak práce umožňuje komplexně pojmout interpretaci tohoto vztahu na evropských lokalitách z hlediska chronostratigrafického zařazení daného kontextu, prostředí, výživy, výroby a dalších aspektů lidské adaptace a chování.

The human-animal relationship arising from the study of osteological material from anthropological contexts (i.e. from selected ethnological comparison with actual evidence from arctic Siberia and from archaeological situations dated to the Pleistocene and Lower Holocene periods) makes the object of this thesis. The pre-domesticated level characterizes a criterion in selection of archaic mobile societies; in the case of recent societies dog and reindeer represent the only domesticated species. Thesis is based on the several commented papers including osteological determination of animal species, their anatomic description and frequencies. In detail, taphonomic agents as well as human manipulations with animal bodies are described and supplemented by documentation of selected pathologies or distribution of animal remains in the settlements or their vicinity. Additionally, limits in symbolic interpretation of human-animal relationship if realised without the knowledge of proper cultural background were demonstrated. All presented perspectives may contribute to complex interpretation of human-animal relationship at European sites from the viewpoints of chronostratigraphy, environment, subsitence, production and other aspects of human adaptation and behavior.

Klíčová slova / Keywords

archeozoologie – ekonomicko-subsistenční strategie – humánní ekologie – etnoarcheologie – gravettien – lidské adaptace – mezolit – mikroregiony – paleolit – tafonomie

archaeozoology – economic-subsistance strategies – human ecology – ethnoarchaeology – Gravettian – human adaptation – Mesolithic – microregion – Palaeolithic – taphonomy

1 Úvod

Hodnocení vztahu člověk - zvíře vyžaduje velmi komplexní přístup a v ideálním případě i kombinaci nejrůznějších analytických pohledů. Prvou a základní částí předkládané práce je proto etnologická analogie u vybraných mobilních společností současné arktické a subarktické Sibiře, u níž vycházíme z předpokladu, že určité přírodní prostředí vede do jisté míry k podobným kulturním adaptacím. Jednotícím kritériem pro výběr recentních mobilních společností byly jejich ekonomicko-subsistenční strategie, založené na lovu, rybolovu a pastevectví sobích stád; přičemž pes (*Canis lupus f. familiaris*) je jediným domestikovaným zvířetem. V případě domestikace soba (*Rangifer tarandus*) se názorově kloníme k pracem B. Laufera (1917), A. M. Zolotareva, M G. Lenina (1940), N. T. Mirova (1945), T. Ingolda (1980) a P. Vitebského (2005), které jej vzhledem k nárokům na chov řadí spíše k semi-domestikovaným druhům. Což ostatně potvrzují i sami sibiřské národy, které tvrdí, že v podstatě není jasné, kdo koho zdomestikoval, zdali člověk soba, nebo naopak sob člověka. Naše etnologická analogie (byť jsme si vědomi jejich limitů, které budou dále diskutovány) je založena na několika metodických přístupech a dokumentuje vztah člověk - zvíře ve dvou oblastech. V prostoru severozápadní Sibiře jsme tak na základě vlastního terénního výzkumu řešili otázky sídlištní strategie při výběru polohy pro tábořiště, zdali existuje sezónní preference pro jejich umístění či jakým způsobem mohou být využívány přírodní bariéry v moderování pohybu sobích stád. Osteologická analýza (tj. stanovení NISP, MNE, MNI) se zde ukázala jako klíčová při deskripci jednotlivých táborů i dílčích lidských aktivit (ať již v prostoru sídliště, nebo jejich bezprostředním okolí). Data získaná z demografické struktury osteologických pozůstatků jsme následně mohli aplikovat při sezónní determinaci opuštěných sídlišť, neboť distribuce zbývajících předmětů se zde ukázala jako sezónně indiferentní (na první pohled tak nebylo možno rozeznat rozdíl mezi letním a zimním tábořištěm). Analýzou etnologických kolekcí a doprovodné dokumentace z prostoru severovýchodní Sibiře jsme mohli konfrontovat předpoklad, zdali má četnost zastoupení určitého zoomorfního tématu ve figurální podobě svou výpovědní hodnotu při intepretaci ekonomického a symbolického významu daného živočišného druhu.

V druhé části předkládané práce je rozpracována osteologická analýza živočišného materiálu z vybraných pleistocenních a starých holocenních lokalit Moravy a severních Čech, které tvoří různě specializovaná/komplexní lovecko-sběračská a rybářská sídliště. Námi sledovaný osteologický materiál je z velké části uložen v depozitáři Střediska pro paleolit a paleoetnologii Archeologického ústavu AVČR Brno v Dolních Věstonicích, vyjma části lokality Předmostí III, které se nachází v Moravském zemském muzeu. V materiálu jsme nejprve stanovili zastoupení dílčích živočišných taxonů, dále jsme zdokumentovali poměr anatomických částí i míru jejich fragmentarizace. V detailu se práce zabývá deskripcí a rozlišením abiotických a biotických tafonomických činitelů, které se podílely na zachování či naopak destrukci osteologického materiálu námi sledovaných lokalit. Zvláštní pozornost je pak věnována dokumentaci lidské manipulace se zvířecími těly v procesech bourání, stahování a porcování (stranou však byla ponechána technologická analýza výrobních postupů artefaktů z tvrdých živočišných tkání). Skladba fauny pak vypovídá o chronostatigrafii lokality a vzájemné odlišení stop po tafonomických činitelích na osteologickém materiálu má svůj nesporný význam při hlubší intepretaci její celkové tafonomické historie (Skutil, Stehlík 1949; Behrensmeyer, Hill eds. 1980; Binford 1981; Lyman 1994; Denys 2002; Alhaique *et al*. 2004; Conor 2007). Dále jsme se aktivně zapojili do současné diskuse k domestikaci vlka v paleolitu, k níž přispíváme pilotní komparativní studií vlčí populace z lokality Dolní Věstonice II, na níž demonstrujeme její vysokou variabilitu (převyšující i 8% sexuální dimorfismus pozorovatelný na recentním vlčím skeletu; Hillis, Mallory 1996; Morris, Brandt 2014). V návaznosti na tradiční diskusi v české literatuře (Maška 1893, 1894, 2008; Pokorný 1951; Musil 1955, 1958a, 1994, 2005) tuto variabilitu dáváme do souvislosti spíše s odlišnými ekomorfotypy (tj. vlčími populacemi adaptovanými na různé prostředí i odlišné potravní strategie), nežli s domestikací jako takovou. Z pohledu takto zúžené systematické analýzy zvířecího osteologického materiálu jsme rovněž konfrontováni s novými problémy. Jako nejpalčivější aktuálně považujeme velikostní i částečné morfologické překryvy mezi některými živočišnými taxony, jež na straně jedné navyšuje podíl chybného určení, na straně druhé zkresluje výsledky navazujících analýz, např. izotopických.

Z obecného hlediska předpokládáme, že obě části předkládané práce nám napomohou zdokumentovat vysokou míru proměnlivosti ve vztahu člověka a zvířete, odrážející i změny přírodních podmínek a doprovodných ekonomicko-subsistenčních adaptací lidských společností, které postupně vyústily v proměnu postavení některých živočišných druhů, (v našem případě psa a soba) během jejich domestikace. Z historiografického pohledu pak tato práce navazuje na tradiční studie realizované například J. Kniesem, J. Skutilem, A. Stehlíkem, P. Pokorným, R. Musilem, I. Horáčkem nebo W. Wojtalem.

Na závěr bych chtěla těmto lidem vyjádřit své poděkování za možnost přístupu k osteologickým sbírkám a podílení se na terénních výzkumech, která postupně přerostly v dlouholetou spolupráci: prof. J. Svobodovi a dr. B. Komoróczymu z Archeologického ústavu AVČR Brno, dr. V. Pešovi z Vlastivědného muzea a galerie v České Lípě, dr. P. Šídovi z Filozofické fakulty Západočeské univerzity v Plzni, Mgr. Z. Schenkovi a Bc. J. Mikulíkovi z Muzea Komenského v Přerově a pí. D. Coufalové ze Správy jeskyní České republiky pro Mladečské jeskyně. Dále bych chtěla poděkovat dr. P. A. Kozincevovi z Institutu ekologie rostlin a živočichů Uralského oddělení Ruské akademie věd v Jekatěrinburgu; dr. H. Saidovi z Institutu Etiopských studií v Addis Abbabě; dr. M. Roblíčkové z Moravského zemského muzea v Brně, dr. E. Pucherovi z Přírodovědeckého muzea ve Vídni; dr. M. Pacher z Institutu orientální a evropské archeologie Rakouské akademie věd ve Vídni a doc. P. Wojtalovi z Institutu systematiky a evoluce živočichů Polské akademie věd v Krakově. V neposlední řadě bych chtěla poděkovat svým mladým kolegům dr. A. Perri z Ústavu lidské evoluce Institutu Maxe Plancka v Lipsku, dr. B. Hromadové z Archeologického ústavu Slovenské Akademie věd v Nitře, dr. A. Pryorovi z Univerzity v Southamptonu, dr. A. Hulme-Beamanovi z Univerzity v Aberdeenu a Mgr. M. Polanské ze Sorbonské univerzity v Paříži za podnětné diskuse; a svým přátelům a rodině za podporu.

2 Příklady z etnologického kontextu

První část předkládané práce tvoří analýza zvířecího osteologického materiálu a sbírek figurálních předmětů se zoomorfní tématikou z vybraných etnologických kontextů recentních mobilních společností arktické a subarktické Sibiře. Tyto etnologické analogie představují metodologický nástroj, na jehož základě můžeme mapovat dynamiku aktuálních projevů vztahu člověk – zvíře, a to jak na úrovni ekonomicko-subsistenční, tak i symbolické. Námi vybrané mobilní společnosti jsou pak charakterizovány pohybem mezi sídlišti s krátkodobým, opakovaným (tj. sezónním) nebo dlouhodobým osídlením; mající sociální uspořádání s prostorovou integritou sídliště i jeho okolí; u nichž se stopy po lidské činnosti akumulují uvnitř i vně sídliště takovým způsobem, že odráží udržitelné využití dostupných divokých i domestikovaných živočišných i rostlinných zdrojů, přičemž pes (*Canis lupus f. familiaris*) a sob (*Rangifer tarandus*) jsou jedinými domestikovanými živočišnými druhy (srov. Laufer 1917; Mirov 1945; Lee, DeVore eds. 1968; Ingold 1980; Gamble 1991; Burch, Ellanna 1994; Chasanov 1994; Svoboda 1996, 1999, 2014; Gowdy 1998; Suominen, Olofsson 2000; Syroečovski 2000; David, Kramer 2001; Johnson 2002; Cunningham 2003; Renfrew, Bahn eds. 2005; Muckle 2006; Røed *et al*. 2008; Grøn 2011).

2.1. Metoda

S používáním etnologické analogie se v archeologické literatuře můžeme setkat již od druhé poloviny 19. století, a to jak v pojmu paleoetnologie (definován v roce 1865 Luigim Pigorrinim a Paolem Mantegazzou), tak i etnoarcheologie (definován v roce 1900 Jessem W. Fewkesem), které však již koncem 19. století byly podrobeny kritice pro nesystematičnost při výběru etnologického kontextu i pro tendence k zevšeobecňování (Mortillet 1883; Hough 1931; Wobst 1978; Gibbon 1984; Pautrat 1993; Stark 1993; Panter-Brick *et al*. eds. 2001; Santagata 2009 online). Jisté rehabilitace se oba pojmy dočkaly na přelomu 60. a 70. let 20. století díky procesuálním archeologům Lewisi R. Binfordovi (1962, 1964, 1978), Richardu A. Gouldouvi (1980), Johnu E. Yellenovi (1977) a Ianu Hodderovi (1982), kteří se na základě etnologických pozorování snažili pochopit procesy podílející se na tvorbě archeologického záznamu, jeho konzervaci či naopak destrukci (čímž zachytili sociálně i ekonomicky významné aktivity, u nichž nemusí dojít k archeologizaci hmotných stop). Binford (1978, 1981) dále podrobněji sledoval lidskou manipulaci s těly zvířat v procesech jejich bourání, stahování a porcování, takže mohl klasifikovat stopy na zvířecích kostech, které po sobě zanechají artefakty během těchto činností. Následně se zabýval distribucí anatomických částí v prostoru sídliště, které odráží preference ve výběru skeletálních částí zvířete při různých lidských aktivitách, např. s ohledem na výtěžnost masa, tuku a morku ve výživě; nebo výběr kvalitní kožešiny v produkci oděvu a obuvi. Jeho klasifikace i metodické postupy jsou používány dodnes. Pro naše studium prostorového uspořádání recentních i archeologických sídlišť a jejich sezónní determinace bylo dále významné jeho pozorování z nunamiutských sídlišť (1981). Na nichž Binford koreloval sociální uspořádání prostoru s délkou pobytu na sídlišti a sezónou, čímž předpokládal, že na základě množství a druhu naakumulovaných předmětů lze predikovat charakter osídlení, tj. zdali bylo krátkodobé/dlouhodobé a jarní – letní nebo podzimní – zimní.

Z aktuálního pohledu předpokládáme, že podobné přírodní podmínky vedou k velmi obdobným kulturním adaptacím, a tudíž zmapováním variability recentních společností získáme dostatečně široký srovnávací rámec, na jehož podkladě jsme schopni konfrontovat podobnosti či naopak unikátnosti současných kultur s těmi archeologickými. Ve smyslu definice etnoarcheologie tak můžeme sbírat informace o technologiích, operačních procesech při výrobě artefaktů či bourání, stahování a porcování těla zvířete, o strukturách sídlišť (dále dělených na domácí, aktivní i odpadní zóny) či o architektuře celkové struktury prostoru (např. orientace k nejbližším zdrojům surovin, pitné vody, přírodním koridorům kudy prochází lovná zvěř, atd.). Ve smyslu definice paleoetnologie pak dokumentujeme rozličnosti v lidském adaptačním chování včetně motivací, které k němu vedou (ať již na úrovni ekonomicko-subsistenční, sociální nebo symbolické). Z metodického hlediska etnologická analogie využívá několika nástrojů, jakými jsou terénní výzkum, práce s etnologickými sbírkami a komparativní studium literatury, a které jsou v této práci postupně představeny (Stiles 1977; Binford 1981; Cribb 1991; Chasanov 1994; Van Reybrouck 2000; Phillips 2001; Rowley-Conwey 2001; Fagan, DeCourse 2004; Barnard 2004; Damm 2005; Sellet *et al.* eds. 2006; Roux 2007; Johnson 2012; Walker, Skibo 2015).

2.2 Materiál

Vybrané příklady z prostoru severozápadní a severovýchodní Sibiře tak na základě různého metodického pozadí dokumentují rozsah vztahu člověk – zvíře těchto mobilních společností. Na straně jedné pak díky autentickému terénnímu výzkumu a následné osteologické analýze sledujeme v prostoru severozápadní Sibiře proces formování něněckých sídlišť ve vztahu k jejich subsistenci, sezonalitě a využití krajiny při kontrole stád domestikovaných sobů, rybolovu a lovu vodního ptactva (podkapitola 2.2.1). Na straně druhé dokumentujeme možnosti odrazu zoomorfních témat z ekonomicko-subsistenčního prostoru do sféry figurálního zobrazení a mytologických konceptů u Čukčů a Korjaků (podkapitola 2.2.2).

2.2.1. Severozápadní Sibiř: Něněcká analogie

V oblasti polárního Uralu – mikroregionu Jangane Pe (Jamalo-Něněcký autonomní okruh (Ruská federace) jsme v letech 2012 a 2009 podnikli dvě terénní expedice ve spolupráci s dr. Pavlem A. Kosincevem z Institutu ekologie rostlin a živočichů Uralského oddělení Ruské akademie věd v Jekatěrinburgu. Oblast se nachází přibližne 170 km od nejbližšího správního města Labytnangi (67° s. š.) a je obývána Něnci, etnikem samojedské jazykové skupiny uralské větve neosibiřských jazyků. Tato typická mobilní společnost tundry a lesotundry má své ekonomicko-subsistenční strategie postaveny na pastvě sobů, rybolovu a lovu vodního ptactva, losů, divokých sobů a kožešinových zvířat (srov. Chomič 1995; Golovněv 1995, 2004; Golovnev, Osherenko 1999; Stammler 2007). Dominantou vybraného mikroregionu je vápencový hřbet, Jangana Pe, o výšce 289 m. n. m., který vzhledem ke svému zásaditému podloží oplývá bohatou skladbou vegetace, utvářející velmi příznivé prostředí právě pro domorodý lov, rybolov a pastvu sobů. Během dvou výzkumných sezón se nám zde podařilo zmapovat přibližně 100 km^2, na nichž jsme se zaměřili na aktivní a opuštěné něněcké tábory, jejich vnitřní organizaci, strukturu, i umístění v krajině ve vztahu k sezonalitě a další infrastruktuře. Díky mapování sídlištních povrchových struktur (kresebná dokumentace, fotodokumentace, GPS lokalizace a soupisy předmětů) a rozhovory s něněckými rodinami se nám postupně podařilo sesbírat data k přibližně třem aktivním a 20 opuštěným něněckým táborům v časovém horizontu posledních padesáti let (1966-2012). Na základě importovaných předmětů, zejména konzervovaného jídla a hygienických potřeb, se nám následně podařilo sestavit chronologii jejich expiračních dat. Přičemž při zohlednění tradičního něněckého migračního cyklu, kdy se na stejná místa vrací po dvou letech, aby ponechali pastvinám dostatečný prostor pro regeneraci (srov. Dwyer, Istomin 2008), jsme zjistili, že jednotlivé tábory jsou opakovaně obývány ve 2 – 5 cyklech. V otázce sezonality se charakter předmětů v prostoru opuštěného tábora jevil na první pohled jako indiferentní. Pro kalibraci expiračních dat jsme proto nejprve použili etnoarcheologickou studii Haakasona (2000) z oblasti řeky Juribej na středním Jamalu, která byla postavena na přítomnosti či naopak abscenci několika předmětů či dílčích faktorů:

a) přítomnost ohniště uvnitř obydlí naznačuje období jara – podzimu, neboť Něnci používají v zimě k vytápění svého obydlí kamna. Nicméně tento faktor se v oblasti Jangana Pe neukázal jako dostatečně spolehlivý s ohledem na zvyk něněckých žen vymetat prostor ohniště, takže uhlíky byly velmi často redeponovány v sekundární poloze v odpadní zóně. Viditelnost povrchových stop po aktivním ohništi z roku 2009 byla díky vegetačnímu pokryvu velmi nízká, takže v odstupu tří let jsme se na jednom a tom samém tábořišti nebyli schopni dohodnout na jeho přesné poloze.

b) přítomnost papírových schránek z brokovnicových nábojnic by mohla podle Haakasona naznačovat jarní lov vodního ptactva nebo naopak zimní lov drobných kožešinových zvířat jako polárních zajíců (*Lepus arcticus*) a lišek (*Vulpes lagopus*) nebo losů (*Alces alces*). Současně jsme ale na našich táborech zaznamenali přítomnost těchto nábojnicových schránek po tréninkové střelbě (vč. „terčů“ v podobě prostřílených plechovek), které podle našeho názoru nelze korelovat se sezonalitou. Z dalších předmětů Haakason použil *ngali*, což je provrtaný kus větve nebo sobího parohu ve tvaru „V“, který Něnci přivazují na krk povahově příliš divokým sobům, aby jim na jaře zabránili v nechtěném útěku. Avšak v regionu Jangana Pe jsme tento typ předmětů objevovali náhodně i v krajině (s největší pravděpodobností po samovolném opadu z krku zvířete); nebo v situaci, kdy bylo ngali využito jako podklad pod skluznicemi saní jakožto provence před jejími přimrznutími k zemi.

Při řešení otázek sezonality opuštěných táborů v oblasti Jangana Pe se proto ukázala jako klíčová osteologická analýza zvířecích ostatků (resp. sobů) i jejich demografická struktura (viz. podkapitola 2.4.1; pro metodický postup podkapitola 3.1). Pozůstatky po nově narozených sobech totiž indikuje přítomnost Něnců v prostoru tábora v pozdně zimním až jarním období (konec dubna – květen), kdy sléhají sobí samice a jejich chovatelé čekají, až budou společně s mláďaty dostatečně silné, aby s nimi mohly odmigrovat na letní pastviště (v oblasti Jamalu dosahují migrační trasy až 1200 km). Tyto pozdně zimní tábory byly navíc charakteristické celkově vyšší populační strukturou poražených zvířat i rozdílnostmi v lidských zásazích na kostech. Po převedení tohoto markeru na aktivní a opuštěné tábory v daném regionu jsme obdrželi sídelní vzorec, kdy se letní tábory koncentrují kolem jezera Taunto, jež je nejvhodnější pro rybolov. Naproti tomu v zimě se sídliště přesouvají na svahy Jangana Pe, kde jsou chráněna před náporem větrů (byť výjimky nejsou vyloučeny).

Ve sledovaném mikroregionu bylo v roce 1986 započato s výstavbou silnice a železnice, které propojují těžební pole na zemní plyn dále na severu s přepravní infrastrukturou na jihu. Stavba byla sice dokončena až v roce 2003, nicméně již v letech 1995-1997 se v oblasti mění infrastruktura, jíž ruští dělníci nově zajišťují trvale, a navíc jsou pravidelně podporováni importovaným zbožím. Tento kontakt způsobil na straně jedné posun něněckých táborů směrem od železnice a silnice (aby nemohli být snadno pozorováni). Na straně druhé se projevil rapidním navýšením importovaných produktů v prostoru něněckých sídlišť, jež mimo jiné s sebou přineslo proměnu ve skladbě něněckého jídelníčku (došlo k trvalé inkorporaci vepřového, hovězího a kuřecího masa, konzervovaných ryb, majonézy, instatních produktů a různých sladkostí či slazených nápojů). Podobně jako další oblasti Jamalu je i tento mikroregion v současnosti postižen dramatickým nárůstem sobích stád, jakožto něněcké kulturní reakce na nejistou budoucnost. Současně došlo k tržnímu navýšení prodeje sobího masa a olíčených parohů (tzv. *panty*), stejně tak jako rapidnímu snížení tradičních pastvin, což má za následek nadměrné spásání a zdupávání vegetace, sníženou úživnost krajiny i některé další chaotické pastevecké strategie (srov. Ingold 1980; Vitebsky 1990; Forbes 1999; Golovnev, Osherenko 1999; Baskin 2000; Krupnik 2000; Suominen, Olofsson 2000; Stammler 2004; Anderson 2006; Beach, Stammler 2006; Degteva, Nellemann 2013).

Co se týče tradičního něněckého obydlí (*mya* nebo čum), má obvykle severojižní orientaci, kterou může pozměnit směr větru, topografie či orientace svahu, s vchodem směřujícím k jihovýchodu. Obydlí je zhotovováno přibližně z 25 dřevěných kůlů vzájemně svázaných k sobě a na vnější pokryv bývá v létě používána stanová plachtovina (dříve kůra stromů) a v zimě to jsou dvě vrstvy sobích kožešin. Místo pro čum vybírá muž, zatímco jeho stavba je na ženách. Jeden čum pak obývá jedna rodina čítající kolem 5-6 obyvatel (nejčastěji 2-3 dospělí a 3-4 děti). Svá tábořiště přesouvají pastevci v létě každé 2-3 dny a v zimě každé 2-3 týdny, aby tak zajistili svým stádům dostatek čerstvé pastvy. Rybařící a lovecké rodiny mohou naopak setrvávat na jednom místě až několik měsíců, a to do doby než je v bezprostředním okolí tábořiště vyčerpána lovná zvěř, ryby nebo dřevo na topení. Vzdálenost mezi jednotlivými čumy je běžně kolem 5 až 15 metrů s tím, že v zimním období se může sídelní struktura více nahušťovat, nebo se naopak více rozptylovat v případě rozepře mezi obyvateli (a to až na vzdálenost 45 m). Vnitřní organizace prostoru obydlí je definována symbolickou osou *siyangi*, která spoluutváří vnitřní životní prostor, a definuje tak pohyb mužů a žen uvnitř obydlí. V případě žen pak dokonce i mimo obydlí až do vzdálenosti, kde je viditelná špička čumu (srov. Chomič 1995; Golovněv 1995, 2004; Golovnev, Osherenko 1999; Haakason 2000; Stammler 2007).

Na základě distribuce předmětů na opuštěných táborech (viz. podkapitoly 2.4.2-2.4.3) jsme byli schopni rozlišit čtyři základní zóny v organizaci něněckého sídlištního i vnějšího prostoru:

a) domácí zóna je limitována přibližně 5 m kruhem vymezeným vlastním obydlím, nicméně stopy po zapuštění kůlů (*ngo*) do země či centrifugální distribuci jednotlivých předmětů jsme nezaznamenali. Ohniště je považováno za centrum lidských aktivit a v prostoru něněckého obydlí bývá vymezeno dvěma kameny. Pokud je ohniště přítomno v centrální zóně, pak se kolem něj obvykle nachází předměty související s chodem domácnosti i kuchyně, a to fragmenty sobích žeber a obratlů (kostěných podkladů pro masitější části zvířat), kousky textilií a zbytky provazů či filcovaných ok pro uchycení čumu, dřevěné třísky nebo drobné akumulace sušené trávy (tj. výstelky po lůžko) nebo dětské hračky a papírové vystřihovánky. Viditelnost této domácí zóny závisí na celkovém stáří tábora, a proto u některých starších sídlišť nebyla vůbec zaznamenána.
b) aktivní zónu vymezuje vzdálenost přibližně 10-30 m od domácí zóny a zahrnuje pozůstatky po bouracích a stahovacích procesech sobů (tj. rozptýlené méně masité kosterní podklady těl a parohů, nebo jejich fragmentů), stopy po práci se dřevem,

ať už na topení či v souvislosti s dalšími aktivitami včetně dětských her, nebo oprav saní.

c) odpadní zóna se nachází v blízké vzdálenosti tábořiště a je tvořena několika výraznými akumulacemi odpadu (např. konzervami a obaly po importovaném zboží, uhlíky z ohniště, apikálními částmi sobích skeletů, aj.), které jsou velmi často jasně vymezeny vůči svému okolí, což usnadňuje orientaci i v prostoru opuštěného tábořiště zejména při průchodu se sobím stádem, a zabraňuje tak nechtěnému zranění zvířat. Přesto se v odpadní zóně nachází i předměty opětovně použitelné, např. prkna na podlahu nebo dřevěné tyče na konstrukci čumu pro založení nového sídelního cyklu. Dále se zde nachází zóny s vysekanými místy, kde Něnci těžili dřevo, nebo zóny použitých toaletních papírů v doprovodu psích nebo sobích výkalů (lidské exkrementy podléhají v tamějších klimatických podmínkách rychlejšími rozkladu).

d) periferní zóna pak představuje oblast, v níž se nachází naložené saně se zimním vybavením. Přítomny jsou i další jasně vymezené zóny (3 x 3 m) pro těžbu dřeva Něnci obvykle vyseknou centrum křovinatého podrostu (*Alnus*, sp.) tak, aby vnější okraje mohly dále regenerovat. Motorové pily používají na poražení vzrostlých modřínů (*Larix*, sp.), a takovou zvláštností jsou atypické délky některých pařezů (někdy i přes jeden metr dlouhé), které můžeme připsat výšce sněhové pokrývky.

V okolí tábořišť jsme zaznamenali několik přírodních dominant (např. nejvyšší část Svahového tábora, izolovaná skála na nejsevernější straně Jangana Pe nebo jeskyňka na jižních svazích Jangana Pe), kde Něnci akumulují sobí parohy (čítající až 70 kusů). Tato místa představují orientační milníky v krajině, vymezující teritorium dané skupiny, i posvátná místa (srov. Haakason, Jordan 2011). Z rozhovorů s Něnci vyplývá, že podobnou funkci mělo i krasové jezírko na hřebenech Jangana Pe, které však bylo znečištěno v 90. letech ruskými geology, hledajícími ložiska bauxitu. V menším měřítku se akumulace sobích parohů (z jedinců různé velikosti, stáří a pohlaví) nachází také v bezprostřední blízkosti některých opuštěných táborů. Tyto shluky pak můžeme interpretovat jako časové převrstvení určitých lidských aktivit, např. dětských her nebo rodinných rituálů. Jednoznačně můžeme v tomto případě vyloučit stavební kostrukci - plošinu, již používají další arktické národy (srov. Binford 1993). Tuto interpretaci můžeme vyloučit vzhledem k velmi vysoké variabilitě a nepravidelnosti těchto parohů, kdy některé z nich jsou navíc stále připojeny k lebce nebo jejímu fragmentu.

V porovnání s Binfordovým předpokladem (1981), že distribuce předmětů v prostoru opuštěného tábořiště souvisí s délkou jeho osídlení a sezonalitou, nejsou něněcká sídliště tímto způsobem korelovatelná. Na starších sídlištích spíše zaznamenáváme úbytek předmětů i stop po lidských aktivitách; a na množství zachovaných předmětů má také vliv sezóna (v zimě dochází k zašlapávání předmětů do sněhu, což ztěžuje úklid při opouštění tábořiště) či specifické návyky jednotlivých rodin (zejm. ve vztahu k pořádkumilovnosti).

2.2.2 Severovýchodní Sibiř: Čukčská a korjacká analogie

Jak bylo zmíněno výše, studium sbírkových předmětů a literatury představuje další metodický nástroj, pro dokumentaci vztahu člověk - zvíře u recentních arktických a subarktických společností (viz. podkapitola 2.4.5). Analýza z prostoru severovýchodní Sibiře, Sachalinu a řeky Amur je postavena na modifikovaných výsledcích disertační práce autorky, založených na studiu elektronicky dostupné sbírky a archivních dokumentů z Jesupovy severopacifické expedice v letech 1898-1902 (Boas 1903), které jsou dostupné prostřednictvím elektronického přístupu Amerického muzea přírodní historie v New Yorku (http://www.amnh.org/). Při studiu jsme se snažili konfrontovat naše kulturní euro-americké postavení zvířat ve vztahu k člověku, který je díky svému biologickému tělu a kulturní mysli představuje jedinečnou bytost převyšující v přírodě vše ostatní (Ingold 1994; 2000; Krupnik 1993; Guthrie 2005; Willerslev 2004, 2007; Jiménez, Willerslev 2007). Avšak toto pojetí zákonitě produkuje limity a ideové bariéry, jež přenášíme do interpretací vztahu člověk – zvíře u recentních, ale i minulých lidských společností. Proto byl náš etnologický model vybrán tak, abychom zdokumentovali koncept tohoto vztahu v takovém kulturním kontextu, kde není tento vztah pouhou náhodou. Nýbrž je důsledkem velkého množství komplexních rituálních aktivit a přístupů člověka do světa zvířat, která se v tomto pojetí shlukují podobně jako lidé za vzniku tzv. Zvířecích lidí, se srovnatelným respektem jako mají ostatní lidské národy. Velmi zajímavým faktem je existence možnosti migrace duší mezi lidmi i zvířaty. Přičemž schopnost vnímat sama sebe jako odlišný živočišný druh bez ztráty vlastní identity, je jedním z klíčových aspektů k tomu, být plnohodnotnou bytostí (Nordenskiöld 1881; Nelson 1900; Czaplicka 1914; Hallowel 1926; Potapova, Levina 1956; Dioszégi 1968; Bird-David 1990; Ojamaa 1997 online; Boukal 2003; Harvey ed.

2003). Například imituje-li lovec svou kořist, musí ve svých pohybech vzorně reflektovat její projev a pohyb. Protože v okamžiku, kdy člověk a zvíře sdílí stejné tělo, rysy i mysl, může dojít k tomu, že se navzájem „uvidí“. Přesto je to nakonec zvíře, které rozhodne, zdali se lovci odevzdá, nebo naopak uteče (Michajlovskij 1892, 1895a,b; Jochelson 1926; Zelenin 1935; Bird-David 1990; Tokarev 1966; Dioszégi 1968; Hoppál 1997 online; Pedersen 2001; Nadasdy 2007; Vitebsky 2000; Willerslev 2007).

Celkem jsme zanalizovali 950 zoomorfních a teriantropických figurek, které v prostoru Sachalinu a řeky Amur sesbíral Berthold Laufer. V oblasti severovýchodní Sibiře byla kolekce shromážděna Vladimírem Germanovičem Bogorasem a Vladimírem Iljičem Jochelsonem. Obrovskou výhodou této sbírky je její rozsáhlá doprovodná dokumentace, díky níž jsme získali velice komplexní informace o problematice symbolismu lidí i zvířat v těchto oblastech. Vedle sbírkových předmětů jsme měli k dispozici průvodní korespondenci i záznamy o ekonomicko-subsistenčním významu jednotlivých živočišných druhů, o jejich výskytu v regionu, i o tom, jakou roli sehrávají v mytologických příbězích vybraných etnik (Jochelson 1900, 1904, 1905-1908, 1926; Laufer 1900; Bogoras 1901, 1904-1909, 1910, 1913, 1917, 1918, 1929).

Z analýzy figurek, tj. studia zobrazovaného tématu, realističnosti propracování, a dokumentaci použitého materiálu ve vztahu k funkci předmětu vyplývá několik pozorování:

a) zastoupení živočišných druhů ve figurkách může odrážet jejich ekologický výskyt, např. severojižní gradient v poměru zastoupení medvěda ledního (*Ursus maritimus*) a medvěda hnědého (*Ursus arctos*), nebo absence zobrazení lososovitých ryb (Salmonidae) u Čukčů, kteří na svém území nemají vhodné řeky pro jejich vplouvání. Ve figurálním zobrazení Korjaků, Kereků i Čukčů je dále přítomen vysoký podíl ploutvonožců (Pinnipedia) a kytovců (Cetacae), přestože na přelomu 19. a 20. století již mizí z jejich subsistenčního rámce v důsledku nadměrného odlovu velrybářskými společnostmi. Tito komplexní lovci-sběrači (úzce specializovaní na lov mořských savců) byli nuceni se přeorientovat na jiné a spíše okrajové lovné druhy – divoké soby v případě Čukčů, rybolov v případě Korjaků, přičemž u obou etnik se navyšuje rovněž poměr domestikovaných sobů. Kereci, jakožto specializovaní lovci mrožů a velryb, svůj adaptační boj prohráli (v dnešní době se ke Kerekům oficiálně hlasí pouze čtyři jedinci a část populace byla asimilována Čukči).

b) u užitných a ozdobných předmětů převažuje realističnost zobrazení, přestože apikální části končetin mohou být nejvíce schematizované. U hraček a rituálních předmětů naopak převládá stylizace se záměrným opomíjením detailů, a to proto, že detailnost podle těchto etnik přitahuje nežádoucí pozornost ze strany duchů, kteří mohou majitelům těchto předmětů přinést nemoc a smrt.

c) z použitých materiálů jsme se nejčastěji setkali se stabilními materiály, jakou je mrožovina, kost a paroh (z importovaných pak kov); a z nestabilních byly nejčastěji používány materiály živočišného původu (šlachy, rohy, zobáky, drápy, peří, kůže, ad.), rostlinného původu (např. dřevo, suchá tráva a další rostlinná vlákna); a importované materiály (nitě, provázky a textilie) (dělení modifikováno podle Soffer 2000). Největší podíl nestabilních materiálů se potom nacházel u rituálních předmětů a hraček (přes 30 %). Rituální předměty jsou k sobě navíc velmi často svazovány šlachou nebo rostlinným vláknem, čímž získávají mnohem komplexnější význam nežli jako samostatné předměty.

Sledovaná etnologická analogie nám tak ukazuje na shody a odlišnosti současných kultur (naší euro-americké i té východosibiřské), stejně tak jako nabízí inspiraci a limity při interpretaci společností minulých. Napomáhá nám uvědomit si živelnost i komplexnost vztahu člověk – zvíře s tím, že ekonomické a symbolické pojetí zvířete přispívá do tohoto vztahu vždy různě velkým dílem. To znamená, že pokud důležitost určitého živočišného druhu posuzujeme na základě četnosti výskytu určitého zoomorfního tématu ve figurálním zobrazení, nemusí to vůbec vypovídat o jeho reálné významnosti (a to jak v ekonomické, tak i symbolické rovině). Zajímavým vlivem je tzv. kulturní paměť, která má repetitivní tendenci uchovávat připomínky a i na takové živočišné druhy, které postupně mizí ze subsistenčního rámce i blízkého okolí sledovaného etnika (srov. Kramer, ed. 1979; Assmann 1988; Connerton 1989; Friedmann 1992; Ingold 2000; Costlow, Nelson 2010).

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2.4 Vybrané publikace k tématu

Z prací k problematice severozápadní Sibiře jsou přiloženy impaktované články *Patterns of change in a Nenets landscape: An ethnoarchaeological study of Yangana Pe, Polar Ural Mts. Russia* (Sázelová *et al*. 2015 s autorským podílem 40 %) a *Resources and spatial analysis at actual Nenets campsites: Ethnoarchaeological implications* (Svoboda *et al*. 2011 s autorským podílem 30 %); dále recenzovaný článek *Ethnoarchaeology of Nenets Campsites, Case of Yangana Pe and Oktyaberskaya (Polar Ural Mts., Northwest Siberia* (Svoboda et al. 2010 s autorským podílem 25 %) a článek ve sborníku *Detecting the children zone at the abandoned Nenets campsites: An ethnoarchaeological example from the Polar Ural Mts., Russia* (Sázelová *et al*. 2014 s autorským podílem 60 %). Autorský podíl se týká dokumentace předmětů v terénu a tvorby databází i tabulek, analýzy osteologického materiálu a doprovodných lidských či zvířecích zásahů, popisu jednotlivých tábořišť a distribucí předmětů v jejich bezprostředním okolí, přípravy podkladů pro mapy a obrázky a tvorby popisného rámce něněcké kultury.

Z prací k severovýchodosibiřské tématice je přiložen recenzovaný článek *Ethnological approach to siberian zoomorphs: A search for meaning and implications for the Upper Paleolithic evidence* (Sázelová 2014). Autorský podíl (100 %) zahrnuje studium archivních záznamů z Jesupovy severopacifické expedice a korespondence W. Bogorase, W. Jochelsona, B. Laufera a F. Boase, přístupné elektronicky přes Americké muzeum přírodní historie v New Yorku, a dále studium popisného rámce sledovaných kultur, zejména pak Čukčů, Korjaků a Kereků.

2.4.1 Patterns of change in a Nenets landscape: An ethnoarchaeological study of Yangana Pe, Polar Ural Mts. Russia

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Patterns of Change in a Nenets Landscape: An Ethnoarcheological Study of Yangana Pe, Polar Ural Mts. Russia

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Abstract Using an ethnoarcheological perspective we examine Nenets site formation, seasonality and landscape usage in controlling reindeer herds in a complex system of more than 20 abandoned campsites and other sites of interest over 100 km^2 and a time-span of several decades. We establish a chronology based on more than 150 expiration dates from imported food items, supported by additional seasonal evidence such as presence/absence of newborn reindeer, hearths and other artifacts. We separated the sites into five stages and compared the patterns of change, especially from 1986 to 2003 as the road and railroad connecting the Yamal gas mining fields were constructed nearby. We find that the impact of road and rail construction is reflected in the increase of imported goods upon its completion.

Keywords Campsite seasonality · Ethnoarcheology · Expired date chronology · Nenets · Northwestern Siberia

Introduction

The ways in which nomadic and semi-nomadic people create, use and abandon their campsites follow established patterns based on cultural traditions. However, there is generally a tendency to repeatedly reoccupy some optimal positions, sometimes independently of season, so that visible patterns become ambiguous in the ethnoarcheological record (Binford 1987, 1991; Gamble and Boismier 1991; Kroll and Price 1991; Hirsch and O'Hanlon 1995; Johnson 2002). In this paper we address questions concerning Nenets site formation, duration and stability of occupation, aspects of seasonality, and use of landscape to control reindeer-herd movement.

In a previous study (Svoboda *et al.* 2011) we compared inner structure and site formation at three campsites, two in the Yangana Pe region in the northern tundra and one in proximity to the town of Labytnangi in the southern forest-tundra. Here we expand our study at Yangana Pe to a complex of more than 20 abandoned campsites and other sites of various human activities within an area of 100 km^2 (Table 1 and Fig. 1). We established the chronology using expiration dates on the packaging of perishable food items, correlated to seasonality, to trace patterns of change over the last five decades. We predicted that the near-completion of a road and rail link connecting the gas mining fields in the Yamal Peninsula and passing the eastern margin of the study area in 1995/1997 had a significant impact on the structure of occupation in the surrounding landscape in general, and especially on the increased importation of products recorded at the individual Nenets sites. This hypothesis is supported by a number of other studies documenting the impact of gas mining on the Yamal Peninsula on the Nenets' lifestyle (Ingold 1980; Podkorytov 1995; Golovnev and Osherenko 1999; Baskin 2000; Krupnik 2000a; Beach and Stammler 2006; Stammler 2007; Forbes *et al.* 2009; Kryazhimskii *et al.* 2011; Dagteva and Nellemann 2013), in particular the dramatic growth of their reindeer herds, which they describe as a traditional response aimed at insuring against an uncertain future. The combination of a more monetized economy, which led to increased

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Table 1 Review of campsites and standing posts, their altitude, density of objects (<100 objects=low; 100-200 objects=middle; >200=large); occupational period with estimated cycles of occupations and seasonality

Campsite/standing post name	Abbreviation	Altitude	Density of objects	Occupational period	Seasonality
"Avka" campsite 1-2	AC 1-2	150 m	Middle	III-V (3 occupational cycles)	One winter season
"Kettle" campsite	KC	163 m	Middle	I; IV (5 occupational cycles)	? probably summer season
Northwestern campsite	NWC	110 m	Small	II-III (2 occupational cycles)	Unknown
Plateau campsite	PC	225 m	Middle	II-IV (2–3 occupational cycles)	Unknown
Slope campsite 1	SC1	160 m	High	IV-V (3 occupational cycles)	Two winter seasons
Slope campsite 2	SC2	180 m	High	V (2 occupational cycles)	Unknown
Slope campsite 3	SC3	206 m	Low	IV (1 occupational cycle)	Unknown
Valley campsite 1	VC1	128 m	High	V (3 occupational cycles)	Two winter seasons
Valley campsite 2	VC2	138 m	Low	III-IV (2 occupational cycles)	Unknown
Valley campsite 3	VC3	145 m	Middle	V (1 occupational cycle)	Unknown
standing post 1	st1	180 m	High	I-V (yearly usage cycle)	Both seasons
"Fur" campsite	FC	89 m	Small	V (2 occupational cycles)	Unknown
Southeastern campsite	SEC	70 m	Middle	IV-V (3–4 occupational cycles)	? probably winter season
Taunto campsite 1	TC1	85 m	Middle	V (2 occupational cycles)	One summer season
Taunto campsite 2	TC2	75 m	Middle	V (2 occupational cycles)	One summer season
Taunto campsite 3	TC3	80 m	Middle	IV-V (3 occupational cycles)	Unknown
Taunto campsite 4	TC4	87 m	High	I; IV-V (4 occupational cycles)	One winter season
Taunto campsite 5	TC5	99 m	Low	V (3 occupational cycles)	Unknown
Standing post 2	st2	88 m	Low	IV-V (2 usage cycle)	One summer season

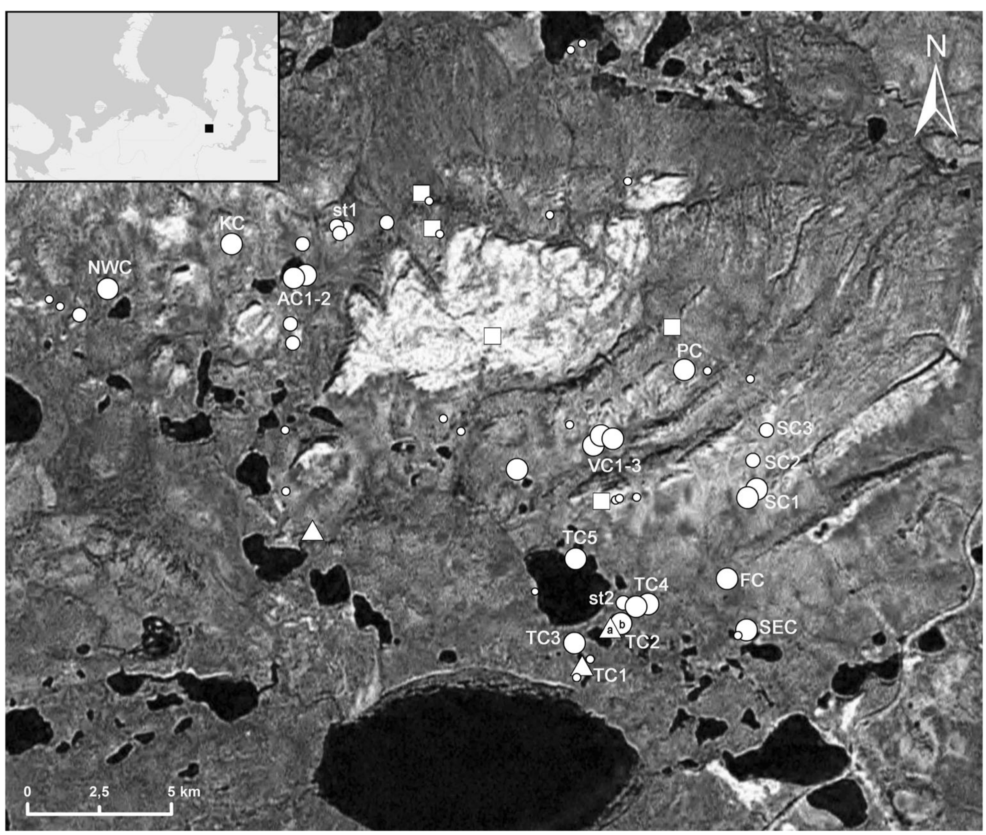


Fig. 1 Map of the micro-region around Yangana Pe, with a distribution of remains after settlement strategies, various human activities and main migration directions (to northwest - Kara Sea and to north - Yamal Peninsula). Legend: *triangle* active summer campsite; *large circle* abandoned campsite or standing posts; *middle circle* remains after human activities (such as wood-cutting); *small circle* isolated objects (e.g., fish-net, loaded sledges, etc.); *square* natural distinctive points. Campsite abbreviations: *AC1-2* "Avka" campsites, *FC* "Fur" campsite, *KC* "Kettle" campsite, *NWC* Northwestern campsite, *PC* Plateau campsite, *SEC* Southeastern campsite, *SC1-3* Slope campsites, *TC1-5* Taunto campsites, *VC1-3* Valley campsites, *st1-2* standing posts

production of reindeer meat, and decreased access to traditional territories suitable for pastures, which has recently led to overgrazing, seem to have resulted in a chaotic disruption of reindeer husbandry.

Nenets Landscape-Use Strategy

The east–west oriented limestone ridge of Yangana Pe (359 masl) creates a favorable micro-region in which the Nenets build two different types of site, winter and summer, on a yearly basis (Fig. 1). Yangana Pe is the northernmost boundary where Nenets households move their reindeer herds from the winter and spring pastures, located mainly around the Labytnangi-Kharp railway, to the summer pastures located on the Yamal Peninsula or the Kara Sea. In addition, the region is the southernmost boundary when they return from the summer pastures in fall and winter (see Kosintsev 2005; Svoboda *et al.* 2011; Kadebskaya and Kosintsev 2012).

Nenets camps are generally composed of one or three *mya* (choom – tent-like dwellings) with 5–6 inhabitants in each. A mya is usually set up on a north–south axis with its entrance facing east to southeast, although the wind direction, topography and slope declination will dictate the final orientation. The symbolic inner axis (*siyangi)* serves to separate the living space within the mya and the immediate space around the structure according to gender. Outside the choom, men and women can move freely once the top of the mya is no longer visible. The normal distance between individual chooms varies between 5 and 15 m, but misunderstandings or disputes cause an increase in the distance to 25–45 m. The children usually play in and around the campsite, creating their own specific residues after digging holes and burying objects, hammering antlers or wood, piling reindeer heads, making piles or patterns of pebbles, or abandoning toys and tools. All these residues can confuse ethnoarcheological interpretations of a site (see also Khomich 1995; Golovnev 1995, 2004, 2005a, b; Haakason 2000; Yoshida 2001).

Campsites are usually moved every 2 to 3 days in summer and every 14–21 days in winter. Families engaged in hunting and fishing camp in summer around the lakes at Yangana Pe and usually occupy these sites for several months until resources, such as game, fish or firewood, are depleted (see also Svoboda *et al.* 2011). When mya are moved, we would expect several holes to be left after removal of the poles (*ngo*), generally 2–3 cm wide and 5–10 cm deep, and natural changes to the color and growth intensity of surface vegetation under the floorboards (*lata*) (see also Haakason 2000). However, at our study campsites we did not observe such traces, although some of them, such as SEC, TC 1 and 4, AC2, had been abandoned only a few months before our visit.

When a campsite is moved, all objects left on the ground are collected up. However, in winter, depending on the depth of the snow cover, many may be lost or trampled into the snow (see also Binford 1993). The tidiness of individual families can also influence the amount that gets left behind. The lost or forgotten objects might be rediscovered and reclaimed when the site is reoccupied. Some objects might also get trampled into the ground by dogs and reindeer as they search for bones, antlers, or other edible items. Their pattern of short-term settlement leads to abandoned campsites being easily disturbed, if not completely destroyed, by Nenets families returning to the same area or often to the same place. In addition, when a site is to be reused, the women are expected to clear out the area of any waste left from previous occupations in order to prevent injury to reindeers' hooves from broken bottles, rusted tins or other sharp objects. Therefore, the garbage toss usually accumulates at several predictable and well-known places within the campsite (the tins might also be pressed) or is hidden under rocks or stones. Isolated objects might also be hung on tree branches.

In addition, several natural, distinctive points around the Yangana Pe still serve (or used to serve) as sacred places. These points are usually important landmarks also used in spatial orientation by the Nenets (see also Dwyer and Istomin 2008; Istomin and Dwyer 2009; Istomin 2012; Haakanson and Jordan 2011; Jordan 2012). Examples include a small and unusually deep karst lake at 254 masl (polluted in the early 1990s by Russian geologists); an isolated rock on the northernmost point of Yangana Pe situated close to the reindeer migration path (216 masl); the uppermost part of SC3 (206 masl); and a small cave located high on the slopes of Yangana Pe (204 masl). At most of these places, Nenets accumulated reindeer antlers, in one case more than 70 items with specific symbolic functions and meanings. In addition, we documented three accumulations of reindeer antlers and skulls just beside or within the campsites at NWC, PC and TC3. The antlers (and the skulls, if still attached) originate from individuals of different ages and vary in shape and size. There is to our knowledge no ethnological record describing antler platform constructions among Nenets (cf. Binford 1993; see also Khomich 1995; Golovnev 1995, 2004; Haakanson and Jordan 2011).

Methods

All abandoned campsites and other evidence of human activities were located by GPS. We recorded the campsite zonality visible on the surface, the spatial distribution of all remains, and the zoological and taphonomical descriptions of all animal remains (Tables 2a, b, 3, and 4). When necessary, we

Table 2 Distribution of reindeer (*Rangifer tarandus*) skeletal parts from the slope and lake campsites of Yangana Pe – additional 2012 data supplementing research in 2009 (Svoboda *et al.* 2011)

a.

Skeletal part	AC1	AC2			KC	NWC			PC		SC1				SC2	VC1			VC2		VC3		st1	Total NISP
	A	*N*	*J*	*A*	*A*	*J*	*SA*	*A*	*SA*	*A*	*N*	*J*	*SA*	*A*	*A*	*N*	*J*	*A*	*SA*	*A*	*J*	*A*	*A*	
Antler	0	0	2	10	0	3	7	9	0	6	0	0	0	0	0	0	0	1	0	4	0	0	18	60
Skull+maxilla	1	0	0	5	0	0	0	1	1	8	0	0	0	0	1	0	3	1	0	5	0	0	3	29
Mandibula	0	1	0	0	0	0	0	0	0	7	1	0	0	5	1	0	1	0	0	0	2	7	0	25
Vertebra	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	4
Rib	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	2	0	0	0	0	0	6
Scapula	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	6
Humerus	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	5
Radius	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	4
Ulna	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Metacarpals	0	0	0	0	1	0	0	2	0	3	0	0	0	0	1	0	0	0	0	1	0	10	0	18
Pelvis	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	3
Femur	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
Tibia	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	2	2	0	0	0	0	8
Tarsals	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	4	0	1	0	8
Metatarsals	2	0	0	0	1	0	0	0	0	5	0	0	0	0	0	0	0	2	0	0	0	3	0	13
Phalanges	0	0	0	0	0	0	0	0	0	1	0	0	0	5	1	0	0	6	0	0	0	0	0	13
Metapodials	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	4
Bone fragment	1	0	0	0	3	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	8
Total NISP	7	1	2	21	7	3	7	14	1	37	1	1	1	18	8	2	7	16	2	15	2	23	23	219

b.

Skeletal part	FC	SEC		TC1		TC2		TC3		TC4				TC5	st2	Total NISP
	A	*SA*	*A*	*SA*	*A*	*J*	*A*	*SA*	*A*	*N*	*J*	*SA*	*A*	*A*	*A*	
Antler	1	0	6	0	0	0	1	0	3	0	0	0	0	1	0	12
Skull+maxilla	1	0	0	0	0	0	2	1	6	5	0	0	1	0	0	16
Mandibula	2	0	2	0	0	1	1	0	1	1	1	0	1	0	0	10
Vertebra	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	3
Rib	0	0	0	0	0	0	0	0	1	2	0	0	0	0	2	5
Scapula	2	1	0	0	0	0	0	0	1	0	1	0	0	0	0	5
Radius	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ulna	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Metacarpals	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2
Pelvis	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	4
Tibia	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Metatarsals	0	0	7	0	1	0	1	0	0	0	0	0	0	0	0	9
Phalanges	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	3
Metapodials	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	6
Bone fragment	1	0	3	0	0	0	0	0	0	0	0	0	1	0	0	5
Total NISP	9	1	27	1	1	1	5	1	14	8	2	1	6	1	5	83

For the campsite abbreviations, see Table 1; other abbreviations: *NISP* number of identified specimens, *N* newborn remains, *J* juvenile remains, *SA* subadult remains, *A* adult remains

photographed the sites and/or selected objects. We then created a chronology from expiration dates on the packaging of imported goods (Fig. 2). The main problem arose from the fact that most of these expiration dates fall within an interval of 1 to 3 years and Nenets traditionally occupy their campsites once every other year. Thus, according to the literature and discussions with Nenets we used the double-year migration cycle. This cycle affects observable changes in migrational paths, but also allows time for pasture regeneration (see also Dwyer and Istomin 2008). In the third step, we estimated the season of occupation by calibration with several reasonably reliable features associated with seasonally bounded activities

Table 3 Distribution of specific damage to reindeer bones (*Rangifer tarandus*) from the slope campsites of Yangana Pe – additional 2012 data supplementing research in 2009 (Svoboda *et al.* 2011)

Campsite/standing post	Gnawing	Breaking	Chopping	Cutting	Total
"Avka" campsite 1	2	0	0	0	2
"Avka" campsite 2	11	2	0	0	13
"Kettle" campsite	0	1	1	0	2
Northwestern campsite	14	1	0	0	15
Plateau campsite	3	4	6	4	17
Slope campsite 1	3	4	2	0	9
Slope campsite 2	2	0	2	0	4
Valley campsite 1	4	0	1	1	6
Valley campsite 2	0	1	1	1	3
Valley campsite 3	2	5	7	0	14
standing post 1	1	0	1	2	4
Total	42	18	21	8	89

Occurrences of bone burning are described verbally in text

(Table 1), for example, the presence of newborn reindeer bones (Table 2a, b) reliably indicate the end of winter or early spring (late April-early May) when calving starts. The herders will wait at the campsite until the newborn reindeer are strong enough for migration northwards. Additionally, young reindeer bones (several months old) at campsites indicate the slaughter after the return from summer pastures. Apart from these demographic indicators, the total amount of reindeer remains might be seasonally estimated. The slope campsites, usually occupied in winter, have higher concentrations of reindeer bones than the lake campsites occupied mainly in summer (Tables 1 and 2a, b). The deviations from this rule were recorded at slope campsite KC, where we thus suggest a summer occupation, contrary to the lake campsite SEC falling probably between winter camps.

Table 4 Distribution of specific damage to reindeer bones (*Rangifer tarandus*) from the lake campsites of Yangana Pe – additional 2012 data supplementing research in 2009 (Svoboda *et al.* 2011)

Campsite/standing post	Gnawing	Breaking	Chopping	Cutting	Total
"Fur" campsite	4	4	0	0	8
Southeastern campsite	1	3	5	1	10
Taunto campsite 1	3	0	0	0	3
Taunto campsite 2	0	0	0	0	0
Taunto campsite 3	1	0	0	0	1
Taunto campsite 4	3	0	2	0	5
Taunto campsite 5	1	0	0	0	1
standing post 2	0	0	1	0	1
Total	13	7	8	1	29

Occurrences of bone burning are described verbally in text

According to Haakason (2000) with reference to the Yuribei river further north, the presence of hearths at campsites might indicate summer camping while their absence might indicate the winter period, when the Nenets use stoves. He also describes the use of smaller fires in the winter months to curve sledge runners (*khasi*). He argues that all remains of these activities disappear after the snow has melted. According to our findings this does not hold for the Yangana Pe region, because here Nenets women carefully sweep the hearths and we find charcoal only in secondary positions at toss zones. Moreover, surface vegetation can easily obscure remains of hearths. For example at TC1 the active hearth inside the mya was observed in 2009, but was obliterated by 2012 so that we were not able to accurately detect the position of the dwelling.

In addition, some other objects might be potentially useful for seasonal calibration, for example tools and paper shotgun shells. The *ngali*, usually a V-shaped branch (or piece of antler), pierced and with a pointed end, is used especially in spring to restrain wilder reindeer. In the Yangana Pe region these objects were dispersed randomly in the landscape. However, at SEC several ngali were found attached to sledges loaded with winter equipment and broken ones were placed under the runners to protect them from freezing to the surface (Fig. 3). The paper shotgun shell casings found at SEC, TC2 and st1 also proved unreliable markers, and may indicate either the hunting of waterfowl in the spring-summer period or of elks and hares in the autumn-winter period, or might otherwise relate to seasonally-independent training in shooting, as documented, for example, at TC5.

Changes in Nenets' Time and Space

The Nenets population on the Yamal Peninsula increased from 13,977 to 17,404 between the early 1960s and mid-1980s, and between 1986 and 2005 it increased from 20,917 to 26,435. More recently (2006–2012), some 29,772 Nenets inhabit the Yamal Peninsula (see also Vasil′ev 1990; Krupnik 2000b; Orudzhieva 2005; Kornilov 2012; Volzhanina 2013).

On the micro-regional scale, we documented the continuous occupation or resettlement at Yangana Pe by Nenets from the mid-1960s (Fig. 4a–e). According to a series of interviews with Nenets families, during the earliest two phases (1966–1975 and 1976–1985) one family was living in the winter around the lakes while one or two families were at Yangana Pe waiting for their reindeer to calve. At the same time, other families migrated with their herds through the region without staying, although all families met here in autumn. However, no physical remains of winter occupation around lakes from these periods were detected, probably because they were obscured by extensive occupation in summer. During this period Russian geologists intensively, and unsuccessfully, searched

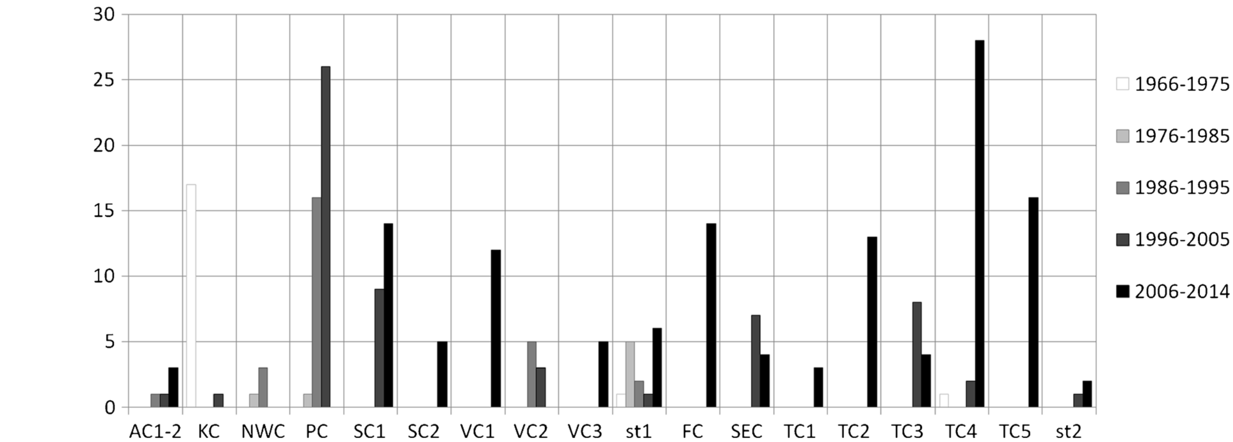


Fig. 2 Distribution and frequency of imported goods related to expiration date chronology at campsites or standing posts. For campsite abbreviations, see Table 1

the Yangana Pe for commercially useful sources of marble and bauxite and remains of these abortive mining efforts and associated campsites and other infrastructure are still marked by piles of coal (which is not used by Nenets), as well as by radical changes in vegetation. Around the Russian camps *Chamaenerion latifolium* occurs as an important synanthropic taxon, along with *Ch. angustifolium*, which also indicates human intervention in the forest tundra biotopes. Another anthropic impact is the introduction of *Tanacetum bipinnatum* and *Rubus chamaemorus*, both pioneer plants here. Peat-bog biotopes disturbed by wheels of large vehicles are occupied by *Eriophorum scheuchzeri* and less frequently by *Parnassia palustris* (Kniazev *et al.* 2006; Rebristaia 2006; Svoboda *et al.* 2011). Overall, the Russian presence around Yangana Pe seems to have been sporadic. The amount of datable imported goods found at such sites is very low, between 3 and 13 % of all datable imported products, although the lower figure might be due to taphonomical causes such as weathering and vegetal or faunal activities.

Fig. 3 Sledges loaded with winter equipment at promontory of SC with 9 *ngali* for taming wild reindeer attached and 5 broken *ngali* under sledge runners to prevent freezing to the ground

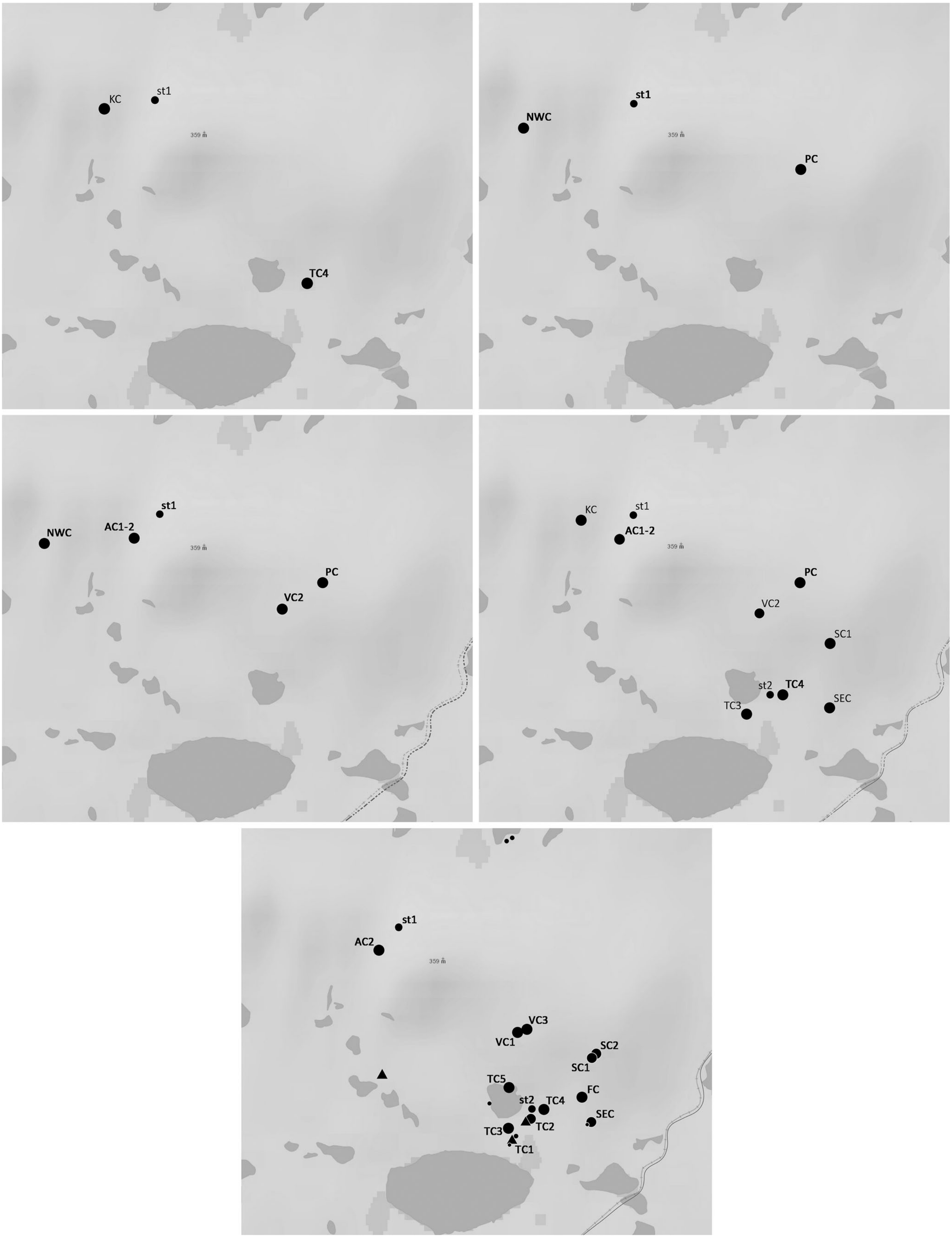
The next two phases (1986–1995 and 1996–2005) were impacted by road and railroad construction connecting the Yamal gas mining fields, which began in 1986 and was finished in 2003. Russian laborers were present at construction sites almost daily through 1997 with their own infrastructure and imported supplies. The Nenets' response was to move their settlements and activities to areas where they could not easily be observed or disturbed by the workers. Even today, no abandoned campsites or other traces of Nenets activities are visible from either the road or railroad. At the same time, they must have had increased contact with the Russians, as evidenced by the increased presence of imported goods at their abandoned sites (Fig. 2). The total amount of these products was estimated as between 10 and 20 % allowing for different taphonomical action relative to the oldest campsites. Their diet also changed as beef and pork, tinned fish, mayonnaise, instant products, and various candies, started to be regularly consumed.

More recently (2006–2014), around five or six Nenets families lived in the summer around lakes; and between 130 and 150 Nenets families travel with their reindeer herds (40–50, 000 head) annually through the region in the spring and autumn. The amount of datable imported goods exceeds 50 % within this later period, but it should be noted that most of the objects were not yet affected by taphonomical agents.

Slope Campsites

AC ("Avka") campsites 1–2: the shorter distance between both campsites, distribution of objects within their areas, and expiration dates on discarded packaging indicate that they were in communication for part of the time. Well-trodden

Fig. 4 **a**–**e** Five stages in distribution of human activity remains in the study area: **a** 1966–1975 (*upper left*); **b** 1976–1985 (*upper right*); **c** 1986–1995 (*middle left*); **d** 1996–2005 (*middle right*); **e** 2006–2014 (*low*). For campsite abbreviations, see Table 1 ▶


KC
st1
TC4
st1
NWC
PC
NWC
AC1-2
st1
PC
VC2
KC
st1
AC1-2
PC
VC2
SC1
st2
TC4
TC3
SEC
st1
AC2
VC3
VC1
SC2
SC1
TC5
FC
st2
TC4
SEC
TC2
TC3
TC1

pathways were detected between them, an unusual feature compared with other sites. The settlement years follow the interval in the 1999s and between 2011 and 2012 (dated vodka bottles and condensed milk or fish tins), although one toss zone at Avka 1 was formed earlier in 1995 (dated by an indeterminate bottle). Thus, we expected at least three occupation seasons with one winter-spring season according to newborn reindeer bone calibration. No clear hearths were present at either site, so we were not able to locate the domestic areas with certainty. The two toss zones at Avka 1 and one toss zone at Avka 2 were slightly overlapping within activity areas. At Avka 1 the bone fragments of an axial skeleton and limbs from an adult reindeer (NISP=7) were recorded, accompanied by bone residues (metapodials) after fur processing of *kamus* used especially in winter-boot production. Traces of dog gnawing were documented in only two instances. At Avka 2 we recorded a newborn reindeer mandible and two juvenile antlers, accompanied by antlers, crania and bones from fore and hind limbs of at least six adult individuals (NISP=28). Only 14 % of these remains were characterized by bone residues from fur processing, such as metapodials and phalanges. Traces of human butchering activities, such as cutting or breaking, and dog gnawing were documented in 15 % of bones and in 85 % of antlers. Within the inner campsite area an extensive accumulation of reindeer feces was recorded; thus we infer a longer presence here due to at least one animal recovering from illness (supported by an antibiotic ampule) or a reindeer with special status (*avka*) as a pet living with a household in their mya. According to artifacts found within both campsites we deduce a family of non-smokers and low alcohol consumption with at least one child.

KC ("Kettle") campsite: we recorded within the domestic zone a clear circle made up of several stones used as a stabilizing element of mya construction. At distances of 11 m, 45 m and approximately 65 m from the center of the domestic zone, three accumulations of toss were located. This campsite was repeatedly occupied in the years 1966, 1969–1975 and in 2003 (being dated by vodka bottles and a fish tin); thus we inferred here at least five periods of re-occupation. Within the area we recorded seven bones of an adult reindeer and all from the meaty parts of the animal or residues of fur processing. However, only the butchering process is clearly supported by traces of breaking and chopping. Dog gnawing was documented on several bones. We inferred occupation by non-smokers with high alcohol consumption and most probably no small children.

NWC (Northwestern) campsite: based on our expiration date chronology the campsite was occupied twice around the years 1978 and 1995 (dated by indeterminate tins). Because the site was deserted for a long time, the domestic area was no longer observable. Nevertheless, we recorded a rich activity zone with an accumulation of 15 reindeer antlers (some with skulls) and their tines belonging to nine individuals. Additionally, bones of a sub-adult and adult reindeer were recorded. No traces of human or dog activities were observed. According to the artifacts found we infer occupation by non-smokers with moderate alcohol consumption and probably children.

PC (Plateau) campsite: the remains of this campsite were hardly visible within the landscape, although it was repeatedly occupied in 1985–1986, 1989, 1991, 1993–1996 (dated by condensed milk tins and indeterminate jars), so we infer at least 3–4 occupation seasons. There was an accumulation of toss with the remains of an adult reindeer (NISP=34) dispersed around it, represented by parts of an axial skeleton and hind limbs and residues after fur processing and one mandibular fragment of a subadult individual. The majority of the bones bore traces of human breaking, cutting and chopping; and only a few had traces of being gnawed by dogs. Moreover, an accumulation of reindeer skulls and antlers were found within the periphery of the campsite, belonging to a minimum of at least six adult and one subadult reindeer. Accumulations of reindeer feces were observed within the outer periphery; thus we can assume that this area was recently used extensively for pasture. We infer occupation by non-smokers with high alcohol consumption and most probably without small children.

SC (Slope) campsites 1–3: the inner structure of the lower and upper part of this campsite was described in Svoboda *et al.* (2011). Here we concentrate on the changes in the last 3 years. The main variation was recorded at SC2, where increasing surface water most probably caused a shift of living space and domestic area solely to SC1. As several concentrations of reindeer feces were observed between these two places, we assume that the herd was driven to the immediate vicinity of SC2. Under the slope of SC1 two new accumulations of toss were established and there are indications of several attempts burn them. According to our expiration date chronology the highest density of occupations at SC1 was in 2002–2003, 2007–2008, and 2010–2011 (dated by jar caps of sweet preserves, condensed milk tins, a liver pâté jar, a plastic instant soup bowl, a toothpaste tube and a vodka bottle). Therefore we infer a minimum of three occupation seasons with at least two winter/early spring seasons according to newborn reindeer bones recorded in 2009 and in 2012 (when a mandible was documented). There were also several leg bones of a subadult reindeer and 26 bones of at least three adult individuals - cranium and mandible (with pathological traces of periodontitis), and vertebrae, ribs and bones of proximal parts of fore and hind limbs, several residues after fur processing and six hooves. The majority of the bones showed traces of gnawing by dogs but only a few fragments bore traces of human activities such as chopping or breaking. Additionally, a front paw of a polar hare was recorded. We infer occupation by a family of smokers with low alcohol consumption and with several children. Evidence of activities connected to sledge repair are a typical feature of this site.

VC (Valley) campsites 1–3: the main differences observed at VC1 since 2009 were the absence of all usable objects left at the toss zone, such as floor desks (*lata*), burning of the waste, and relocation and intensification of woodcutting. By contrast, VC2 was also almost unchanged, except for the presence of several new reindeer bones. The structure of the newly established VC3 campsite was a domestic zone surrounded with activity zones and two accumulations of toss. Reindeer feces were dispersed in the immediate vicinity of this site. All three campsites were repeatedly occupied in 1994, 2002–2003 and 2007–2011 (dated by a marine seaweed tin, a paper ‘Brookbond’ tea box, a ‘Baltika’ beer can, a sunflower oil bottle, part of a TetraPack juice cover and a newspaper fragment). The first two occupation seasons were at VC2, then VC1 was occupied for at least three seasons (with a minimum of two winter periods, according to newborn reindeer bones), and in the last season at a new settlement VC3. Animal remains at VC1 consist of bone fragments of newborn reindeer and remains of at least one adult reindeer (NISP=19), represented by fragments of axial skeleton and remains after fur processing. In addition, two fragments of elk (*Alces alces*) metatarsus and one long bone fragment of a middle-sized bird (*Aves* indet.) were recorded. At VC2 remains of at least one subadult (NISP=3) and two adult reindeer (NISP=13) were collected. At VC3 the reindeer remains consisted of two mandibular fragments of a juvenile reindeer, 23 bone fragments of at least two adult individuals, and also a proximal metatarsal part of an elk. Most of the bones bore traces of human activities, such as breaking, chopping and cutting, and, exceptionally, also burning; only three bones were gnawed by dogs. We infer occupation by non-smokers and non-drinkers, at least one adult able to repair sledges, and a minimum of two children.

st (Standing) post 1: based on the available evidence of human activities, this site cannot be classified as a typical campsite, although hearths are present. It is within the natural corridor of Yangana Pe where the Nenets annually migrate with their reindeer herds to summer pastures and back. We infer that this site was used by Nenets to consolidate the small herds of individual families for whom it is uneconomic to migrate northwards in the spring, and to redistribute them when they return in the autumn (Svoboda *et al.* 2011). The importance of this strategic position is also supported continuity of use: 1972, 1976, 1980–1982, 1995, 2001, and 2007 to 2009–2010 (dated by condensed milk tins, vodka bottles and a mayonnaise jar).

Lake Campsites

FC (“Fur”) campsite: dated objects (condensed milk tins, a preserved mushroom jar) place the settlement within the period 2006–2009. The presence of two hearths with different stages of vegetation coverage, with a distance of 10 m between each lead us to infer at least two occupation seasons. The presence of dispersed objects at site indicates an overlap of domestic and activity zones during both occupations. Antler and eight bones of one adult reindeer were collected here, in addition to 10 indeterminate bone fragments (sized 2–5 cm), which had been trampled into the upper ground layers. Several bones were broken for marrow extraction by humans and several showed traces of dog gnawing. At the periphery approximately 25 m from both hearths were two accumulations of toss material. We infer that occupation was by non-smokers and non-drinkers with no children younger than 12 years.

SEC (Southeastern) campsite: the campsite comprises three natural promontories between two small lakes. However, only the eastern one was occupied; a loaded sledge with winter equipment was left on the middle promontory. According to our expiration date chronology this site was occupied in 1999, 2002–2003, 2008–2009 and 2011 (dated by a ‘Bol′shaia kruzhka’ beer bottle and several indeterminate tins), so we infer at least 3–4 occupation seasons. The domestic zone was hardly visible and there was no evidence of a hearth, so we were able to identify only the activity zone and two accumulations of toss, one of which also included an ash pile with several reindeer bones at various stages of burning. The unburned reindeer remains included a scapular fragment of a juvenile reindeer and 28 bones of at least two adult reindeer. Several bones, especially metapodials, bore traces of human activities, such as breaking, cutting or chopping; only one pelvic fragment showed evidence of gnawing by dogs. Additionally, a tibia of a polar hare (*Lepus timidus*) was recorded. We infer occupation by a non-drinking and non-smoking family probably without children younger than 12 years.

TC (Taunto) campsite 1: this campsite was visited in summer 2009, when a family of two adults (non-smoking and non-drinking) and three children in residence. The second occupation season inferred to have been between years 2010 and 2011, based on our expiration date chronology (a ‘Baltika’ beer can and an ‘Aquafrut’ liquid soap bottle). In the following summer (2012) the campsite was abandoned, and from information from other Nenets families we learned that this family were with their herd in the northern pastures. When mapping this abandoned campsite we were surprised that after 3 years we were not able to detect the domestic zone (traces of the hearth had completely disappeared under the vegetation). It was almost as difficult to detect the toss accumulation, because all the “waste” seemed to have future uses and was almost evenly dispersed within the activity zones. In addition, one aluminum boat and three sledges had been left within the campsite area or its close vicinity. Reindeer remains included a fragment of adult metatarsus and a pelvic fragment of a subadult animal. Both bones bore traces of dog gnawing. Activities connected to sledge repair were typical of this site.

TC (Taunto) campsite 2: this campsite was also occupied in 2009, although we did not meet its inhabitants. According to our expiration date chronology, this site was probably occupied twice in the period 2007–2012 (dated by condensed milk tins and 'Baltika' beer cans). The inner structure of the campsite is characterized by its extensive toss zone with four huge waste accumulations, of which several were partly covered by reindeer fur or wooden splinters and shavings left from sledge repairs. The domestic zone was not detected, as in the previous case. Reindeer remains included one juvenile mandible and an antler and several bones belonging to one adult reindeer. No traces of human or dog activities were observed on the bones. According to the artifacts found, we infer occupation by a family with moderate tobacco and alcohol consumption and at least one child.

TC (Taunto) campsite 3: the inner structure of the campsite was composed of two hearths covered by residues from activity zones, and one toss accumulation. Another toss accumulation was unusual in that it covered a concentration of six reindeer heads and remains. Another unusual object was an iron sledge, not traditionally used by Nenets, at the campsite periphery. This might be explained by significant contact between Nenets and Russians during overlapping occupation. Additionally, remains of at least six adult reindeer (NISP= 16) were recorded. According to our expiration date chronology this campsite was occupied in 1998, and in 2007–2008 (dated by condensed milk tins and a baby food container cover); thus we infer at least two occupation seasons. We also infer occupation by a non-drinking and non-smoking family probably with at least one child. One of the adults is able to repair sledges.

TC (Taunto) campsite 4: the inner structure of this campsite consists of three units with their own hearths and domestic zones surrounded by their own activity and toss zones. However, from the distribution of datable artifacts, it is obvious that at least two of these units were occupied simultaneously. The occupations were documented for 1972, 1998–1999, 2007, and 2010–2012 (dated by stewed beef meat tins, a 'Tatarskiy ostriy' ketchup bottle, a hydrogen peroxide bottle and condensed milk tins); thus we infer at least four occupation seasons with one winter/early spring stay, evidenced by a newborn reindeer bone fragment. In addition, remains of one very young reindeer (NISP=6), a metacarpal of a subadult individual and remains of an adult reindeer (NISP=11) were recorded. The majority of the bones showed traces of gnawing by dogs, but only a few fragments bore traces of human activities such as chopping and cutting. We infer occupation by a family of moderate smokers and drinkers with at least one child.

TC (Taunto) campsite 5: according to our expiration date chronology this campsite was occupied in 2006 and 2009–2012 (dated by a roasted whitefish in oil tin, and condensed milk, beef, and chicken pâté tins), so we infer at least three occupation seasons. The inner structure of the campsite consisted of three domestic zones surrounded by one common activity zone, and waste was almost evenly dispersed in the surroundings. One gnawed antler of an adult reindeer and one femoral fragment of a bird the size of a ptarmigan (*Lagopus*, sp.) were documented. According to the artifacts at both campsites, we infer occupation by a family of non-smokers and light drinkers with at least one child.

st (Standing) post 2: we recorded 12 sledges loaded with winter equipment in 2009, and according to our expiration date chronology, this site was previously used in 2002 (dated by condensed sweet milk tins), probably for the same purpose.

Discussion

Our study primarily addressed the seasonality, chronology and function of a network of abandoned Nenets campsites covering Yangana Pe. We encountered a problem in differentiating between winter and summer occupation. According to Binford (1991), the anticipated length of Nunamiut campsite use and its seasonality affect the social organization of space. Since the Nenets do not change their technique of dwelling construction but only the cover (rough canvas in summer and a double layer of reindeer fur in winter) their campsites are always structured in the same manner regardless of season. Naturally, there are differences in campsite activities during the winter and summer; however, these are not necessarily reflected in the composition of objects at a site. In contrast to Haakason (2000), in our region even Nenets' winter sites are highly visible. We use the presence of newborn reindeer bones as a strong indicator of the winter/early spring period, namely at AC 1–2, SC1-3, TC4 and VC1 campsites. Most of these sites are located on the slopes of Yangana Pe, with the exception of TC4, which lies near the lake in a position suitable for fishing. The amount of reindeer bones found is obviously higher at winter campsites than at summer sites (see KC and SEC), and consequently the position of winter campsites might be predicted with a fair degree of accuracy. Finally, interpretations of symbolic accumulations of reindeer skulls and antlers at natural distinctive points are less clear if such accumulations occur inside or near the abandoned campsites.

Another question is the bias created by the lack of datable artifacts in old campsites around Taunto Lake, although we know that in the 1970s and 1980s at least one family stayed here. This might be explained by repeated cleaning of the sites by the Nenets families' during the resettling processes. In addition, the cleanliness of individual families impacts the availability of useful ethnoarcheological evidence. Tidiness was observed, for example, at TC1, where we were able to detect neither the domestic zone nor toss accumulation.

The main differences observed between 2009 and 2012 at SC and VC campsites were the Nenets' attempts to burn or to cover better the waste in their toss zones. In this case, it is possible that their efforts might have been a direct response to our research activity at the sites. Generally, we did not confirm our assumption that the length and the number of occupation seasons might proportionally increase the presence of objects left in the campsite.

In some cases, the stable demographic structure at one campsite (with 6–18 people) and specific habits of the inhabitants (such as smoking or drinking alcohol) suggest that we are dealing with the same or a closely related family.

Conclusion

During our two research seasons at Yangana Pe, an area of 100 km^2 was mapped and a complex system of more than 20 abandoned campsites, standing posts and other residues of Nenets activities were documented. Nenets settlement strategy is seasonal. In winter, they prefer sites on the slopes of Yangana Pe, whereas in summer sites near lakes suitable for fishing and hunting waterfowl are selected. We argue that this system of sites of different complexity, season and function, is flexible and subject to external influences, such as road and railway construction.

We separated the sites into five stages and compared the patterns of change, especially as the road and railroad connecting the Yamal gas mining fields further north were built nearby. This construction affected the frequency of Russian-Nenets contact, increased the presence of imported goods at our study sites, and impacted the Nenets' seasonal movements and settlement site selections as a reaction to a decrease of available pastures. However, despite the impacts of construction, we conclude that length and number of occupations are not proportionally reflected in an increase of artifacts left in campsites.

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2.4.2 Detecting the children zone at the abandoned Nenets campsites: An ethnoarchaeological example from the Polar Ural Mts., Russia

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DETECTING THE CHILDREN ZONE AT THE ABANDONED NENETS CAMPSITES: AN ETHNOARCHAEOLOGICAL EXAMPLE FROM THE POLAR URAL MTS., RUSSIA

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INTRODUCTION

In this paper we apply an ethnoarcheological approach to questions arising from archaeological studies of Upper Paleolithic settlements in Europe concerning the role of children and their activities in site formation processes (Hammond and Hammond 1981; Binford 1991; Crawford 2009; Lillehammer 2010). Our two micro-region field studies, of Yangana Pe (Polar Ural Mts., Russia) in 2009 and 2012 (Svoboda et al. 2011; Sázelová et al. n.d.), were primarily based on mapping a complex system of more than 20 abandoned campsites and other human activity areas within an area of 100 km^2 (Fig. 1). We established an expired date chronology based on more than 150 dates from imported objects and supported by additional seasonal evidence. The majority of the summer Nenets campsites are concentrated around lakes, in areas suitable for fishing or the hunting of waterfowl, while the winter and early spring campsites are situated higher on the slopes. Furthermore, we separated the sites and compared the patterns of change, especially as the road and railroad connecting the Yamal gas mining fields were built nearby in 1986-2003. In our record, the termination of these constructions is reflected by an increase of imported goods at the sites. In some cases, the stable demographic structure at one abandoned campsite (with presence/absence of children) and the specific habits of the adults (such as smoking or drinking alcohol) suggest that we are dealing with the same or a closely related family.

STRUCTURE OF NENET CAMPSITES

Nenets camps are usually composed of 1-3 tents (*choom*) with 5-6 inhabitants in each, so that 6-18 people may concentrate at a site during movement of the reindeer herd. The *choom* is usually set up on a north-south axis with its entrance facing east to southeast. A symbolic inner axis separates space within the *choom,* and the immediate space around it, into two worlds, of men and women. The symbolic *siyangi* line running from the hearth backwards through the *choom* restricts adult men and women in their movement until the top of the *choom* is visible (children and dogs are excepted from this rule) (cf. Chomich 1995; Golovnev 2004; Gemuev et al. 2005).

Campsites are usually moved every 2-3 days whilst herding in summer and after two or three weeks in winter, while searching for new pasture or reoccupying a place that has not been visited for some time. The hunting and fishing families camping around the lakes at Yangana Pe in summer usually occupy these sites for several months and move only when the resources are depleted. For each abandoned Nenets campsite we documented a fixed inner site structure pattern composed of a domestic zone for the *choom*; an activity zone for woodworking, sledge-repairing and other activities; and a surrounding toss zone with several accumulations of toss. Several cycles of occupation were recorded at each campsite and it is clear that the selected areas were usually re-occupied systematically, although certain spatial modifications may have been made (for example due to higher moisture content of the ground). The model of a campsite´s inner structure might therefore be easily disturbed with new resettlement activities.

THE ROLE OF NENETS TOYS

Nenets children are usually expected to produce toys by themselves, and it is through games that they improve in activities necessary for their future life (see Ivanov 1970; Chomich 1995; Golovnev 2004; Arefieva 2008). Boy´s toys are miniatures of items used in the world of adult males, and include weapons such as bows and arrows, guns, slingshots and lassos, but also snowshoes, sledges and all necessary equipment for reindeer yokes. Boys also play with a variety of human and animal figures such as reindeers, dogs, foxes, fishes, etc. Such boy´s toys are usually carved of wood and bark, or cut out as silhouettes from paper, but in a game an individual human/animal character might be represented by piece of bone, a hoof, a feather,

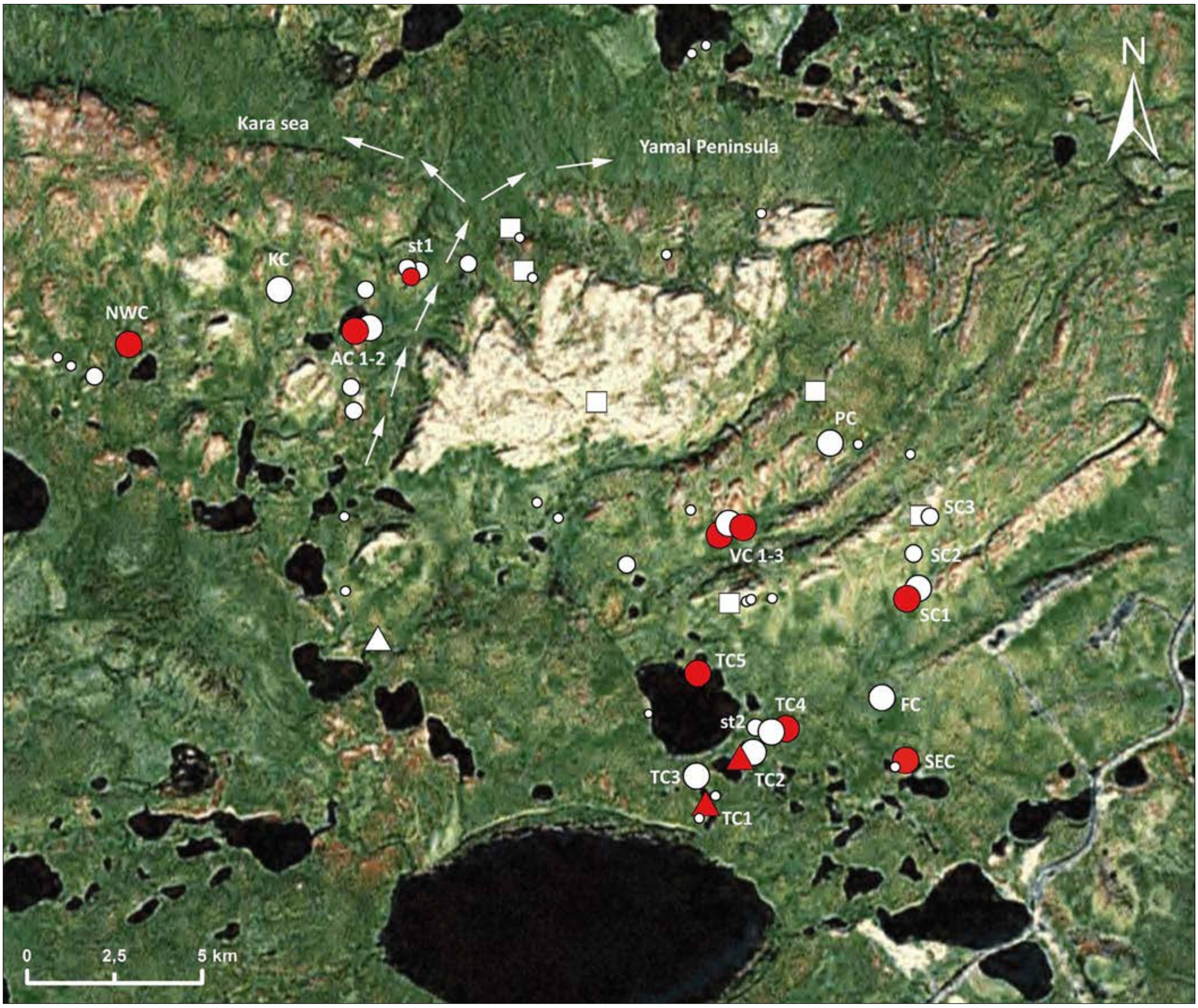

Figure 1. Distribution of human activities in the Yangana Pe micro-region; the location of children´s objects and activities are marked with red. Legend: triangle = active summer campsite; large circle = abandoned summer or winter campsites; medium circle = accumulation of human activities, such as woodcutting; small circle = individual objects, such as fishnets or loaded sledges with winter equipment; square = natural distinctive points, which might be connected to sacred places; and two migration routes for reindeer herds which are marked by arrows.

piece of fur or a twig. A *nguchuko*, a hand-made doll with a head made of a water-fowls´ beak is a typical girl´s toy. Dolls displaying male characteristics are usually made of swan or wild goose beaks, as opposed to female dolls which are made of duck beaks. The doll´s body is flat in shape and made of woolen textiles or fur, and always wears removable dress. The front is decorated with colorful textile strips (usually with a pattern of odd numbers, such as 3, 5, 7, 9, etc.), and other decorative motifs shaped from various textiles, beads or fur. The color of the dress also indicates the gender and age of the character represented – young women wear bright, colorful dresses, compared to old women who are represented by muffled colors (all female dolls might be decorated with necklaces or earrings made of beads). The dresses of male dolls are dark in color, usually black, dark blue or green, and most often without additional decorations. In producing their dolls, girls are improving their skills in sewing, embroidery and fur working, which are duties of all adult Nenets females. The care of dolls involves miniatures of dishes, blankets and lamps, which represent the necessary equipment of a future woman´s household.

Each figure, whether of a boy or girl, is a best friend, mentor, helper, and teacher of the child. It is gifted with its own voice, character and behavior, which is further developed in games. All human/animal toys might thus act in various situations of play according to their characters. During play a child and their comrades may agree or disagree with this behavior, so the children may acquire important moral knowledge for use in the future. A toy may also turn into a feared enemy of the child, especially if it is inhabited by a demon which brings illness or death. The "life" of each toy may thus represent the

Campsite name	Abbreviation	Paper cut-outs	Miniatures of utilitarian objects	Imported toys	Traces of play	Total
"Avka" Campsite 1	AC1	2	-	1	1	4
Northwestern Campsite	NWC	-	2	-	1	3
Valley Campsite 1	VC1	2	-	1	-	3
Valley Campsite 3	VC3	2	-	-	-	2
Slope Campsite 1	SC1	10	15	1	-	26
Slope Campsite 2	SC2	-	-	1	-	1
Standing Position 1	st1	-	-	1	-	1
Southeastern Campsite	SEC	-	1	-	-	1
Taunto Campsite 1	TC1	-	3	2	6	11
Taunto Campsite 2	TC2	n	-	2	3	5+n
Taunto Campsite 4	TC4	27	4	11	2+2n	44+2n
Taunto Campsite 5	TC5	-	1	-	-	1
Total		43+n	26	20	13+2n	102+3n

Table 1. Distribution of different children´s objects and activities at abandoned Nenets campsites in the Yangana Pe region. Abbreviations: n = non-numbered accumulations.

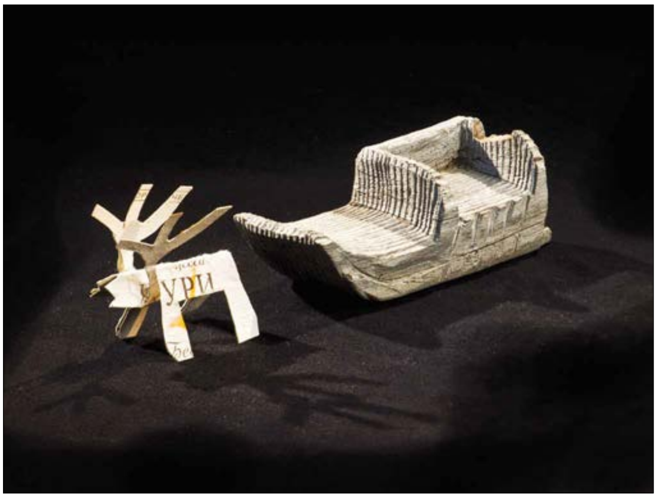

Figure 2a, b. Left: A Nenets doll, *nguchuko*, from the museum in Labytnangi. Photo: Sandra Sázelová. Right: miniature Nenets toy sledge made from larch wood, and a paper cut-out representing a reindeer (both objects from Taunto 4 Campsite). Photo: Martin Frouz.

fate of its owner. As a result, the production of toys follows the same strict rules as charms, especially in their shaping. They are usually stylized with schematic faces and their limbs are often completely or partially suppressed.

CHILDREN'S ACTIVITIES AS SEEN AT ABANDONED CAMPSITES

Within our micro-region at Yangana Pe we recorded several abandoned campsites with traces of childreln´s play concentrated mostly within the domestic and activity zones. The remains of these activities can be separated into several categories (Tab. 1):

a) Self-made toys or the remains of their production include paper cut-outs mainly of reindeer silhouettes (found at AC1, TC4, SC2 and VC1), lines of triangles or indeterminate shapes and the remains of paper/or TetraPack cutting. Representative toys include miniatures of men´s utility objects, specifically three sledges (from TC1 and TC4; Fig. 2b); two paddles (from NWC); a *ngali*, used in taming stubborn reindeer (during play this might be attached to a dog) (from SEC); a toy winter-scooter (from TC1), and two wooden slingshots (found at TC4 and TC5). At SC1 a bag was found, handmade from the plastic cover from toilet paper with a felt handle, which held a "Baltika" matchbox with broken branches imitating matches, five plastic forks, three covers from sweet preserves, four stones and several paper cut-outs.

These objects were most probably in imitation of woman´s household equipment.
b) Imported toys include several pieces of dolls (found at AC1, VC1, TC2 and TC4), an eye from a stuffed animal (from TC4), several pieces of Lego or other toy building sets (found at SC1, TC1 and TC4), a string of beads (from SC2), a glassy marble (from st1), paper stickers (with African animal motifs) and a page with a nursery rhyme (from TC4).
c) Traces of play are represented by holes (found at TC1, TC2 and TC4), wood hammered into the ground (from AC1 and NWC), collections, piles and different patterns of pebbles (from TC2 and TC4), and drawings of water-fowl motifs on plastic insulation boards (from TC1). Another aspect of play might be connected to the loss of toys (a stuffed animal was found several hundred meters from the higher Slope campsite). Haakason (2000) described children from the Yuribei River on the Yamal Peninsula, making piles of reindeer skulls during play. We observed piled reindeer skulls and antlers near the campsites NWC, PC and TC3, but in this case, we could not exclude other explanations such as their being a personal symbolic area maintained by a specific family, or after the remains of other activities resulting from overlapping periods of occupations.
Finally, the presence of children at a campsite might be reflected in objects connected with child care, such as: a) baby-food (found at VC1 and TC3); b) pieces of clothing and boots (documented at SC1, st1, TC4 and TC5); or c) objects connected with child hygiene or medicine, such as napkins (found at VC1, SC3, st1, TC4 and TC5), a tube of polish (from TC3), a box from washing powder (from TC5) and Panadol Baby suppositories (from TC3). In two instances such objects were recorded at campsites (SC3 and TC3) with no other traces of children´s activities. We tested a hypothesis that the presence of children at a campsite could be seen in differences in foodstuffs, for example in the higher consumption of candies, sweet condensed milk, sweet preserves (honey and jams) or sweet non-alcoholic beverages. The season and number of occupational cycles proved to be more important factors in the accumulation of sweets, however, than the simple presence/absence of children at site.

CONCLUSION

Traditionally, Nenets children produce their own toys from unstable materials; they are strictly bound to gender and usually reflect the every-day activities of adult life. More recently imported plastic and stuffed toys have been added to this traditional assemblage. During their play, Nenets children create specific patterns, usually detectable within the domestic and activity zones of abandoned campsites. In order to interpret them in context, supplementary ethnoarcheological evidence should be incorporated and evaluated.

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2.4.3 Resources and spatial analysis at actual Nenets campsites: Ethnoarchaeological implications

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Resources and spatial analysis at actual Nenets campsites: Ethnoarchaeological implications

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ABSTRACT

The aim of this paper is to present and discuss empirical evidence on the dynamics of occupation and site formation processes from contemporary mobile campsites in Northwest Siberia. The questions posed are derived generally from archaeological studies of Upper Paleolithic record in Europe. We document the active Nenets summer camps at lakes and the abandoned winter and spring camps in the open tundra and the forest tundra. Analysis of the floral and zoological resources shows that plant resources and fish are available predominantly in the summer while reindeer are abundant in these regions in fall and winter when they return from summer pastures further north. When natural resources are not available, groups supplement with food purchased at shops. Within these living camps, ''structures évidentes'' and ''structures latentes'' of classical French paleoethnology cannot be distinguished as clearly as at Upper Paleolithic sites: and architectural remains, ash from hearths, and other objects may be removed from the central areas towards the site peripheries. However the investigated camps preserve a discrete structure with interior living areas (including children's playgrounds), exterior areas with evidence of reindeer carcass processing, woodworking, and other activities, peripheral toss zones, and dispersed activity remains in the surrounding landscape.

The ethnoarchaeological questions

A methodology based on planigraphy of contemporary nomadic campsites was introduced with the development of more scientific approaches in archaeology during 1960s and 1970s. Numerous documents and publications concerning the spatial distribution of objects and features at nomadic campsites within a variety of contemporary environments inform our research (Yellen, 1977; Binford, 1978, 1987; Cribb, 1991; Gamble and Boismier, 1991; Phillips, 2001), but inadequacies remain in the interpretation of nomadic behaviors, resource exploitation, site formation processes, and their visibility in the landscape (Gamble, 1991; Rossignol and Wandsmider, 1992; Khasanov, 1994).

Upper Paleolithic settlement archaeology provides a rich record of hunterś settlement strategies and resource exploitation in the Last Glacial landscape (Kroll and Price, 1991; Peterkin and Price, 2000; Vasiĺev et al., 2003) and the reindeer-and-horse-based Magdalenian sites of the Paris Basin serve as the classic case study (Leroi-Gourhan and Brézillon, 1972; Stapert, 1989; Cziesla, 1990). Our approach was inspired by current fieldwork at Upper Paleolithic archaelogical sites in the Moravian corridor as one of the most important European passages for animals and their prehistoric hunters. One of the aims of Moravian archaeology (or, paleoethnology) is to explain how this landscape was used and exploited by a variety of cultural entities. In terms of resources, the Gravettian hunters adapted their site-location strategies to maximize mammoth exploitation along the river valleys. Mammoths markedly predominate over reindeer in the faunal remains from most of these sites, and are supplemented by a variety of small animals. In contrast, the Magdalenian economy in the same area is predominantly reindeer-oriented and partly horse-oriented, again supplemented by small animals. However, the Magdalenian settlement strategy does not echo the geomorphology of the Moravian corridor and its riverine network as closely as the Gravettian one, and the majority of sites are limited to distinct cave clusters in the Moravian Karst.

In terms of spatial analysis of the Upper Paleolithic landscape, human occupation reflects the seasonally predetermined changes of vegetation cover and the regular migrations of animal herds. Seasonal observations inferred from archaeological and environmental data suggest that the large settlements might have had

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year-round or long-term winter occupations, while some of the smaller sites were more temporary spring and summer campsites. Theoretically, there are several levels of spatial analysis: In the Moravian corridor, the complex landscape contains individual sites and site-clusters localized on the valley slopes and elevations, in relatively lower altitudes, and with almost regular distances between one another. On a smaller scale, the individual sites demonstrate a distinguished hierarchy with regards to their size and complexity. Another factor is the seasonality and function of sites, and the extent to which they were specialized hunting or tool production sites or more general occupation sites. Therefore, these Upper Paleolithic sites are composed by elements and factors which may not be directly comparable. A variety of analytical approaches are necessary.

Contrary to recent nomads who rely on food security and keep reindeer herds as constant source of meat, wild reindeer might be perceived as an unstable subsistence resource during the Upper Paleolithic. In the archaeological record, it is not even clear how to distinguish the effect of hunting from herding (Ingold, 1980; Krupnik, 1993). Recent nomads are accompaniers of reindeer rather than their active leaders, thus reindeer herding appears as an intermediate adaptation between hunting and domestication (Bogoras, 1901; Ingold, 1980; Krupnik, 2000; Stammler, 2007).

Given the variability observed in the Upper Paleolithic record, the aim of this paper is to present and discuss empirical evidence on dynamics of occupation and site formation processes from contemporary mobile campsites. To a large extent, our approach was *a priori* oriented by the aforementioned questions, derived from an archaeological context with a different environment and social structure. During our summer stay in the Polar Ural Mts. in 2009, we documented active Nenets summer camps on the Lake Taunto, as well as remains of temporarily abandoned winter and spring camps in the open tundra at Yangana Pe mountain ridge (the Valley camps and the Slope camps), and in the forest tundra west of the Ob River near Labytnangi (Oktyaberskaya campsite). Using a methodology basically similar to the one developed at Upper Paleolithic sites, we recorded the spatial distribution of objects, listed their inventories according to zones, and created photographic documentation. Dating of the abandoned sites (Table 1) was based on bone preservation (presence of muscles, fat, and ligaments) and on the expiry dates marked on industrial subsistence products.

Polar Ural and southern Yamal: ecological frameworks

In the Yamal–Nenets Autonomous Region, the north–south oriented principal mountain chain of the Polar Ural Mts. is paralleled in the east by one of the traditional migration corridors. This corridor is periodically frequented by reindeer herds moving along the mountains from the plains around the Kara Sea, where they spend the summer, towards their winter locations around the Labytnangi–Kharp railway. Along this roughly 250–300 km long corridor, the landscape grades from the open tundra through the dwarf shrub tundra to the forest tundra.

At the northern latitude of 67°, Polar Ural Mts. are joined by an east–west oriented limestone ridge named Yangana Pe (289 m a.s.l.) and the adjacent metamorphic ridge of Nyava Pe (236 m a.s.l.). Yangana Pe represents a unique phenomenon of the southern Yamal Peninsula because of its rich vegetation cover, influenced by the calcaneus subsoil, which makes it an attractive environment for aboriginal hunting, fishing and pastoralism (Figs. 1 and 2). The landscape exhibits a structured geomorphology featuring mountain chains, isolated hillrock, broad valleys and gorges. Willow bushes are prevalent, with dominant species of willows, *Salix lanata*, *Salix glauca*, *Salix lapponum* and *Salix phylicifolia*, accompanied by alder, *Alnus fruticosa*. Towards the higher elevations of western Yangana Pe, the subzone of open southern tundra grades into mountain tundra, comparable to the vegetation of the Polar Ural Mts. The hilltops allow a good overview to the surrounding flat tundra of southern Yamal Peninsula while sheltering the basins and lakes along the southern foothills from winds from the sea. A more favorable climatic at the southern foothills is supported by solar reflection of the whitish limestone cliffs, creating here the northernmost sheltered area where some dwarf trees and shrubs grow.

Yangana Pe intersects with the traditional reindeer migration route approximately in the middle of the pathway. In the past, strategic passes crossing the rocky ridge would have been good places for reindeer catches and kills. Although reindeer bones, skulls, and antler are widely dispersed over the landscape, they markedly concentrate in such passes.

The Oktyaberskaya camp lies 150 km south of Yangana Pe, where the forest-tundra vegetation zone expands from the eastern slopes of Polar Ural Mts. to the left banks of Ob River mouth. *Larix sibirica* is the dominant tree and *Betula nana* is the most frequent bush in this area. Geological subsoil is formed by fluvial gravel-and-sand cover of the Ob River in the east, whereas the western part is predominantly formed by fluvioglacial sediments with a higher representation of larger-sized gravel. Depending on geomorphology, hydrology, exposition and other abiotic factors, the vegetation composition varies both on micro- and mesoscales. Such versatile mosaic patterns are typical for a natural landscape not yet influenced by significant anthropogenic impacts (Knyazev et al., 2006; Rebristaya, 2006).

The aboriginal human impact on this vegetation is small, based on the data we collected. This small human impact contrasts with the radical vegetation changes that occur around the camps of Russian geological, mining, and biological expeditions (Forbes et al., 1999; Haller et al., 2007).

Northern aboriginal populations collect and use a variety of plant resources (Sinclair, 1953; Owen, 2005). The highly valued quality of any plant available in the tundra and forest tundra is its sugar content. Sugar also acts as an important means of food conservation. Along the Polar Ural Mts., the plants most frequently collected for subsistence are *Vaccinium uliginosum* (bog billberry) and *Vaccinium vitis-idaea* (cranberry). Both are used to produce very sweet "vareniye" jam, which is used as a substitute for sugar in tea, as an addition to vodka and other alcohols, or produce a drink called "napitok". *Vaccinium myrtillus* (blueberry) is scarcer, and is used for jam in cakes and, again, for a "napitok".

Another plant, *Oxycoccus quadripletalus* (moosberry), is collected from peat bogs. It has larger and tastier fruits, especially when frozen. It is also used to make jam and "napitok". *Rubus chamaemorus* (cloudberry) is a highly valued plant with orange fruit which is used in "vareniye" preserves, compotes and alcoholic drinks. *Lonicera altaica* (Altaic honeysuckle) is a medium-sized bush primarily found alongside streams. The fruits are small and difficult to collect but good for "vareniye" and when used in cakes or to sweeten tea. *Allium schoenoprasum* (chive) is collected and used fresh or conserved (probably in salt). Wherever the sporadic bushes of *Ribes rubrum* (red currant) are found, the fruit is directly consumed.

Mushrooms are usually not consumed in this region, but *Amanita muscaria* may have been used for ritual (shamanist) purposes and "chaga" (*Innonotus obliquus*, a mushroom that acts as a parasite on birches) is used to produce a heavy, dark liquid to drink.

Animal composition in this region changes radically throughout the year (Dobrinskiy, 1995; Kosintsev, 2005). Dominant animals present throughout the year are reindeer (*Rangifer tarandus*), wolf (*Canis lupus*), glutton (*Gulo gulo*), ermine (*Mustela erminea*), mountain hare (*Lepus timidus*), lemmings (*Dicrostonyx torquatus*, *Lemmus*

Table 1
Review of dating, based on production and expiry dates on industrial products and state of bone preservation. VC – Valley camp, SC – Slope camp, OC – Oktyaberskaya camp; two other letters refer to specific site zone: Do – domestic zone, Ac – activity zone, To – toss zone, Uc – upper camp.

Location	Object	Dating
VC01_Do	Paper covers from tetracycline liniment	2001–2004
VC02_Ac	Unspecific tin	Consumption up to March 2009
VC03_Ac	Tin from beer	Consumption between April and October 2009
VC04_Ac	Piece of newspapers from the Saturday	16th February (it could be 2002 or 2008)
VC05_To	Reindeer bones	Spring 2009; some older than 1 year
SC01_Uc	Tin from milk	2002
SC02_Ac	Tin from milk	2003
SC03_Ac	Tin from milk	Consumption up to 15th July 2003
SC04_Do	Tin from milk	Consumption up to October 2007
SC05_Do	Tin from milk	Consumption up to 7th May 2008
SC06_Do	Reindeer bones	Spring 2009
SC07_Ac	Reindeer bones	1–2 years; more than 3 years
SC08_Uc	Reindeer bones	More than 5 years
OC01_Do	Piece of newspapers (sever OK)	7th September 2006
OC02_Do	Piece of newspapers (sever OK)	28th March 2007
OC03_Ac	Cover from Czech chocolate stick	13th November 2007–12th November 2008
OC04_Ac	Paper cover from flour	16th March 2008
OC05_Do	Cover from biscuits	July 2008–July 2009
OC06_Do	Jar of caviar	11th November 2008–11th May 2009
OC07_Do	Jar from pickles	6th September 2008–6th September 2011

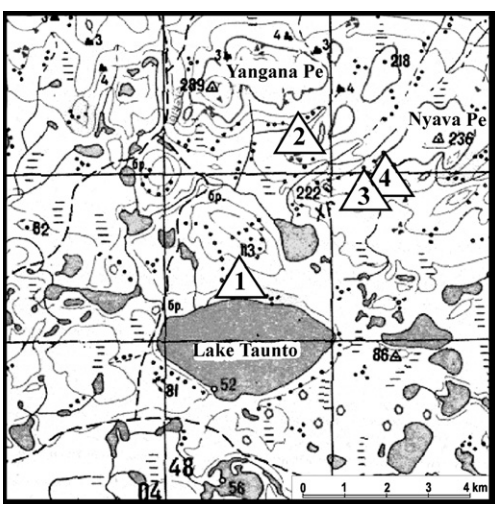

Fig. 1. Map of Yangana Pe and Nyava Pe showing location of the recorded campsites, facing north: (1) the active summer camp; (2) the abandoned Valley camp, (3) the abandoned Slope camp (lower); (4) the abandoned Slope camp (upper).

sibiricus), voles (*Microtus gregalis*, *Microtus middendorfii*, *Moeconomus oeconomus*, *Arvicola terrestris*), willow ptamirgan (*Lagopus lagopus*), and raven (*Corvus corax*). Twenty species of lake and river fish are present in the region, but the most important for human subsistence are whitefish (*Coregonus nasus*, *Coregonus lavaretus*, *Csardinella sardinella*, *Coregonus peled*), pike (*Esox lucius*), and burbot (*Lota lota*). In the winter, Arctic fox (*Alopex lagopus*) are found in the area, and in the summer, elk (*Alces alces*) appear. In the spring, more than 80 bird species arrive, and many of them stay until fall. For humans, the most important birds are Arctic loon (*Gavia arctica*), whooper swan (*Cygnus cygnus*), two species of goose (*Anser albifrons*, *Anser fabalis*) and six species of duck (*Anas penelope*, *Anas clypeata*, *Anas crecca*, *Anas acuta*,

Fig. 2. The open toundra landscape. View from Yangana Pe mountain ridge over the lakes towards the mountain ridge of Polar Ural.

Authya fuligula, *Clangula hyemalis*). Mosquitos, namely northern house mosquito (*Culex pipiens*), black fly, and black gnats, represent the most important insect species, especially between June and September.

Throughout the year, fishing and hunting of reindeer, mountain hare, and willow ptarmigan is possible in the Polar Ural region, whereas water fowl is primarily hunted in the summer. However, the economically important animals become most numerous in spring and fall, when large flocks of water fowl pass the region. In early winter and early spring mountain hare and willow ptarmigan migrate to the region, where they may be hunted by loops. Hunting and fishing alone can sustain humans in this region from spring to fall. However, in the winter, only those owning reindeer can survive in this region.

During the past few winters, reindeer were not pastured at Yangana Pe, and, consequently, wolfs (*C. lupus*) left the area. As a result, bones left in the campsites by humans were not destroyed and the collected bones represent complete assemblages that were only partly gnawn or eaten by dogs.

While analysing the bone assemblages, we investigated the formation time of the complex at each camp (according to organic decomposition of the bone surfaces and remains of muscles, fat, and ligaments); the season (according to the age of each animal); composition of bone types; composition of skeletal elements of each type; individual age structure; patterns of bone fragmentation; and postmortum changes.

Nenets social frameworks

The nomadic Nenets base their traditional economy on reindeer exploitation (Golovnev, 1995; Chomich, 1995). Their predecessors first hunted and harnessed reindeer during immigrations between 500 and 1100 AD, herding more progressively after 1600 AD (Golovnev and Osherenko, 1999). Their actual economic cycle correlates with annual reindeer migrations. During the summer, the open tundra offers more resources and some protection against mosquitos, whereas in the winter, subsistence resources are more accessible in the forest and forest-tundra zones. Therefore, spring reindeer migrations are oriented northwards to the open tundra zone and their fall migrations take them back to the forest zone. A complete Nenets family, or 2–3 related families, migrate repeatedly along the same route, males together with females, children, "chums", and equipment. To practice this lifestyle, a family needs minimally 80–100 reindeer. Most families do not possess enough animals to practice this lifestyle. Instead, they send their reindeer northwards with larger herds while the family stays at rivers and lakes along the border of forest tundra and open tundra. Here, they survive by fishing and occasionally hunting (Kryazhimskii and Danilov, 2000; Johnson, 2002; Stammler, 2007).

While Upper Paleolithic populations in Europe existed independently from modern cultural and economical systems, the subpolar populations of Siberia were subjected to the effects of political and economical centralization. Collectivisation and construction of villages since the 1920s and 1930s introduced intensification, which led to efforts to maximize reindeer herd sizes. Reindeer groups also began to increase in the number of females per group to ensure reproductive success, while retaining males who were needed for transportation. Human movements also became centralized and groups maintained a smaller circumference around villages rather than adapting to take advantage of the natural potentials of each region. The discovery of a Yamal gas field in the 1960s resulted in the destruction of large areas of natural landscape for mining and its infrastructure. This activity pushed increasing numbers of reindeer into smaller areas of pasture. These industrial processes led to overgrazing in certain areas (Potapova and Levina, 1956; Forsyth, 1992; Pika and Bogoyavlensky, 1995; Forbes, 1999; Rees et al., 2003; Krasovskaya and Tikunov, 2008), although we did not observe this overgrazing in our region of study. At Yangana Pe, reindeer pastoralism is not the dominant activity throughout the year. In summer, Nenets families who do not own enough reindeer to accompany them to northern pastures, stay at place and send their reindeer together with the larger herds. While Nenet families wait for their reindeer to return from northern pastures, they settle periodically on lake shores south of the Yangana Pe ridge, where they practice systematic fishing and occasional hunting. During the winter, as the lakes freeze and fishing is no longer possible, Nenets families move to higher altitudes, in the protected valleys and slopes of Yangana Pe, while other groups follow reindeer herds further south towards the railway and the forest. In these instances, natural resources are supplemented by goods purchased in nearby shops. An episodically frequented north–south oriented communication axis, consisting of a field road, a parallel railway, and a shop, runs east of the mountain ridge. Laborovaya, the nearest village, serves as another center of shopping, basic medical care, and administration.

During our stay in August 2009, we encountered the Nenets in four family "chums", in groups of two, located along the shores of the lakes south of Yangana Pe (Fig. 3). A typical family unit is composed of parents with 2–3 children. The dwelling and the landscape immediately surrounding it represent the base of spatial thinking of all northern aboriginal populations. A "chum" with a central hearth and an axis determined by the entrance creates an ideal circle, reflecting the structure of the world. The "chum" as a whole is considered a female zone, while the surrounding tundra is male zone. This does not prevent the other family members or guests from entering such zones, but activities in a given spatial context are always the initiative of the responsible sex. In addition, the "chuḿs" interior is also divided into a male and female zone, but the women nevertheless move preferentially around the hearth in center, whereas the most interior zone opposite the entrance is strictly male (Golovnev, 1995, 2004).

The summer "chum" is constructed by women using wooden poles and canvas. The work takes about 0.5–1 h; the winter "chum" is made of reindeer skin and construction takes 1.5–2 h. Around the "chum," sledges are arranged with furs and other materials prepared for the winter "chum" (Fig. 4). The Nenets move freely throughout the landscape, treating it in the same way as we treat our own private apartments and houses. Sledges will be parked wherever it is convenient, given the plans for the next season, the fishing nets will be left at the lake shore for the next use, and vessels or prepared cut wood for the next camp will be left at favorable camping spots in the landscape.

The "Valley camp" (VC)

The Valley camps (latitude 67°41′34.32″N, longitude 67°51′25.53″E, 126 m a.s.l.) are located on two platforms about 80 m from each other, in a hidden valley of Yangana Pe oriented towards the SW, and in a strategic position high above the valley bottom. Vegetation covers about 60% of the occupied surface and it is predominantly composed of low herbs such as *Dryas punctata*, at places accompanied by *V. uliginosum* ssp. *microphyllum*, *Ledum decumbens* and *Empetrum hermafroditum*. *Astragalus subpolaris* (*Astragalus alpinus* ssp. *arcticus)*, *Luzula* sp. div., *Equisetum arvense/boreale*, *Oxytropis sordida*, *Polygonum viviparum*, *Campanula rotundifolia*, *Dianthus repens*, and *Arctous alpina* are also found regularly scattered in the area. Isolated occurrences of *Rosa acicularis* were recorded. Low bushes of *S. lapponum* appear in the vicinity.

The valley bottom on both sides of the brook is covered by dense bush willows (*S. lanata*, *S. glauca*, *S. lapponum*, *S. phylicifolia)* with moist herbal vegetation covering the floor level (*Polygonum bistorta*, *P. viviparum*, *Cirsium heterophyllum*, *Calamagrostis heterophyllum*, *R. chamaemorus*, *R. arcticus*, *Caltha palustris*, *Saxifraga hirculus*, etc.).

Dense formations of *A. fruticosa* grow, predominantly on the SE expose of the slope in the protected biotopes. "Tall herbs" are found in between (*Polemonium acutiflorum*, *Aconitum* cf. *baicalense*, *Trollius* cf. *asiaticus*, *Dianthus superbus*, *Veratrum lobelianum*, *Angelica decurens*, *Lamium album*, *Veronica longifolia*, *Geranium silvaticum* (=*Geranium krylovii*), *Petasites frigidus*, *Parnassia palustris*, *Valeriana capitata*, *R. chamaemorus*, *R. arcticus*, *Viola biflora*, *Pedicularis* cf. *oederii*, etc.).

The lower camp platform, approximately 35 × 25 m in size, may be separated into three domestic areas, possible "chums", four activity areas, and discard or toss zones along the periphery (Fig. 5). On the main platform, there are two *in situ* hearths surrounded by domestic areas, a pile of wood, and two adjacent circular activity areas of 5 m and 3 m in diameter with wood splinters and additional objects. At the southern promotory, there is another domestic area, possibly a "chum", containing a hearth with two flat stones for cooking, with wood splinters and sticks around. An adjacent activity area included a pile of stones and scattered stones around. Below the promotory lies a depository of wooden planks stored here for the next occupation, a toss zone of discarded objects and reindeer bones, and two discrete toss piles. Occupation traces are less clear on the higher platform, which is adjacent to the east, and measures 50 × 25 m. Dates marked on the industrial products go back to 2001, but most relate to the last (2009) occupation.

With the exception of a few hare bones, the majority of the bones is of reindeer (Table 2), and belongs to a minimum of nine adults. A fragment of one *cranium*, one *mandibula*, one *humerus*,

Fig. 3. Actual Nenets summer camp at lake Taunto, showing a chum and sledges.

one *ulna*, one *radius* and two *metatarsus* III belong to new-born animal, and one *humerus* and one *tibia* are from an unborn fetus. Calves are birthed starting during the second half of April in the Yamal region (Podkorytov, 1995), and the presence of fetuses and new-born individuals in this assemblage thus indicates the site was occupied during the spring (later April–early May) of 2009. A special characteristic of this assemblage is the absence of bones from the skull and trunk (no ribs and only two vertebral fragments were found). The majority of the fragments show breakage, and many *vertebrae* are smashed. Epiphyses of all bones (except fetal and new-born individuals) are fused. Another characteristic is that all *metapodia*, *phalanges* and part of the long bones are not split, despite the fact that marrow is highly valued by the Nenets and is treated as a delicacy in their traditional diet (Evladov, 1992). Complete bones (excluding antler and bone of the new-born individuals) comprise only 15% of the overall assemblage. Larger proportions of *metapodia* and *phalanges* (75%) are intact and remain connected by ligaments. The skin, called "kamus," is valued as a material for dressing and was scraped off from these elements. Only four *metapodia* (14%), 22 *phalanges* (27%), and 20 other bones (61%) display gnawing marks from dogs.

The majority of the bones belong to one assemblage, formed in springtime of 2009. All most all bones retain some muscle, fat, and a larger amount of ligaments. Only three fragments of *humerus* (one distal end and two fragments of diaphysis) and one fragment of *femur* (from diaphysis) seem to be older than 1 year.

The structure of this assemblage is specific, always dominated by metapodia and phalanges, whereas skulls and trunks are almost completely missing. The first group of bones includes shoulder-bones, *vertebrae*, ribs, and long bones, as remains of subsistence activities. The second group includes *metapodia* and *phalanges*, which are the remains of working processes. Fragments of antler may be added to this group. The third group is formed by fetal and new-born individuals.

The "Slope camp" (SC)

One of the shallow valleys crossing the southern slopes of Yangana Pe, formed by a brook surrounded by bushes shows intensive and diverse traces of human activities, with two camps. Dwarf shrubs (*L. decumbens*, *D. punctata* and *E. hermafroditum*) and low forms of *B. nana*, *A. fruticosa*, *S. lapponum*, *S. glauca* and *S. phylicifolia* are among the dominating taxons. At some climatically exposed areas we observed the typical frost boil soils, deprived of vascular plants on the surface and thus vulnerable to erosion by water, wind and frost. The initial development of these rough soils, prepared for possible future coverage by vascular plants, is marked by algae (*Chlorophyta*, *Cyanophyceae*) and by sporadic occurrences of young lichens and bryophytes. Compared to the Valley camp, the landscape physiognomy is closer to mountain tundra.

The lower Slope camp (latitude 67°41′14.38″N, longitude 67°54′26.37″E, 154 m a.s.l.) occupies a platform of 100 m × 70 m in size and it may be structured into several zones (Fig. 6). The upper (northern) margin is marked by a limestone rock formation, the southern margin by an oval-shaped elevation dominating above the brook valley. Pentagonal sorted circles are visible along the upper rock and on the slope below the site. On the platform between the rock and the elevation, two circular domestic areas, possibly "chums", were recorded. The first one has no visible hearth,

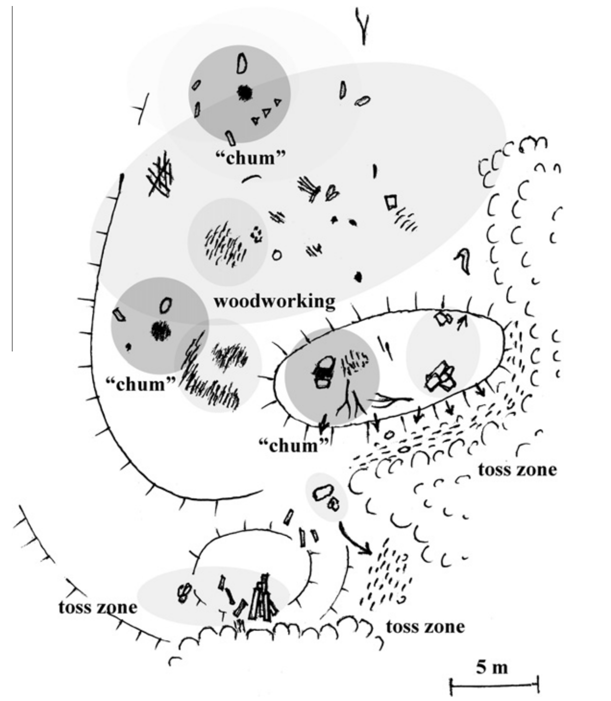

Fig. 5. Yangana Pe, plan of the Valley camp – lower, facing north. Dark circles: interior domestic areas ("chums"), light zones: exterior activity areas, peripheric toss areas.

Table 2
NISP of reindeer bones (*Rangifer tarandus*) based on selected samples from Valley camp. Letters refers to animals age category: E – embryon, N – newborn, A – adult; letters refers to specific damages: G – gnawed, B – broken, Ch – chopped.

Valley camp				
Part of skeleton	E	N	A	Damage
Antler	0	0	0	None
Skull + maxilla	0	1	0	None
Mandibula	0	0	0	None
Vertebra	0	0	2	0/0/2Ch
Rib	0	0	2	0/0/2G
Scapula	0	0	3	0/0/3G
Humerus	1	1	6	1G/0/3G, 5B
Radius	0	1	6	0/1G/4G, 3B
Ulna	0	1	3	0/1G/3G, 1B
Carpals	0	0	0	None
Metacarpals	0	0	12	None
Pelvis	0	0	0	None
Femur	0	0	1	0/0/1B
Tibia	0	1	4	0/1G/3G, 4B
Tarsals	0	0	5	0/0/5G
Metatarsals	1	1	11	1G/1G/0
Phalanges	0	0	86	0/0/17G
Total	2	6	141	2G/4G/40G, 14B, 2Ch

Fig. 4. Sledges loaded with furs for winter and with antler. Yangana Pe in distance.

but a relatively high concentration of objects (wood, bones, cans, textiles, cordage, straw). The second one has traces of an *in situ* hearth in the center, and a children's area inside (paper cutouts of animal images, a childś ring). The plateau between these features yielded individual dispersed objects, but discrete activity areas could not be discerned.

An accumulation of bottles lies on the top of the southern promontory. A complete sledge with a pot on it stands on the plateau below, and animal bones were dispersed all around. Three restricted toss accumulations were deposited along the eastern margin of this elevation.

Isolated objects are located on the peripheries, including part of another sledge, a reindeer skin, and other objects discarded on the slope. The limestone rock above the camp has a fissure within which a large bottle was found. In the low alder bushes surrounding the camp and along the brook between the lower and upper camps, we recorded several small areas that were cleared by woodcutting. Expiry dates on products go back to 2002, but most of them are more recent.

The faunal assemblage belongs to minimum of five adults, one semi-adult, one juvenile, and a *mandibula* belongs to a newborn reindeer (Table 3). The presence of the newborn associates this settlement with a spring occupation (Podkorytov, 1995). Another *maxilla* belongs to an individual of about 2 years old, probably killed here in spring (Klevezaĺ, 2007). Bones from all parts of the skeleton are present. Of importance is the lack of trunk bones (no ribs and only two vertebrae). Almost all bone fragments are due to breakage; only one skull and one rib are cut. The complete bones comprise 62% of the assemblage, with a dominance of metapodia and phalanges. Dog gnawing is visible on almost all bones from the domestic area (90%) and less than a half in the activity area (40%).

Part of the bone assemblage show traces of fat and ligaments, suggesting that they were accumulated during the last spring (2009). Other parts of the assemblage show no traces of fat and muscles, while ligaments, preserved on almost all of the bones, are dry; this suggests that the bones were accumulated 1–2 years ago. The third part includes fragments of one *cornu*, one *coxa* and one *humerus*; of the lack of ligaments on these fragments, along with the converge of their surfaces with moss, suggest that these bones were deposited more that 3 years ago.

In terms of usage, the skull, vertebrae, ribs and long bones are food remains; metapodia, phalanges, and antler fragments are remains of technological process, namely the production of "kamus". The third group includes remains of the newborn individual.

The upper "Slope camp"

In a dominant position higher on the same brook, we recorded a smaller site, only 20 m × 12 m large (Fig. 7). On the highest part of the oval-shaped elevation lies a discrete accumulation of reindeer antler. The lower platform is marshy. Individual objects scattered over the plateau include additional pieces of antler, reindeer skulls, fragments of sledges, pieces of textiles, and bottles. Several accumulations of discarded objects are deposited on the slope along the eastern margin of the elevation.

The bone assemblage scattered within the area includes fragments of two *cornu* and two *crania*, indicating a minimum of two adult individuals. The antler accumulation at the highest position included 11 pieces, seven right a four left, originating from eight adult individuals. There are three pairs from three individuals and additional single pieces from five individuals. Eight pieces are naturally discarded, while five pieces were broken off from skulls of three individuals before the natural discard. All distal parts of the branches shows gnawing by reindeer, one left antler

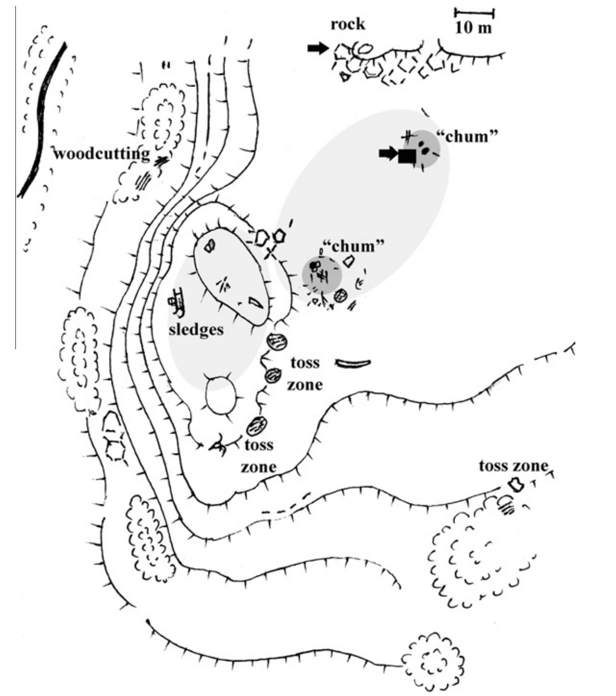

Fig. 6. Yangana Pe, plan of the Slope camp – lower, facing north. Dark circles: interior domestic areas ("chums"), light zones: exterior activity areas, peripheric toss areas. The arrows point to the upper rock (with large bottle inserted in a fissure) and an interior children's playground (black square).

shows breakage of the branch, and some branches are sawn-off by humans. This variability suggests that the antlers were selected and collected, and the presence of some pieces covered by moss and lichen suggest that the accumulation proceeded for more than 5 years. It is possible that one or both antlers of one individual were added into the cache each year. Reindeer males discard antler in winter, females do so 4–7 days after giving birth (Podkorytov, 1995) in the spring, but it is difficult to determine male and female antler in this case. Regardless, given the fact that Nenets families stay in this region in spring, summer, and fall, these pieces were

Table 3
NISP of reindeer bones (*Rangifer tarandus*) based on selected samples from Lower Slope camp. Letters refers to animaĺs age category: N – newborn, J/S – juvenile or semi-adult, A – adult; letters refers to specific damages: G – gnawed, B – broken, Ch – chopped.

Slope camp				
Part of skeleton	N	J/S	A	Damage
Antler	0	0	3	0/0/1G, 1B
Skull + maxilla	0	1	6	0/1B/4Ch, 2B
Mandibula	2	0	0	2G/0/0
Vertebra	0	2	0	0/2G/0
Rib	0	0	3	0/0/3G, 1B
Scapula	0	0	0	None
Humerus	0	0	3	0/0/1G, 3B
Radius	0	0	1	0/0/G + B
Ulna	0	0	2	0/0/2G, 2B
Carpals	0	0	2	None
Metacarpals	0	0	7	0/0/5G, 5B
Pelvis	0	0	3	0/0/2G, 1Ch
Femur	0	0	2	0/0/2G, 2B
Tibia	0	0	3	0/0/1B
Tarsals	0	0	6	0/0/1G
Metatarsals	0	0	12	0/0/8G, 7B
Phalanges	0	0	14	0/0/2G
Long bones	0	0	4	0/0/4G, 4B
Total	2	3	71	2G/2G, 1B/33G, 29B, 5Ch

probably collected and deposited in the cache in spring. Nenets usually deposit antler at holy places (Chomich, 1995), and the Upper SC may represent such a location used by one of the families migrating around.

The Oktyaberskaya camp (OC)

About 150 km further south, near the city of Labytnangi and near the railway, we explored another type of a winter camp closer to the city. The Nenets brought their reindeer almost to the city periphery and sold some of the animals, while others were evidently killed here.The campsite (latitude 66°42′51.71″N, longitude 66°34′27.80″E, 97 m a.s.l.) is located on the margin of a light *L. sibirica* forest tundra in the north and a shallow tundra valley with a brook in the south (Fig. 8). The shrub layer is dominated by *B. nana*, sporadically by *S. phylicifolia*, and very rarely by *Juniperus sibirica*. Among the dwarf shrubs, species of *Ericaceae* and *Vacciniaceae* (*E. hermafroditum*, *Ledum* cf. *palustre*, *V. uliginosum*, *V. vitis-idaea* and *A. alpina*) dominate. *R. chamaemorus* and *Luzula* sp. are rarer in this area.

Among lichens, we regularly recorded *Cladonia* cf. *rangiferina*, *Cladonia* cf. *silvatica*, *Cladonia* cf. *pyxidata*, *Cetraria islandica*, *Cetraria alpestris*, *Peltigera* cf. *aphtosa* and others, among mosses dominate *Hylocomium splendens*, *Dicranum* sp., *Enthodon schreberi*, *Ptilidium ciliare*, *Polytrichum* cf. *strictum*, *Sphagnum* sp. div., *Pogonatum* sp. among many other taxons.

The site is formed by an irregular circle with an overall diameter of 65 m and a core diameter of 35 m. Individual objects are scattered in the tundra behind the site boundaries (Fig. 9). The core area is composed of two domestic areas, possibly ''chums'', with directly adjacent woodcutting areas, conus and a pile of cut wood, and a constrained region of reindeer bones. One of the ''chums'' included an interior children's playground (suggested by a paper cutout, a pencil, and gum).

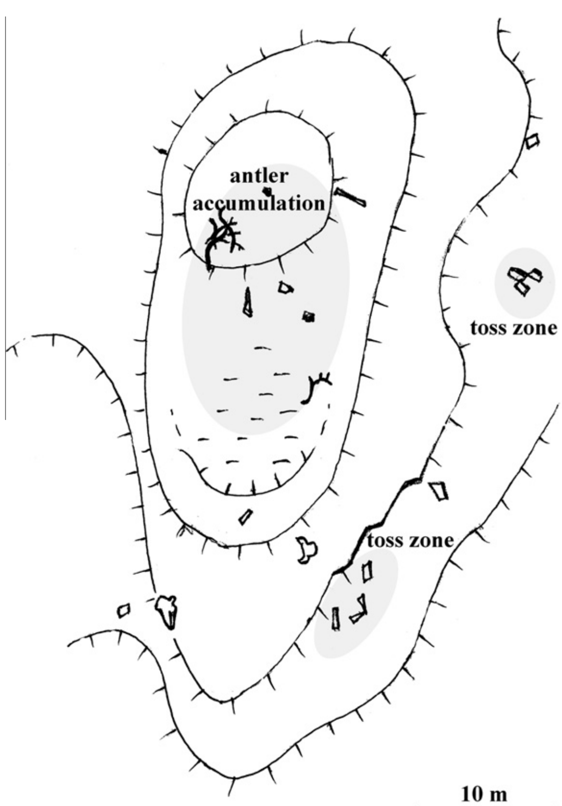

Fig. 7. Yangana Pe, plan of the Slope camp – upper, facing north.

The frontal (southern) periphery, opened towards the tundra, consists of woodcutting activity areas with reserve piles of cut wood, cumulations of various objects and bones, two scatters of reindeer remains (bones and skins). More dispersed areas of reindeer excrement and reindeer hair are located along the SW periphery, where the animals were obviously kept.

The back (northern) periphery along the forest margin consists of about eight toss accumulations with discarded bottles, cans, paper boxes, 2–3 ash accumulations, reindeer skins and a reindeer cadaver.

Compared to the northern sites, the structure of Oktyaberskoye shows standard character, but the prepared wood piles left at this site were larger and cut by a motor saw (and a benzine or kerasine canister was found here as well). Cut tree trunks are visible in the nearby forest. There is an evident change in toss structure: the discarded bottles of honey or preserves, predominating in the north, are replaced here by bottles of vodka and boxes of champagne. The preference for alcohol suggests that the site was dominated by adults, although the identified children's playground demonstrates their presence. Dates marked on the products point to the period from 2006 to the present time.

The peripheral areas of reindeer excrements and hair indicate where the animals where kept, while the reindeer bone accumulations correspond to a killing and processing area, where almost all particles of the skeletons were identified (Table 4). In contrast to the Valley and Slope camps, the bone assemblage from Oktyaberskaya includes a considerably higher percentage of *vertebrae* and ribs, a high number of cut-off or broken-off antler, and lack of *carpals*, *tarsals*, and *phalanges*. The remains belong to several adult and subadult individuals, while newborn reindeer were not recorded. One adult reindeer tibia is pathological (tumor). Gnawing by dogs is evident here, and similar to that observed in the other camps.

In the surrounding forest tundra, we recorded areas of intensive woodcutting by motor saw. Antler, cans, belts, and a variety of other objects were attached to individual trees, possibly suggesting a symbolic practice.

Interpreting the campsites: resources and activities

The objects were catalogued at each camp, and sorted according to their origin as natural products from the surrounding landscape or as imported items. At the Valley camp, 70% were natural, 30% were imported; at the Slope camp, 56% natural, 44% imported; and at Oktyaberskaya camp, 55% natural, 45% imported. Subsequently, the objects were sorted according to their presumed functions, for subsistence, architecture, clothing, a variety of indoor and outdoor activities, symbolic activities, and related them to spatial zonality of the particular camp (Fig. 10; Tables 5–7).

Fig. 8. Forest toundra landscape around Oktyaberskaya. Individual objects are attached to the trees.

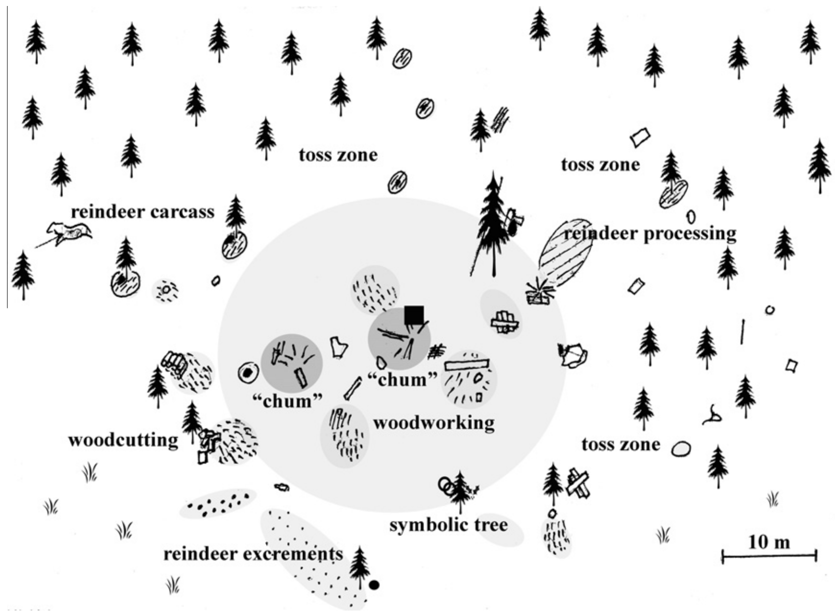

Fig. 9. Plan of the Oktyaberskaya camp, facing north. Dark circles: domestic areas ("chums"), light zones: activity areas, dispersed bones of a reindeer, toss areas. Black dots: dispersal of reindeer excrements, light dots: dispersal of reindeer hair, black square: interior children's playground.

Subsistence

The primary components of animal-based subsistence are the bones of edible animals, namely reindeer (only supplemented in the VC by a few hare bones). Fishing represents an important activity in summer, but since we focused on winter camps located further from the lakes, evidence of fishing was absent in these contexts. In addition, fish remains are given to dogs and disappear from the record. There is also little surviving evidence of the plant resources, which were available in summer, while imported goods were relied upon in winter and spring (Table 6).

Reindeer bone remains represent a major information source about actual Siberian subsistence (Abe, 2005). Materials from the Valley camps and Slope camps show several common patterns (Fig. 11a and b; Tables 2 and 3). Only a small portion of items are of *cranium*, *vertebrae* and *costae* (3% and 8%, respectively), and a large portion belongs to bones of distal parts of the extremities (*carpalia*, *tarsalia*, *metapodia*, *phalanx* I, II, III; 89% and 64%, respectively). In contrast, inverse relationships are encountered at Oktyaberskaya (Fig. 11c; Table 4), where the animals were kept and no transport is expected. Although marrow is highly valued in the traditional Nenets nutriture (Evladov, 1992), all phalanges are complete, a large amount of complete metapodia were found (41%), and similar values were recorded for the other long bones. When fragments occur, these results from breakage instead of cutting. Both assemblages include new-born individuals. Differences lie in the amount of dog gnawing (52% in VC, and 29% in SC).

Preserved fruits represent an important group in all recorded inventories, including jars from pickled cucumbers (all camps), several jars from jams, especially strawberry, peach, apricot and apple (VC, SC) and ketchup bottles (VC, OC). We recorded at all camps wrappings from various kinds of caramels, fruit caramels, confectionaries, burley sugars, etc. or plastic sticks from lollipops, which is consistent with observations that subarctic populations are fond of sweets. There was a greater variety of candies, chocolates or biscuits at the Oktyaberskaya camp, while at Yangana Pe, candies were less common than milk (including tins from condensed sweet milk, two sacks of dried milk and two crucibles from yoghurt). This evidence, together with other indications, suggests the presence of children at Yangana Pe.

Table 4
NISP of reindeer bones (*Rangifer tarandus*) based on selected samples from Oktyaberskaya camp. Letters refers to animaĺs age category: J/S – juvenile or semi-adult, A – adult; letters refers to specific damages: G – gnawed, B – broken, Ch – chopped.

Oktyaberskaya camp			
Part of skeleton	J/S	A	Damage
Antler	0	29	0/5Ch, 1B
Skull + maxilla	1	3	None
Mandibula	1	2	None
Vertebra	0	34	0/6Ch
Rib	0	26	0/12G, 4Ch
Scapula	0	4	0/1G
Humerus	1	1	1G/1G
Radius	0	4	None
Ulna	0	3	0/2G
Carpals	0	0	None
Metacarpals	0	3	None
Pelvis	0	4	0/1Ch
Femur	1	0	1G/none
Tibia	0	4	0/2G
Tarsals	0	0	None
Metatarsals	0	4	0/3Ch
Phalanges	0	2	None
Long bones	0	10	0/3G, 4B
Total	4	133	2G/22G, 5B, 12Ch

The category of beverages includes paper boxes and sacks of black tea, non-alcoholic drinks such as lemonades and juices and alcoholic drinks, such as tins of local beer (Arsenalnoe, Baltika), bottles or fee stamp from vodka, wine and champagne. The concentration of alcoholic drink remnants was greatest at the Oktyaberskaya camp. Frequently, the packings from Tetra Pak boxes, plastic bottles or tins from beverages were cut in center and worn out to be reutilized as vessels.

The last group of objects is related to personal smoking habits, and it includes cigarettes (SC, and especially OC), separate matches, boxes of matches, and a lighter (OC).

Several unusual or distinct artefacts were found at each individual camp. At Valley camp we have found a tin from marine algae and a sack from buckwheat. At Slope camp there was a jar from honey, a sack from pasta and from instant noodle soup and in the toss zone, there were two mouldy onions plus a wrapper from

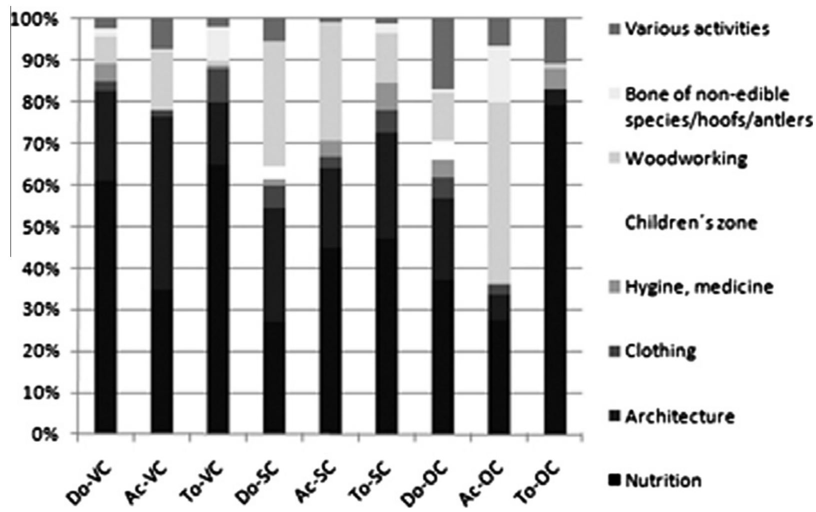

Fig. 10. Graph showing structure of objects in relationship to zonality of the individual campsites.

Table 5
Material composition of objects in the abandoned Nenets camps. Letters refer to site zonality: Do – domestic zone, Ac – activity zone, To – toss zone.

Material	Valley camp			Slope camp			Oktyaberskaya camp			Total	%
	Do	Ac	To	Do	Ac	To	Do	Ac	To		
Wood	3	24	8	49	40	17	62	100	1	304	22.16
Ash	2	1	1	3	0	0	2	1	0	10	0.73
Bone	23	50	88	21	55	7	24	32	59	359	26.17
Antler	0	1	0	0	0	6	1	28	0	36	2.62
Hoof	0	0	13	0	0	0	1	2	0	16	1.17
Fur	3	11	14	5	12	3	5	4	3	60	4.37
Straw	1	5	2	4	1	0	3	1	1	18	1.31
Stone	2	11	0	0	0	0	0	0	0	13	0.95
Paper	2	13	5	7	8	8	51	16	11	121	8.82
Glass	1	0	1	4	23	2	3	0	9	43	3.13
Porcelain	0	0	1	0	1	2	0	0	0	4	0.29
Plastic	5	42	8	18	9	5	55	18	13	173	12.61
Metal	1	5	10	6	18	1	11	2	3	57	4.15
Textile	4	11	2	21	21	11	27	11	0	108	7.87
TetraPak	0	1	1	3	0	0	0	0	0	5	0.36
Others	0	0	0	4	0	4	25	12	0	45	3.28
Total	47	175	154	145	188	66	270	227	100	1372	100
%	3.43	12.75	11.22	10.57	13.71	4.8	19.68	16.55	7.29	100	

Table 6
Composition of nutritions in the abandoned Nenets camps. Letters refer to site zonality: Do – domestic zone, Ac – activity zone, To – toss zone.

Nutrition	Valley camp			Slope camp			Oktyaberskaya camp			Total	%
	Do	Ac	To	Do	Ac	To	Do	Ac	To		
Bone – edible species	22	50	88	21	55	7	24	31	59	357	62.41
Cereals/pasta	0	1	0	0	1	0	0	1	0	3	0.52
Instant	0	0	3	1	0	2	7	3	1	17	2.97
Milk	3	3	8	3	6	0	0	0	0	23	4.02
Candy	2	2	0	2	0	2	22	9	12	51	8.91
Preserves	0	0	2	4	15	1	2	1	3	28	4.9
Alcohol	1	2	1	2	12	1	12	1	4	36	6.29
Juice/limo	0	4	2	3	0	0	4	0	0	13	2.27
Cigarettes	0	0	0	2	0	3	20	13	0	38	6.64
Vegetables	0	0	0	2	0	0	1	1	0	4	0.7
Others	0	0	0	0	0	0	1	0	1	2	0.35
Total	28	62	104	40	89	16	93	60	80	572	100
%	4.89	10.84	18.18	7	15.56	2.8	16.26	10.48	14	100	

margarine. Special objects from Oktyaberskaya included a small jar from caviar, a paper sack from flour, two plastic dishes from an instant food ‘‘Byznysmen’’, two sacks from a potato purée and an instant noodle soup, one bottle from Tchibo coffee, one boxboard of sect, one mayonnaise, several chewing gum wrappers, and a sack from lemons.

Table 7
Composition of utilities in the abandoned Nenets camps. Letters refer to site zonality: Do – domestic zone, Ac – activity zone, To – toss zone.

Utilities	Valley camp			Slope camp			Oktyaberskaya camp			Total	%
	Do	Ac	To	Do	Ac	To	Do	Ac	To		
Wood for fire	3	22	2	41	35	12	38	95	1	249	31.2
Stone	2	11	0	0	0	0	0	0	0	13	1.63
Ash	2	1	1	3	0	0	2	1	0	10	1.25
Insulation	1	29	0	0	0	0	0	0	0	30	3.76
Cord/rope/wire	0	3	0	18	6	1	5	2	0	35	4.39
Wooden object	0	1	6	5	5	4	23	5	0	49	6.14
Textile covers	3	7	0	5	11	7	11	3	0	47	5.89
Domestic equipment	0	3	4	2	7	2	7	0	0	25	3.13
Game/toy	0	0	0	5	0	3	11	0	0	19	2.38
Shaving	0	3	0	3	0	1	1	0	0	8	1
Clothes	1	3	4	8	7	4	13	5	0	45	5.64
Hygiene/medicine	2	0	1	2	10	0	11	1	5	32	4.01
Non-edible bones/hoof/antler	1	1	13	0	0	6	2	30	0	53	6.64
Fur	3	11	12	3	12	3	5	4	3	56	7.01
Straw	1	5	2	4	1	0	3	1	1	18	2.26
Packing	1	10	3	3	2	2	25	10	5	61	7.64
Newspaper	0	2	0	0	0	0	13	3	5	23	2.88
Others	1	1	0	3	3	5	7	5	0	25	3.13
Total	21	113	48	105	99	50	177	165	20	798	100
%	2.63	14.16	6.02	13.16	12.41	6.27	22.17	20.67	2.51	100	

Dwellings

The structure of the "chum" is composed of approximately 25–30 wooden poles (one of them was lent against a larch at OC). On the left and right side of the hearth, the Nenets first place several wooden planks on the ground (found prepared in peripheric zones of the VC), than cover them with straw, and finally with reindeer furs. During winter, an open fire in the center is replaced by a stove (we found an iron desk with nails from it at SC, and a pipe from a stovés chimney at OC). In the area opposite the "chuḿs" entrance (in front of the zone forbidden to women) is a small table and boxes with dishes.

In an abandoned camp, the location of the central hearth is sometimes difficult to find, due to cleaning of the ash and moving into the camṕs periphery. Some of the associated objects, however, were recorded at all camps: parts of a table cover with a sunflower pattern, a broken vessel and broken cup were found at VC. A pot with drilled holes on each side, through which a wire was passed, fastened on sledges was found at SC, along with a 10 l capacity boiler, an 20 l capacity aluminum kettle, with a sherd from a cup with a flowery pattern, and a broken saucer.

Reindeer furs serve as a typical cover for winter "chums" and the Nenets always prefer two layers, one of them with trimmed

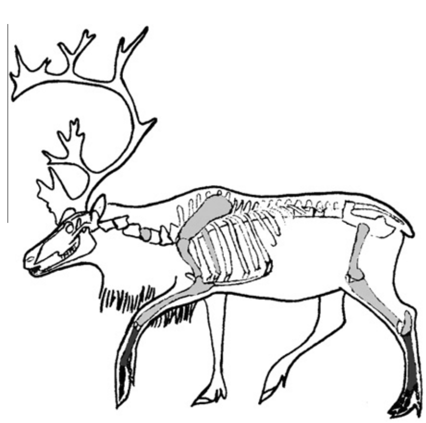

Fig. 11a. Valley camp, quantity reindeer bones in the analyzed assemblage, represented by intensity of coloration.

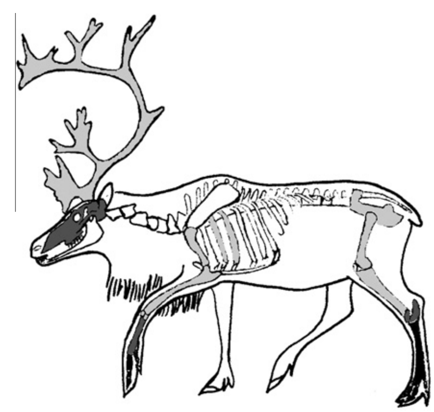

Fig. 11b. Slope camp (lower), quantity of reindeer bones.

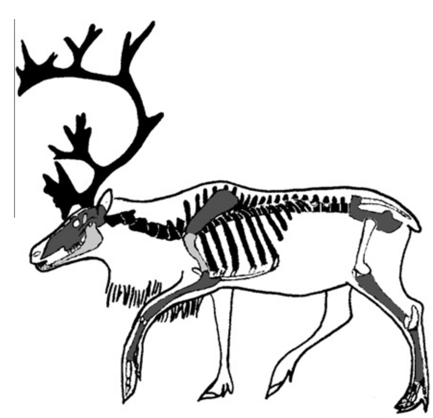

Fig. 11c. Oktyaberskaya camp, quantity of reindeer bones.

hair. For the summer "chums", rough canvas is used to cover the structure, similar to what is used to cover the sledges. Parts of canvas sometimes have felt loops along the edges. The group of cords, ropes, and wires, including hand-knitted cords and ropes from polyethylene fibers of various colors, may be related either to "chum" construction or to fastening of the load carried on sledges. However, we cannot exclude that some of these cords or ropes were used to help manage the reindeer, although the lasso for catching reindeers, "tinzjan", is traditionally knitted from the reindeer skins. Cords and ropes occur at all camps, whereas parts of wires were sporadically observed only at SC and OC. Several wooden posts (VC) or pegs (SC, OC) might be related to the architecture or to nearby activities like breeding reindeer or dogs.

Specific features were recorded in the VC, with two piles of stones (one of seven pieces and the other of 11 pieces), all of which are sandstones with huge slickenside corns. Two similar stones laying the domestic zone, showing traces of burning and the rest of ash in between – an *in situ* cooking facility from a hearth. We recorded individual examples of insulation and a part of linoleum at VC, chipboard at SC, and a part of wooden box pallet, a hacked bunch, and one mailing box at OC.

Clothing

The Nenets clothes for cold seasons are traditionally produced of furs, whereas in the warmer seasons, commercially-made clothing is purchased. Womens' summer clothes include skirts or blouses with flowery patterns, which are documented by fragments found at all camps (some of these items were re-used and their strings were twisted in a thin cord). Other clothing encountered at all camps includes pieces of utility gloves with nonskid attachments on the surface, some with traces of technical oil. Children's clothing discovered at the camps include two boots sewn from reindeer fur, discovered at the toss zone of VC, part of a track suit and sweat shirt, a terry glove, children's socks (at SC and OC), knickers for a girl of 4–7 years old, and green, white and pink colored hair ribbon. At SC there were fragments of various textiles of blue and white color and pieces of rough woolly textiles. At OC, we recorded a tie from jeans, a paper package from socks, a label from clothes, one handkerchief, and large womeńs knickers.

Hygiene and medicine

In the toss zones at all camps were discarded residues of toilet paper, napkins (VC, SC), and a sanitary towel (SC). Traditionally, straw plus dried mosses were used for hygienic purposes, as documented at all camps. At VC, we recorded a bottle of cologne; at SC there was a terry towel, and a tooth paste tube. At OC we recorded a plastic soap box, a piece of polyporus (which could be used as tinder or for healing) and an elastic hairband. First aid and medical equipment found included balled linen, used as a finger-bandage, a grouting point and its cover, capping strip and two ampoules – one with a pellucid solution and the other with white powder at SC, and three tablets of Paracetamol for children, a tablet Baralcin M, a tube from Fastum Gel, and box from Diroton at OC. Paper boxes like this were also re-used for mailing, as indicated by addresses visible on some of them.

The children's zones

Inside the domestic zones of two camps, SC and OC, were could identify children's zones with remains of games. At Slope camp, this zone included a part of a blue plastic toy, a sprig with a tied rope, several cutouts in the shape of reindeers with the rest of cuttings (Fig. 12), several white beads on the elastic band (ring?) and two fragments of reindeer fur, one of them with a green dot from felt tip and other with cut hairs and several bunches of hair. At Oktyaberskaya camp, the children's zone included a rubber, a paper with unspecified drawings, part of softened yellow plastic with a pierced hole and traces from human nails on surface, several cutouts in the shape of triangles ("chums"?) from the cover of candy, a plastic letter, and two pencils.

Woodworking

Typically, women collect wood from alder bushes in the direct vicinity of the camp for fuel for the hearths. However, at Oktyaberskaya camp, where the larger larch trunks were cut by a motor saw, we expect male work during the cutting, whereas later preparation of fuel from these trunks was left to women and girls. In these areas were fuel was prepared, pieces of birch-bark and dried moss are usually found.

A typical feature at all camps is circular concentrations of shavings from repairing various kinds of wooden objects, especially sledges. Broken parts of sledges were present at all camps. These shawings could be also used for heating or placed on the "chuḿs" ground floors.

Modification of non-edible bones

This group of artefacts includes complete reindeer hoofs and antlers, as well as otherwise edible bones such as *metapodia* and *phalanges* could be used to produce specific skin named "kamus". Hoofs were usually still-joined to the limb bones and placed in toss zones as butchering waste. The traditional habit of using reindeer hoofs and phalanges as symbols of complete animals in children's games (as suggested by museum collections in Salekhard and Sośva) was not evident at the sites we studied. At all camps, we recorded a mixture of naturally dropped reindeer antlers and antlers cut away from skulls. Skulls with cut-off antler were also dispersed on the slopes and valleys of Yangana Pe, offering supporting evidence for this practice. Some of these remains show traces of gnawing by reindeer or carnivores, in search for minerals.

Other activities

Two woolly tassels (VC, OC) and a few fragments of wool in a variety of colors (all camps) might be linked to clothing decorations or reindeer harnesses. Various kinds of wrappings (of paper, aluminum, polythene, cellophane, etc.) were found but cannot be related to specific activities. Pieces of newspapers were dispersed at all camps. In addition, four 1.5 V batteries and two kerosene or benzine tins were found at SC and OC. At VC, there also was a fired shell from a cheap shotgun. At SC we found a part of tarry and two handmade patches. A piece of cello tape, part of a plastic stake (as from a party tent), several pins, and an anti-slip treadle from a scooter were also found at OC.

Symbolic activities

Symbolic meaning may be presumed in relation to the antler cache deposited on a remarkable elevation at the Upper Slope camp (Fig. 13). The various objects attached to trees in the forest tundra, north of Labytnangi (Fig. 8), may also be the result of symbolic activities.

Interpreting the campsites: zonality

Schematic plans for each of the analyzed camp (Figs. 5–7 and 9) allow a functional separation into discrete zones:

Domestic areas

No ring-shaped alignment of larger objects was visible along the margins of any "chum", either as a stabilizing part of construction or as the result of long-term "centrifugal" accumulation of objects along the peripheries. The diameter of these circular dwellings seems similar at archaeological and ethnological sites and

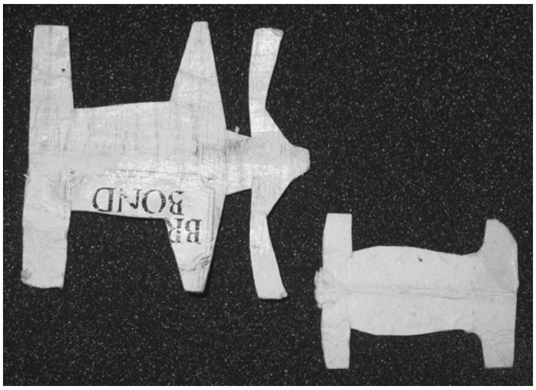

Fig. 12. Slope camp (lower), children's zone. Paper cutouts representing reindeer.

Fig. 13. Slope camp (upper), antler deposit, probably symbolic.

oscillates around the optimal size of 5 m, but the precise outlines of the domestic areas are unclear (Fig. 11). The hearths, the central location of which is considered straightforward at archaeological Upper Paleolithic sites (Leroi-Gourhan and Brézillon, 1972; Stapert, 1989; Cziesla, 1990; Svoboda, 1991, 2005), are rarely conserved in their original position at the ethnologically documented sites. Rather, we encounter areas of ash redeposition on the sités peripheries. If conserved in its original location, a hearth is usually equipped with two flat stones for cooking. The area around such hearths ideally corresponds to a "chum", and the scarce inventory includes fragments of textiles or cords, bone fragments, wood splinters and twigs, straw and straw wisps.

At Slope camp and Oktyaberskaya camp, we identified and located children's zones inside the presumed "chums", with several paper cutouts, a pencil or gum, and associated objects. This evidence, together with the evidence of children's subsistence activities, napkins, and clothing, suggests at least one child approximately 0–3 years old and another one around 5 years old at Slope camp, and one child 4–7 years old at Oktryaberskaya. Although we were unable to identify a children's zone in the interior living area at Valley camp, children could have been present at this site as well, and the evidence may have been discarded into the toss zone. Napkins and a fur shoe at this site belong to children of 0–3 years and around 5 years in age. The presence of children was also recorded by Binford (1991, p. 43) at the fall site at Kongumuvuk. Locating interior children's play zones in fall, winter and spring camps is expected, because children do not run around as in summer camps, but tend to play in groups inside during the colder months.

Activity areas

Activity zones exist in front of the "chums" and between them. Wooden splinters and shavings, in particular, are dispersed in circular shapes surrounding the chims, as a relic of woodcutting or the construction of sledges. In addition, there are fragmented reindeer bones, while complete body parts in anatomic position are rare (and are usually removed to the site peripheries). Certain differences were observed in activity zones of the individual sites. At Oktyaberskaya, we reconstructed reindeer butchering within the activities areas, whereas in the other camps such remains were usually discarded. At this same site, woodworking using motor saws markedly predominates over the discernable activities. At lower Slope camp, a higher concentration of medical equipment may be related to treating reindeer during breeding.

Faunal assemblage compositions, especially the relationship between the axial and appendicular skeleton, vary at the individual Nenets sites, which may be explained as a result of transportation. Similar variability in faunal composition as a result of transport has been purported at the Upper Paleolithic reindeer sites (Enloe, 1993; West, 1997) and actual Siberian sites (Abe, 2005). Breakage patterns and other traces of human impact on bones are more intensive at the Upper Paleolithic sites than at the Nenets sites (as at Pavlov I; Musil, 2005; Wojtal et al., 2005). Dog gnawing

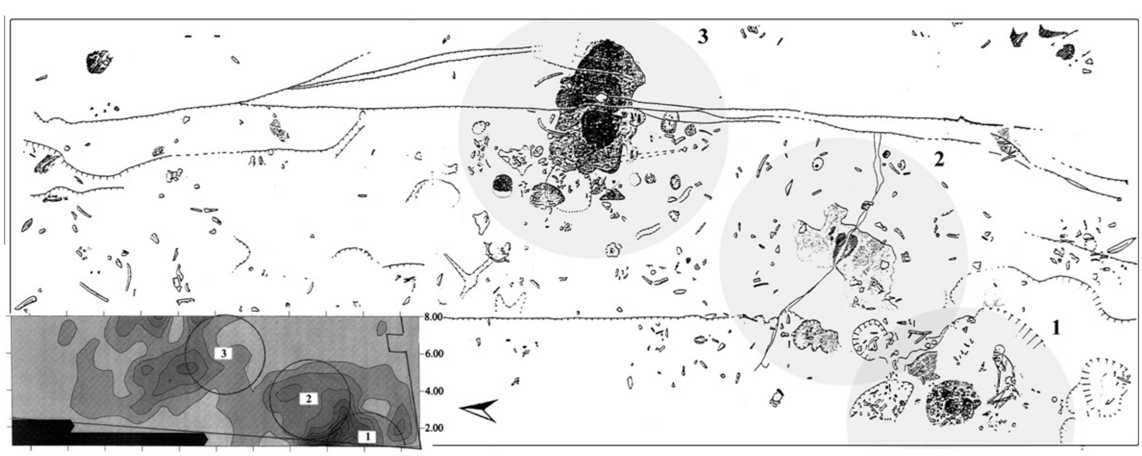

Fig. 14. Dolní Věstonice II – western slope. Plan of the 1987 excavation area, showing spatial distribution of hearths, density of objects, and reconstruction of three domestic areas (dark circles), based on Upper Paleolithic archaeological evidence.

occurs in various percentages in the Nenets camps; in contrast, of the rarity of gnawing marks at Upper Paleolithic sites (such as Pavlov I) probably reflect the absence of dogs at these sites.

Peripheries

The toss zones lie on the back periphery or on adjacent slopes just below the camps. There are accumulations of bottles, cans, pieces of paper or fur, and straw. Trends observed on peripheries are the following: at Oktyaberskaya, there is a huge accumulation of packaging from purchased foods; along the peripheries of the Valley camp and the Slope camp, toss zones may overlap spatially with objects conserved for further usage; and, even if traces of woodworking do not habitually accumulate in the toss zones, one example of this practice was noted in the Slope camp.

The landscape around

In the tundra surrounding the Slope and Valley camps, we observed restricted areas with evidence of manual woodcutting, always limited to zones of about 3×3 m, to enable easy regeneration of the alder bushes. In the forest tundra around Oktyaberskaya, a motor saw was used to cut down larger larch trunks.

Individual objects dispersed in the surrounding tundra or forest tundra may either have been prepared in place for a next use (sledges, boats, fishing nets), or represent items of ritual and/or symbolic significance (objects attached to individual trees, antler depositions on the ground), or be just randomly discarded objects. At upper Slope camp, which was a rarely settled place in a dominant position, we identified an accumulation of 11 antler pieces at the highest spot. In the Polar Ural region, antler is offered to the Mattress of the Mountains, Pe-erv-ne. Large accumulations of antler are deposited at various places in Yamal, and especially on Beliy Island. It should be recalled that caches of discarded antler were also recorded at several Upper Paleolithic sites of North Eurasia, as in the Medvezhya Cave in Northern Ural, and the open-air sites of MaÍta, Bureť and Mezin.

Conclusions

There is a range of significant differences between semi-nomadic Upper Paleolithic hunters of Central Europe, where cultural systems functioned without external political or economic influence, and the contemporary nomadic pastoralists, fishers and hunters of Polar Ural, which are tangibly effected both politically and economically by external civilization (Forsyth, 1992; Pika and Bogoyavlensky, 1995; Golovnev and Osherenko, 1999; Stammler, 2007). An Upper Paleolithic site is composed of one or more settlement units, represented by a central hearth surrounded by related features and dispersed objects. Whatever type of dwelling structures one may reconstruct – chum, teepee, or yurta – are just purported architectural reconstructions of the archaeologically recorded settlement units. In addition, various activity areas and specialized areas are located between these purported dwellings. At complex and palimpsest sites, the spatial/temporal relationships among these structures are the object of a complex site analysis, as at Pavlov I, for example (Svoboda, 2005).

The contemporary camps documented in the pure tundra and forest tundra were inhabited in winter or early spring, when the society concentrates on reindeer and when the other natural resources (available in summer) were to a large extent substituted by imported items bought in shops. There are general similarities in the spatial arrangement and structure of the objects recorded in the three camps, but apparent variation could be caused by the distance between camps and to the nearest shop, by the demographic structure of the site and by the habits of its occupants. Compared to the camps at Yangana Pe, the Oktyaberskaya campsite displays a remarkable difference in the structure of the recorded objects, because of its location close to the railway and to the city of Labytnangi where reindeer are sold and occupants could obtain a large and diverse quantity of imported goods. Other differences might be caused by a demographic structure of the inhabitants of the camps, their economic status (after selling reindeers) or by their particular habits (for example, smoking cigarettes at Slope camp or Oktyaberskaya).

Of what nature and significance are the ethnoarchaeological analogies? Theoretically, both the past hunterś camps and actual pastoralistś camps are structured along discrete zones: the interior living areas, exterior activity areas, inner periphery zones and outer periphery zones, and dispersed objects and activity traces in the adjacent landscape. However in the living camps, "structures évidentes" and "structures latentes" of classical French paleoethnology cannot be separated as clearly as in Upper Paleolithic sites: all is in movement here, and architectural remains, ash from hearths, and other objects may be removed from the central areas towards the peripheries. We collected little evidence that would allow us to separate archaeologically (or archaeozoologically) the pastoralistś sites from past hunting sites. The zones of reindeer excrements and hair recorded along periphery of the Oktyaberskaya site (Fig. 9) would hardly be detected using the classical archaeological methods.

Duration and stability of occupation is one of the key factors of difference, both at ethnological and archaeological sites. One of the characteristics of the Moravian Upper Paleolithic sites is a relatively stable location of hearths and pits; these features may form palimpsests at intensively reoccupied sites, as in Pavlov I (Svoboda, 2005), or a more readable network across larger areas, as at Dolní Věstonice II (Fig. 14, Svoboda, 1991). Nevertheless, the spatial distributions of artifacts and nature facts at archaeological sites do not allow us to separate the domestic areas, a variety of activity areas, and toss zones as clearly as in the contemporary Nenets campsites. For example, wood splinters and shavings, as widely distributed evidence of woodworking at all Nenets sites, are archaeologically not detectable. The same concerns the children's zones, marked especially by the paper cutouts. Activity traces and individual objects left in the surrounding landscape, be it of practical and symbolic meaning, remain unrecorded by present-day archaeological methods.

Compared to ethnological sites, selective preservation and dynamics of long-term human behavior at archaeological sites creates more obstacles for discerning the clear-cut separation of the individual zones.

Acknowledgments

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2.4.4 Ethnoarchaeology of Nenets Campsites, Cases of Yangana Pe and Oktyaberskaya (Polar Mts., Northwestern Siberia)

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Ethnoarchaeology of Nenets Campsites. Cases of Yangana Pe and Oktyaberskaya(Polar Ural Mts., Northwest Siberia).

Etnoarcheologie něněckých tábořišť. Jangana Pe a Okt'aberskaja (Polární Ural, severozápadní Sibiř).

Jiří Svoboda, Pavel A. Kosintsev, Sandra Sázelová, Vlasta Jankovská, Martin Holub

Abstract

As a part of an investigation of Nenets settlement patterns (Yamalo-Nenets Autonomous Region, Northwest Siberia) in summer 2009, we documented active summer campsites at lakes and abandoned winter and spring campsites in open tundra (mountain ridge of Yangana Pe) and forest tundra (Oktyaberskaya, north of Labytnangi). Discussion of the floristic and zoological potentials of tundra, forest tundra, and forest for nutriture shows that plant resources and fish are available predominantly in summer while reindeer occur in these regions during fall, winter and spring, as they return from summer pastures further to the north. Movements of the individual Nenets families depend on ownership of sufficient reindeer. Missing components of the nutriture are substituted by purchasing consumer products. The documented camps are structured along discrete zones such as interior living areas (including children´s playgrounds), exterior areas with evidence of woodworking, processing reindeer, and other activities, peripheral toss zones, and dispersed activity remains in the surrounding landscape (some of which may have ritual meaning). Certain variation recorded in the individual camps is caused by distances between camps, to the nearest shop and to communication networks, by demographic structure of the site, by activities of the inhabitants and their financial potential (after selling some of the reindeer in winter, for example). The scope of these comparisons is enriched by Upper Paleolithic evidence from central European hunters' settlements which display a basically similar camp structure and zonality but include (of course) different types of objects and activities.

Keywords

Ethnoarchaeology, Siberia, Polar Ural, Nenets, natural resources, activities, settlement structure, settlement zonality

1. Introduction: The ethnoarchaeological approach

Incorporating current ethnological analogies into the reconstructions of past human behavior in the Pleistocene is a technique as old as the beginning of Paleolithic research itself, and it goes back to the 19th century (Mortillet 1883). However a methodology based on systematic creation and usage of maps and plans of actual hunter-gatherers´ campsites was introduced considerably later, with the development of more scientific approaches in archaeology during 1960s and 1970s. At present, we have a series of documents, publications, and methodological issues concerning the spatial distribution of actual sites and objects within a variety of geographic zones and environments (Yellen 1977; Binford 1978; 1987; Gamble, Boismier, eds. 1991, with refs.).

Upper Paleolithic settlement archaeology provided a wealth of databases and related information on mobile settlement strategies and resource exploitation in the Last Glacial landscape (Peterkin, Price, eds. 2000; Vasil´ev *et al.*, eds. 2003). The reindeer-and-horse-based Magdalenian sites in the Paris Basin served as a classic case in all these efforts (Leroi-Gourhan, Brézillon 1972; Stapert 1989; Cziesla 1990). In Central Europe, the literature rightfully emphasizes the geographic role of the Moravian Gate as one of the most important European passages, both for animals and their hunters. Between 49.5°

Fig. 1: Polar Ural showing location of reindeer summer pastures at the Kara sea, Yangana Pe campsites (upper arrow), and Oktyaberskaya campsite (lower arrow). *Obr. 1: Polární Ural s vyznačením letních sobích pastvišť u Karského moře, táborů na Jangana Pe (horní šipka) a tábora Okt´aberskaja (spodní šipka).*

and 50° of northern latitude, the 70 km long bottleneck of the Moravian Gate and the adjacent corridors composed of narrow plains between the Bohemian Massif and the western Carpathians, opens a passage in excess of 300 km long between the plains of northeastern Europe and the Danube valley to the southwest. One of the aims of Moravian Upper Paleolithic archaeology is to explain how this landscape and its potentials were used and exploited by a variety of cultural entities (*cf.* papers published in Přehled výzkumů 47, 2006, with refs.). Having our previous field experience from the European Last Glacial sites in mind, we present here examples from polar and subpolar latitudes, with expectations that these will be a more preferable comparative sample than others. During our summer stay in the Polar Ural Mts. in 2009, we observed active Nenets summer camps on the Lake Taunto, as well as remains of temporarilly abandoned winter and spring camps in the open tundra at Yangana Pe mountain ridge (the Valley camps and the Slope camps), and in the forest tundra west of the Ob River near Labytnangi (Oktyaberskaya campsite). We recorded spatial distribution of objects, listed their inventories according to zones, created photographic documentation and recorded its GPS locations.

2. The Nenets annual cycle

The Nenets, as typical nomadic people of the tundra, base their traditional economy on reindeer exploitation (Golovnev 1993; Chomich 1995) and their economic cycle coincides with annual reindeer migrations. During summer, the open tundra offers more resources and some protection against mosquitoes, whereas in winter nutriture is better accessible in the forest and forest-tundra zones. Therefore, reindeer spring migrations are oriented northwards to the open tundra zone and their fall migrations take them back to the forest zone. A complete Nenets family, or 2–3 related families, migrate repeatedly along the same route, males together with females, children, "chums", and equipment. To practice this lifestyle, a family needs minimally 80–100 reindeer. Families that do not own enough animals send their reindeer northwards with larger herds, stay at rivers and lakes along the border of forest tundra and open tundra, and live there from fishing and occasional hunting. In winter, majority of the Nenets stay in the forest and live there from hunting and some fishing, but few families who own large enough reindeer herds may stay in the tundra over the year. Basing on the number of reindeer, one may separate the Nenets families into four groups: those who migrate annualy between forest and tundra (majority of families); those who migrate within tundra throughout the year (small number of families), those who move from forest just to the borderland of forest tundra and tundra and stay there (small number), and those who do not migrate at all (small number).

3. East of the Polar Ural Mts.: Region, plants, animals and people

3.1. Geography and botany

Fig. 2: View from Yangana Pe ridge towards surrounding open tundra, with lakes and Nenets settlements. *Obr. 2: Pohled z hřebene Jangana Pe do okolní otevřené tundry, s jezery a něněckými tábory. Foto S. Sázelová.*

In the Yamal-Nenets Autonomous Region, the north-south oriented principal mountain chain of the Polar Ural Mts. is paralleled in the east by one of the traditional migration corridors, periodically frequented by reindeer herds moving along the mountains from plains around the Kara Sea, where they spend the summer, towards their winter locations around the Labytnangi–Kharp railway. On this journey, about 250–300 km long, the landscape grades from open tundra through to dwarf shrub tundra, to forest tundra (Fig. 1). The flat or partly elevated tundra of the southern Yamal is formed by mosaics of lakes, brooks, small rivers, and various marshes. The banks are lined with willow shrubs dominated by *Salix lanata*, *S. glauca*, *S. lapponum* and *S. phylicifolia*. In the aquatic biotopes of the numerous peat bogs and wet meadows, we regularly encounter various species of *Carex* and *Eriophorum* (most frequently *E. scheuchzeri*, *E. russeolum*, *E. vaginatum*, *E. polystachion*) together with *Rubus chamaemorus*, *Polygonum bistorta*, *Menyanthes trifoliata*, *Comarum palustre*, *Myosotis* cf. *asiatica*, *Pedicularis* sp., *Thalictrum* sp. and others. Shallow waters are inhabited by *Arctophila fulva* and *Sparganium* cf. *hyperboreum*. At favourable, not completely marshy biotopes, the vegetation is enriched by *Valeriana capitata*, *Trientalis europaea*, *Saxifraga hirculus*, *Cerastium* sp., *Melampyrum* sp., *Euphrasia frigida*, *Salix nummularia*, *Salix reticulata*, *Salix polaris* and other herbs, mosses and lichens.

In the northern latitude of 67°, Polar Ural Mts. are joined by an east-west oriented limestone ridge named Yangana Pe (289 a.s.l.) and adjacent metamorphic ridge of Nyava Pe (236 a.s.l.). Yangana Pe represents a unique phenomenon of the southern Yamal Peninsula due to its floristically rich vegetation cover, influenced by the calcareous subsoil, and attractive for aboriginal hunting, fishing and pastoralism (Fig. 2). It recalls the role of the limestone Pavlov Hills during the Upper Pleistocene in the Danubian basin (in the Czech Republic). Yangana Pe shows structured geomorphology with mountain chains, isolated hillrock, broad valleys, and gorges, and allowing a general overview of the surrounding flat tundra of southern Yamal Peninsula. Yangana Pe and Nyava Pe also protect the basins and lakes along their southern foothills against winds from the sea, and create the northernmost shelter area for limited extension of dwarf trees and shrubs. A more favourable climatic regime in the southern foothills is supported by reflection of the whitish limestone cliffs. Towards the higher elevations of western Yangana Pe, the subzone of southern tundra grades into mountain tundra, comparable to vegetation of the Polar Ural Mts. In the low vegetation cover on top of the hills we encounter a variety of plants such as *Rhodiola quadrifida*, *Delphinium middendorffii*, *Saxifraga aizoides*, *Papaver lapponicum*, *Saussurea alpina*, *Saxifraga spinulosa* and others. *Boschniakia rossica* from the family *Orobanchaceae* is a plant without chlorophyll which parasitizes on *Alnus fruticosa* and was recorded on several occasions.

Yangana Pe intersects the traditional reindeer migration route approximately in the middle of the pathway. In the past, strategic passes crossing the rocky ridge were certainly good places for reindeer ambushes and kills. Although reindeer bones, skulls, and antler are found dispersed throughout the whole landscape, they concentrate in such passes more frequently than elsewhere (Fig. 3).

The Oktyaberskaya camp is located 150 km south, in the forest-tundra vegetation zone of southernmost Yamal peninsula, with *Larix sibirica* as the most important tree and *Betula nana* as the most frequent shrub. This zone expands longitudinally from the eastern slopes of Polar Ural Mts. to the left banks of Ob River mouth. Geological subsoil is formed by a fluvial gravel-and-sand deposit of the Ob River in the east, whereas the western part is predominantly formed by fluvioglacial sediments with higher proportions of larger-sized gravel. Depending on geomorphology, hydrology, exposure and other abiotic factors, the vegetation composition varies both on micro- and mesoscales. Such versatile mosaic patterns are typical for a natural landscape not yet influenced by large-scale anthropogenic impacts.

Relatively dense forests of the northern taiga type with *Larix sibirica* and a higher representation of *Picea obovata* and *Betula pubescens* are directly associated with typical forest tundra wherever protected and favourable mesoclimatic biotopes appear. Species of *Salix* such as *S. phylicifolia*, *Alnus fruticosa* and the less commonly occurring *Rosa acicularis* represent the dominant shrubs. Dwarf shrubs form a closed cover of *Ledum palustre* and *Vaccinium uliginosum*, sporadically *Vaccinium myrtillus*, in open places with *V. vitis-idaea*, *Linnaea borealis*, *Trientalis europaea*, *Rubus arcticus*, *R. chamaemorus*, *Melampyrum* cf. *sylvaticum* and others. Mosses and lichens are very common, with dominance of various species of *Sphagnum*, *Hylocomium splendens*, *Dicranum* sp. and *Polytrichum* spec.div. Species of the genus *Cladonia* and *Cetraria* also occur.

Along brooks, the moist biotopes are rich in plant communities. The shrub cover is dominated by willows (*Salix lanata*, *S. glauca*, *S. lapponum*, *S. phylicifolia*), together with *Salix myrtilloides*. Amongst herbs we encounter species *Carex* and *Eriophorum* (*E. polystachion*, *E. vaginatum*, *E. scheuchzeri*), and *Cirsium heterophyllum*, *Trollius* cf. *asiaticus*, *Sanguisorba officinalis*, *Polemonium acutiflorum*, *Polygonum bistorta*, *Parnassia palustris*, *Comarum palustre*, *Menyanthes trifoliata*, *Rubus chamaemorus*, *Rubus arcticus*, *Veratrum lobelianum*, *Petasites frigidus*, *Angelica decurrens*, etc. Mosses are dominated by *Sphagnum* sp. accompanied by *Meesia triquetra*, *Paludella squarrosa*, *Aulacomnium turgidum* and others.

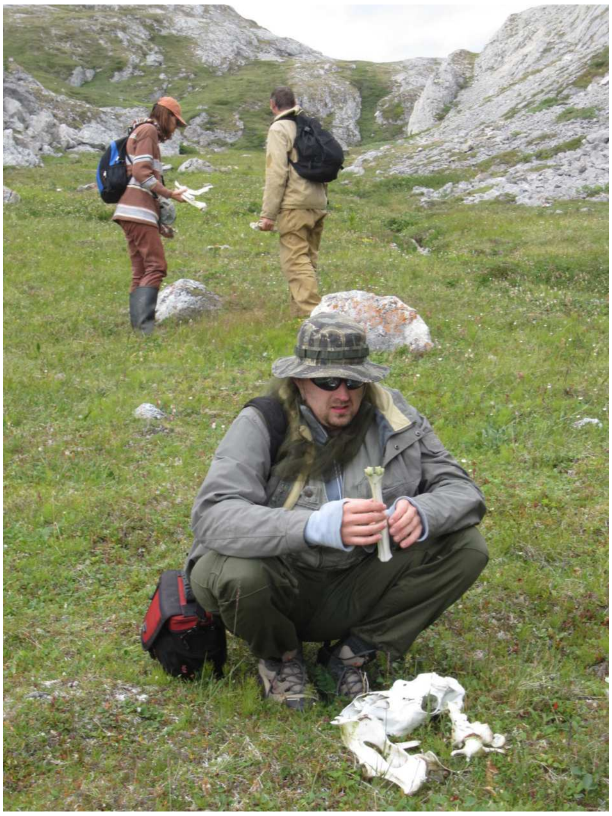

Fig. 3: Strategic passes crossing Yangana Pe were places for reindeer catches and kills. Reindeer skeletal remains are concentrated here more frequently than elsewhere in the landscape even in contemporary times. *Obr. 3: Strategické průsmyky přetínající hřeben Jangana Pe byly vhodnými místy pro odchyt a zabíjení sobů. Ještě v současnosti se zde kosterní pozůstatky sobů koncentrují více než ve volné krajině. Foto J. Svoboda.*

Vegetation on the steep left banks of the Ob River, protected by a favourable mesoclimate of this large river, is enriched by presence of *Sorbus aucuparia*, *Betula pubescens* is more common, and at footslopes by *Lonicera altaica*, *Ribes glabellum* and various communities of tall herbs. Eroded surfaces of the sandy subsoil are occupied by *Arctostaphyllos uva-ursi*, *Rosa acicularis* and other pioneer vegetation. Surprisingly, this vegetation is accompanied also by *Ledum palustre* and *Rubus chamaemorus*, growing directly on the sand, and otherwise recorded in marshy biotopes.

3.2. People and plants

Although data from preliminary field research are still restricted, it may be concluded that aboriginal human impact on this vegetation is minor and reflects simple human occupation within a settled area rather than larger structural changes. In contrast, radical vegetation changes oc-

Tab. 1: Review of dating, based on expire dates printed on industrial products and the state of bone preservation. VC – Valley camp, SC – Slope camp, OC – Oktyaberskaya camp; letters refer to site zones. *Tab. 1: Přehled datací na základě dat vytištěných na průmyslových produktech a podle zachovalosti kostí. VC – Údolní tábor, SC – Svahový tábor, OC – Okt´aberskaja; písmena odpovídají zónám.*

Location	**Object**	**Dating**
VC01_C	Tetracycline liniment paper wrapper	2001–2004
VC02_D	unspecified tin	consumption up to March 2009
VC03_D	beer tin	consumption between April–October 2009
VC04_G	pieces of newspaper from a Saturday	16th February (it could be 2002 or 2008)
VC05_H, I	reindeer bones	spring 2009; some older than 1 year
VC06_J, K	reindeer bones	more than 1 year
SC01_I	milk tin	2002
SC02_C	milk tin	2003
SC03_C	milk tin	consumption up to 15th July 2003
SC04_A	milk tin	consumption up to October 2007
SC05_A	milk tin	consumption up to 7th May 2008
SC06_A	reindeer bones	spring 2009
SC07_D	reindeer bones	1–2 years; more than 3 years
SC08_I	reindeer bones	more than 5 years
OC01_B	pieces of newspapers (Sever OK)	7.9. 2006
OC02_A	pieces of newspapers (Sever OK)	28.3. 2007
OC03_D	wrapper from a Czech chocolate stick	13.11. 07–12.11. 08
OC04_E	paper wrapper from flour	16.3. 2008
OC05_A	biscuit wrapper	July 2008–July 2009
OC06_A	caviar jar	11.11. 2008–11.5. 2009
OC07_A	pickles jar	6.9. 2008–6.9. 2011

cur around the camps of Russian geological, mining, and biological expeditions. Here, *Chamaenerion latifolium* is being introduced as an important synanthropic taxon, accompanied by *Chamaenerion angustifolium*, which nevertheless also indicates human intervention into the forest tundra biotopes. Both are associated with areas of former "gulags" along the railway from the Komi Republic to Labytnangi, for example.

In Yangana Pe, introduction of *Tanacetum bipinnatum* likely indicates another anthropic impact, and, surprisingly for a botanist from Central Europe, even *Rubus chamaemorus* occurs here as a "pioneer" plant in areas impacted by humans. This plant, generally considered a peat-bog element, occupies clearly edaphically dry biotopes on sands, gravels, and other extreme biotopes. Peat-bog biotopes, when disturbed by wheels of large vehicles ("vezdekhods") are precisely copied by *Eriophorum scheuchzeri* and, less frequently, by *Parnassia palustris*.

Northern ethnics collect and use a variety of plant resources (Sinclair 1953; Owen 2005). Along the Polar Ural Mts., the plants most frequently collected for nutriture are *Vaccinium uliginosum* (bog billberry) and *Vaccinium vitis-idaea* (cranberry). Both are used to produce very sweet "vareniye" jam to substitute sugar in tea, or as an addition to vodka and other alcohols, or to produce a drink "napitok". *Vaccinium myrtillus* (blueberry) is a scarcer type, used for jam in cakes and, again, for "napitok".

On peat-bogs, another collected plant is *Oxycoccus quadripletalus* (mooseberry) with larger and tastier fruits, especially when freezed. It is also used for jam and "napitok". A highly valued plant is *Rubus chamaemorus* (cloudberry) offering orange fruit and used for "vareniye" preserves, compotes and alcoholic drinks. *Lonicera altaica* (Altaic honeysuckle) is a medium-sized shrub following mainly water streams. The fruits are small, difficult to collect but good for "vareniye" and used for cakes or as a tea sweetener. *Allium schoenoprasum* (chive) is being collected and used fresh or preserved (probably in salt). Wherever the sporadic shrubs of *Ribes rubrum* (red currant) are found, the fruit is consumed directly.

A highly valued component of any plant available in the tundra and forest tundra is its sugar content. Sugar also acts as a preservative, without further cooking, because the region is cold and without microbes.

Mushrooms are usually not consumed in this region, but *Amanita muscaria* may have been used for ritual (shamanistic) purposes and "chaga" (a mushroom parasitizing on birches) is used to produce a heavy, dark liquid for drinking.

3.3. Animals of Polar Ural Mts

Animal composition in the Polar Urals changes radically throughout the year (Dobrinskiy, ed. 1995; Kosintsev 2005). Animals present over the year include reindeer (*Rangifer tarandus*), wolf (*Canis lupus*), glutton (*Gulo gulo*), ermine (*Mustela erminea*), mountain hare (*Lepus timidus*), lemmings (*Dicrostonyx torquatus*, *Lemmus sibiricus*), voles (*Microtus gregalis, M. middendorffi, M. oeconomus, Arvicola terrestris*), willow ptamirgan (*Lagopus lagopus*), and raven (*Corvus corax*). In lakes and rivers we encounter 20 fish species, but most im-

Fig. 4: Actual summer "chum", occupied by one family, lake Taunto. *Obr. 4: Současný letní čum, obývaný jednou rodinou, jezero Taunto. Foto J. Svoboda.*

portant for human nutriture are whitefish (*Coregonus nasus*, *C. lavaretus*, *C. sardinella*, *C. peled*), pike (*Esox lucius*), and burbot (*Lota lota*). Arctic fox (*Alopex lagopus*) appears in winter and elk (*Alces alces*) appears in summer. In spring, more than 80 bird species arrive, and most of them stay until fall. For humans, the most important birds are Arctic loon (*Gavia arctica*), whooper swan (*Cygnus cygnus*), two species of geese (*Anser albifrons*, *A. fabalis*) and six species of ducks (*Anas penelope*, *A. clypeata*, *A. crecca*, *A. acuta*, *Authya fuligula*, *Clangula hyemalis*). Mosquitoes, namely the northern house mosquito (*Culex pipiens*), black fly, and black gnats, represent the most important insect species, especially between June and September.

3.4 People and animals

Throughout the year, fishing and hunting of reindeer, mountain hare, and willow ptarmigan is possible in the Polar Ural region, whereas water fowl is hunted in summer. However the economically important animals become most numerous in spring and fall, when large flocks of water fowl pass through the region. In early winter and early spring, mountain hares and willow ptarmigans migrate and may be hunted with snares. Hunting and fishing can provide nutrition for people only from spring to fall, whereas in winter, only people owning reindeer can survive in this region. From July to September both people and animals suffer from mosquitoes.

During the past few winters, reindeer were no longer pastured at Yangana Pe so wolves (*Canis lupus*) left the area as a result. Bones left by humans in the campsites are not destroyed and the collected bones represent complete assemblages, only partly gnawed or eaten by dogs.

While determining the bone assemblages, in each camp we investigated the accumulation period of the complex (according to organic decomposition on the bone surfaces and remains of muscles, fat, and ligaments); the season (according to individual age); composition of bone types; composition of skeletal elements of each type; individual age structure; patterns of bone fragmentation; and post-mortem changes.

3.5. Active summer camp at the Taunto Lake in 2009

Whereas the Upper Paleolithic occupations in Europe represent independent cultural and economical systems, the subpolar populations of Siberia were exposed to effects of political and economical centralisation. Collectivisation and construction of villages since the 1920s and 1930s introduced intensification with stress upon maximum possible herd sizes, and upon increase in number of females used for reproduction compared to males used for transport. Human movements also became centralized, gravitating around villages instead of adapting optimally to the natural potential of each region. Overgrazing of some areas was one of the results. The discovery of Yamal gas field in the 1960s resulted in the loss of large tracts of land to mining, infrastructure, and associated regimes that pushed increasing number of reindeer into smaller areas of pasture (Potapova, Levina 1956; Chomich 1966; Forbes 1999; Rees *et al.* 2003; Krasovskaya, Tikunov 2006).

Actually, these general tendencies were no more observed in our region of study. An episodically frequented north-south oriented communication axis, consisting of a field road, a parallel railway, and a shop, runs east of Yangana Pe and Nyava Pe. Laborovaya, the nearest village, serves as another center for shopping, basic medical care, and administration. Both the road and the village do not affect substantially the life and economies in the adjacent tundra. Reindeer pastoralism is not the dominant activity over the year, and it is seasonally replaced by fishing and occasional hunting. In summer, Nenets families who do not own enough reindeer to accompany them to northern pastures, stay in place and send their reindeer together with the larger herds. While awaiting the return of their reindeer, they settle on the lake shores south of the Yangana Pe ridge, practice systematic fishing and occasional hunting. The natural resources, of course, are being supplemented by nutriture from the nearest shops. During winter, as the lakes freeze and fishing is not viable, Nenets families move higher to the protected valleys and slopes of Yangana-Pe, while others follow reindeer herds further south towards the railway and the forest.

During our stay in August 2009, we met the Nenets in four family "chums", in groups of two, located on shores of the lakes south of Yangana Pe (Fig. 4). The dwelling and the surrounding landscape represent the base for spatial thinking of all northern ethnics. "Chum" with a central hearth and an axis determined by the entrance creates an ideal circle, reflecting the structure of the world. The "chum" as a whole is considered a female zone, while the surrounding tundra is a male zone. This arrangement certainly does not prevent the other family members or guests to enter such zones, but activities in a given spatial context are always the initiative of the respective sex. In addition, the "chum´s" interior is also divided into a male and female zone, but the women nevertheless move preferentially around

Fig. 5: Sledges with furs and other materials prepared for the winter "chum" are kept near the "chum" or in the open tundra, lake Taunto. *Obr. 5: Kolem čumu nebo ve volné tundře jsou umístěny saně s kožešinami a dalším materiálem pro zimní čum, jezero Taunto. Foto S. Sázelová.*

the central hearth, wheras the more distant zone opposite the entrance, is strictly a male zone (Golovnev 1995; 2004; Sokolova 2007).

The summer "chum" is constructed by females with canvas and these constructions take about 0,5–1 hour to build (the winter "chum" is of reindeer skin and takes 1,5–2 hours). No alignment of larger objects was visible along the margins, be it a stabilizing part of construction (the "teepee-rings" of North America) or result of long-term accumulation of objects on the peripheries (the Yamana model, Svoboda 1999). Around the "chum" are located sledges with furs and other materials prepared for the winter "chum" (Fig. 5; Boukal 2003). The Nenets behave in the landscape as freely as urban dwellers in their apartments. The sledges will be parked wherever it is comfortable, given the plans for the next season, the fishing nets will be left at the lake shore for subsequent use, and vessels or prepared cut up wood for the next camp will be left at favourable camping spots in the landscape.

4. The abandoned "Valley camps" (VC)

The two valley camps are located about 80 m from each other, in a secluded valley of Yangana Pe oriented towards the SW, and in a strategic position on two platforms elevated high above the valley.

4.1. The inside-camp vegetation

Vegetation covers only about 60% of the site´s surface and predominantly includes low herbs. *Dryas punctata* is most common, at places accompanied by *Vaccinium uliginosum ssp. microphyllum*, *Ledum decumbens* and *Empetrum hermafroditum*. Scattered, but in regular spacings, appears *Astragalus subpolaris* (*A. alpinus ssp. arcticus*), *Luzula* sp. div., *Equisetum arvense* / *boreale*, *Oxytropis sordida*, *Polygonum viviparum*, *Campanula rotundifolia*, *Dianthus repens*, *Arctous alpina*, with isolated occurences of *Rosa acicularis*. Low bushes of *Salix lapponum* also appear rarely.

4.2. Vegetation in direct vicinity

The valley bottom on both sides of the brook is densely covered by bush willows (*Salix lanata*, *S. glauca*, *S. lapponum*, *S. phylicifolia*) with moist herbal vegetation covering the floor level (*Polygonum bistorta*, *P. viviparum*, *Cirsium heterophyllum*, *Calamagrostis langsdorffii*, *Rubus chamaemorus*, *R. arcticus*, *Caltha palustris*, *Saxifraga hirculus*, etc.).

In protected biotopes on the slope with a predominantly SE exposure dense patches of *Alnus fruticosa* occur, with "tall herb" communities in between (*Polemonium acutiflorum*, *Aconitum* cf. *baicalense*, *Trollius* cf. *asiaticus*, *Dianthus superbus*, *Veratrum lobelianum*, *Angelica decurens*, *Lamium album*, *Veronica longifolia*, *Geranium silvaticum* (= *Geranium krylovii*), *Petasites frigidus*, *Parnassia palustris*, *Valeriana capitata*, *Rubus chamaemorus*, *R. arcticus*, *Viola biflora*, *Pedicularis* cf. *oederii*, etc).

4.3. Reindeer remains

See Tabs. 2–3.

The bone assemblages accumulated during several different deposition periods. The Upper VC assemblage includes one antler (*cornu*) fragment and 3 complete *metacarpalia* III from minimally 2 adult reindeer. The epiphyses of metapodia are fused. Because the bones do not show remains of muscles and fat and only very few ligaments, the assemblage is more than 1 year old. Two or three (dog) gnaw marks are visible on lower extremities of two metacarpals.

The bone assemblage of Lower VC, area H, includes fragments of: 1 *scapula*, 2 *vertebrae*, 5 *humeri*, 2 *radii*, 1 *femur*, and 1 *tibia*; 2 complete *ulnae* + *radii*, complete *humerus*, *calcaneus*, 2 *metacarpalia* III, 7 *phalanges* I, 5 *phalanges* II and 1 *phalanx* III; fragments of *humerus*, *radius*, *femur* and *tibia* from minimally 2 adult reindeer. One *tibia* belongs to a pre-born individual and 1 *metatarsus* III belongs to a new-born individual. Almost all bones display remains of muscles, fat and a larger amount of ligaments. A fragment of *tibia* and *calcaneus*, as well as 2 *metacarpalia* III and *phalanges* I, II, III are connected by ligaments.

Firsts calves are being born in the second half of April in the Yamal region (Podkorytov 1995), and the presence of pre-born and newborn individuals in this assemblage thus indicates accumulation during spring (late April–early May) of 2009. Only three fragments of *humerus* (1 distal end and 2 fragments of diaphysis) and one fragment of *femur* (from diaphysis) seem to be older than 1 year. A special character of this assemblage is given by the absence of skull bones and trunk (no ribs and only two vertebral fragments present). A larger proportion of the fragments are broken bones, smashed *vertebrae*, and majority of bones (about 60%) show gnawing marks from dogs.

The bone assemblage from Lower VC, area I, includes fragments of 2 *costae*, 2 *scapulae*, 2 *radii*, 3 *tibiae*; complete 2 *calcanei*, 2 *tali*, 10 *metacarpalia* III, 11 *metatarsalia* III, 30 *phalanges* I, 29 *phalanges* II, and 16 *phalanges* III as a minimum of 7 adult reindeer. Part

Tab. 2: Valley camps (VC), reindeer bone assemblages from selected areas. *Tab. 2: Údolní tábory, složení sobích kostí z vybraných ploch.*

Site	Bones	Side	Damages
Upper "VC" area J–K	*cornu*, fr.		broken
	2 *metacarpalia* III, complete	dex	1 gnawed
	metacarpus III, complete	sin	gnawed
Lower "VC", area H	*vertebra cervicalis*, 2 fr.		chopped
	scapula, fr., central part	sin	gnawed
	humerus, complete	dex	gnawed
	humerus, distal end	dex	broken, gnawed
	humerus, distal end	sin	broken, gnawed
	humerus, distal end	sin	broken
	humerus, fr. of diaphysis	dex	broken
	humerus, fr. of diaphysis	dex	broken
	ulna + *radius*, complete	dex	gnawed
	ulna + *radius*, complete	sin	gnawed
	ulna + *radius*, upper half	sin	broken, gnawed
	radius, fr. of diaphysis	dex	broken
	femur, fr. of diaphysis	sin	broken
	tibia, lower end + *calcaneus*	sin	broken, gnawed
	tibia, newborn	dex	gnawed
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II + 1 *phalanx* III, complete	sin	gnawed
	ph. II & *ph.* III & *metacarpus* III + 2 *phalanges* I, complete	sin	gnawed 2 ph. I
	metatarsus III, complete, embryon	dex	gnawed
	phalanx I + *phalanx* II, posterior, complete	sin	
Lower "VC", area I	*cranium*, *os frontalis*, complete, newborn	sin	
	mandibula, complete, newborn	dex	
	costa, upper half	dex	gnawed
	costa, caput	sin	gnawed
	scapula, fr., anterior half	dex	gnawed
	scapula, fr., central part	dex	gnawed
	humerus, complete, newborn	dex	
	humerus, complete, embryon	sin	gnawed
	ulna, complete, newborn	dex	gnawed
	radius, complete, newborn	sin	gnawed
	radius, fr. of diaphysis	sin	broken, gnawed
	radius, fr. of diaphysis	sin	broken
	tibia, lower half + *talus* + *calcaneus*	dex	broken, gnawed
	tibia, lower end + talus + calcaneus	sin	broken, gnawed
	tibia, upper end	sin	broken
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	dex	
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	dex	
	metacarpus III + *phalanx* I + *phalanx* II, complete	dex	gnawed 1 ph. II
	metacarpus III, complete	dex	
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	sin	
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	sin	
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II, complete	sin	gnawed 1 *ph.* I & 2 *ph.* II
	metacarpus III + 2 *phalanges* I + 2 *phalanges* II, complete	sin	gnawed 2 *ph.* II
	metacarpus III + *phalanx* I + *phalanx* II + *phalanx* III, complete	sin	gnawed 1 *ph.* II
	metacarpus III + *phalanx* I + *phalanx* II, complete	sin	gnawed 1 *ph.* II
	metatarsus III + *phalanx* I + *phalanx* II + *phalanx* III, complete	dex	
	metatarsus III + *phalanx* I + *phalanx* II + *phalanx* III, complete	dex	
	metatarsus III + *phalanx* I, complete	dex	
	metatarsus III, complete	dex	
	metatarsus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	sin	
	metatarsus III + 2 *phalanges* I + 2 *phalanges* II + 2 *phalanges* III, complete	sin	gnawed 1 *ph.* II & 1 *ph.* III
	metatarsus III + 2 *phalanges* I + 2 *phalanges* II + *phalanx* III, complete	sin	gnawed 2 *ph.* II
	metatarsus III + 2 *phalanges* I + 2 *phalanges* II, complete	sin	gnawed 2 *ph.* II
	metatarsus III + 2 *phalanges* I + 2 *phalanges* II, complete	sin	gnawed 2 *ph.* II

Tab. 3: Valley camps, individual skeletal segments of reindeer (*Rangifer tarandus*) from selected areas. *Tab. 3: Údolní tábory, jednotlivé části sobích skeletů (Rangifer tarandus) z vybraných oblastí.*

Bones	**Upper "VC", area J–K**		**Lower "VC", area H**		**Lower "VC", area I**	
	NISP	%%	NISP	%%	NISP	%%
cornu	1	25	0	0	0	0
cranium	0	0	0	0	0	0
vertebrae, costae	0	0	2	7	2	2
scapula, coxae	0	0	1	4	2	2
humerus, ulna + radius, femur, tibia	0	0	12	44	5	5
carpalia, tarsalia	0	0	1	4	4	4
metapodia	3	75	2	7	21	19
Phalanges I, II, III	0	0	9	33	77	69
Total	4	100	27	100	111	100

Tab. 4: Material composition of objects in the abandoned Valley camps. A–I: Lower camp, J–K: Upper camp. *Tab. 4: Složení materiálu v Údolních táborech. A–I: spodní, J–K: svrchní.*

Material	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**Total**	%
wood	(-)	(-)	3	2	2	3	17	1	7	4	3	42	10,17
ash	1	1	(-)	1	(-)	(-)	(-)	1	(-)	(-)	(-)	4	0,97
bone	8	11	4	9	(-)	10	31	9	77	2	1	162	39,23
antler	(-)	(-)	(-)	(-)	(-)	(-)	1	(-)	(-)	1	(-)	2	0,48
hoof	(-)	(-)	(-)	(-)	(-)	(-)	(-)	2	11	(-)	(-)	13	3,15
fur	1	(-)	2	1	(-)	(-)	10	13	1	(-)	(-)	28	6,78
straw	(-)	(-)	1	1	(-)	2	2	1	1	(-)	(-)	8	1,94
stone	(-)	(-)	2	11	(-)	(-)	(-)	(-)	(-)	7	(-)	20	4,84
paper	(-)	(-)	2	4	1	1	7	4	1	(-)	(-)	20	4,84
glass	(-)	1	(-)	(-)	(-)	(-)	(-)	1	(-)	7	6	15	3,63
porcelain	(-)	(-)	(-)	(-)	(-)	(-)	(-)	1	(-)	(-)	(-)	1	0,24
plastic	(-)	2	3	8	3	4	27	6	2	(-)	1	56	13,56
metal	1	(-)	(-)	5	(-)	(-)	(-)	10	(-)	3	1	20	4,84
textile	2	(-)	2	10	(-)	(-)	1	1	1	(-)	3	20	4,84
TetraPak	(-)	(-)	(-)	(-)	(-)	(-)	1	1	(-)	(-)	(-)	2	0,48
Total	**13**	**15**	**19**	**52**	**6**	**20**	**97**	**51**	**101**	**23**	**15**	**413**	100
%	3,14	3,73	4,60	12,59	1,50	4,84	23,48	12,34	24,46	5,56	3,73	100	

of *cranium*, 1 *mandibula*, 1 *humerus*, 1 *ulna*, 1 *radius* and 1 *metatarsus* III belong to new-born individual, and 1 *humerus* belongs to a pre-born individual. All bones show remains of muscles, fat and a large amount of ligaments. Fragments of *tibia*, *calcaneus* and *talus*, as well as 9 *metacarpalia* III, 9 *metatarsalia* III and *phalanges* I, II, III are connected by ligaments. As in area H, bones of skull and trunk are almost absent (no vertebrae and only 2 ribs); aspects of bone fragmentation and gnaw marks are the same.

In conclusion, bones collected in the Lower VC (areas H and I) belong to a unique assemblage, formed in spring of 2009. The structure is specific, always dominated by metapodia and phalanges, whereas skulls and trunks are almost completely missing. Epiphyses of all bones (except embryos and new-born individuals) are fused. Another characteristic is that all *metapodia*, *phalanges* and part of the long bones are not split. This is uncommon since marrow is highly sought after by the Nenets and appears as a delicacy in traditional nutriture (Evladov 1992). The ratio of complete bones (excluding antler and bone of the new-born individuals) makes up only 15%. Larger part of *metapodia* and *phalanges* (75%) are connected by ligaments. The skin is scraped off; it is called "kamus" and is valued as a material for dressing. Only 4 *metapodia* (14%), 22 *phalanges* (27%), and 20 other bones (61%) display gnawing marks from dogs.

The bone assemblage from the Upper VC is similar in composition to the Lower VC. Both are formed by 3 groups of bones. The first group includes shoulder-bones, *vertebrae*, ribs, and long bones, as remains of nutriture. The second group includes *metapodia* and *phalanges*, as remains of working processes, namely production of "kamus". Fragments of antler may be added to this group. The third group is formed by embryos and new-born individuals.

4.4. Structure of the Lower Valley camp

See Fig. 6, Tabs. 4–6.

Structure of the lower platform may be separated into domestic areas A–C, possibly "chums", activity areas D–

Tab. 5: Types of food in the abandoned Valley camps. A–I: Lower camp, J–K: Upper camp. *Tab. 5: Složení potravy v Údolních táborech.. A–I: spodní, J–K: svrchní.*

Nutrition	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**Total**	%
bone – edible species	8	11	3	9	(-)	10	31	9	77	2	1	**162**	76,06
cereals	(-)	(-)	(-)	1	(-)	(-)	(-)	(-)	(-)	(-)	(-)	**1**	0,46
instant	(-)	(-)	(-)	(-)	(-)	(-)	(-)	3	(-)	(-)	(-)	**3**	1,41
milk	(-)	2	1	2	(-)	(-)	1	8	(-)	1	1	**16**	7,51
candy	(-)	(-)	2	(-)	(-)	(-)	2	(-)	(-)	(-)	(-)	**4**	1,88
preserves	(-)	(-)	(-)	(-)	(-)	(-)	(-)	2	(-)	8	(-)	**10**	4,69
alcohol	(-)	(-)	1	2	(-)	(-)	(-)	1	(-)	1	6	**11**	5,16
juice/limo	(-)	(-)	(-)	2	(-)	(-)	2	2	(-)	(-)	(-)	**6**	2,81
Total	**8**	**13**	**7**	**16**	**(-)**	**10**	**36**	**25**	**77**	**12**	**8**	**213**	100
%	3,80	6,10	3,27	7,51	0	4,69	16,90	11,74	36,2	5,63	3,80	100	

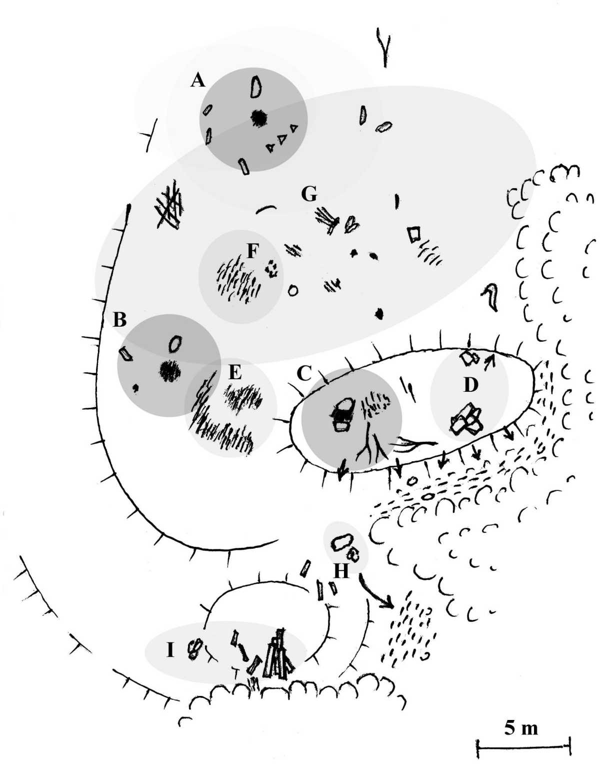

Fig. 6: Yangana Pe, plan of the Valley camp – lower, facing north. Dark circles A–C: interior domestic areas (“chums”), light-colored zones D–G: exterior activity areas, H–I: peripheral toss areas. *Obr. 6: Jangana Pe, plán Údolního tábora – spodní část, orientace k severu. Tmavé kruhy A–C: interiérové sídlení zóny (čumy), světlé kruhy D–G: exteriérové zóny aktivit, H–I: periferní odpadové zóny.*

Fig. 7: Valley camp – lower. View from a hearth with two cooking stones towards the site periphery. *Obr. 7: Údolní tábor – spodní část, pohled od ohniště se dvěma kameny pro vaření směrem k periferii sídliště. Foto J. Svoboda.*

G, and depository and toss zones H–I. The total dimension of the occupied area is approximately 35 × 25 m in size. Two hearths with circular domestic areas around, and a pile of wood nearby, are located on the platform (A, B). Adjacent are two circular activity areas of 5 m and 3 m in diameter with wood splinters (E, F) and additional objects were scattered over the surrounding area (G).

On the elevation at the southern promontory, there is another domestic area (a “chum”?) containing a hearth with two flat stones used for cooking, with wood splinters and sticks around (C). An adjacent activity area (D) included a pile of stones and individual stones around. Below the promontory lies a depository of wooden planks and a toss zone of discarded objects (reindeer bones), and two piles of toss (H–I).

4.5. Structure of the Upper Valley camp

Occupation remains on the higher platform (J–K), adjacent to the east, and measuring 50×25 m, are less clear. A pile of stones dominates on the plateau promontory, an accumulation of ashes and objects is dispersed on the surface. Nevertheless we expect that domestic and activity areas existed here as well.

5. The abandoned “Slope camps” (SC)

One of the shallow valleys crossing the southern slopes of Yangana Pe, formed by a brook surrounded by bushes, shows intensive and variable traces of human activites. There is a larger lower camp and a smaller upper camp.

5.1. The inside-camp vegetation

Tab. 6: Types of objects in the abandoned Valley camps. A–I: Lower camp, J–K: Upper camp. *Tab. 6: Složení potravy v Údolních táborech.. A–I: spodní, J–K: svrchní.*

Nutrition	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**Total**	%
wood as fuel	(-)	(-)	3	1	1	3	17	1	1	4	2	**33**	16,41
stone	(-)	(-)	2	11	(-)	(-)	(-)	(-)	(-)	7	(-)	**20**	9,95
ash	1	1	(-)	1	(-)	(-)	(-)	1	(-)	(-)	(-)	**4**	1,99
insulation	(-)	(-)	1	3	3	3	20	(-)	(-)	(-)	1	**31**	15,42
cord/rope	(-)	(-)	(-)	2	(-)	(-)	1	(-)	(-)	(-)	1	**4**	1,99
wooden object	(-)	(-)	(-)	(-)	1	(-)	(-)	(-)	6	(-)	(-)	**7**	3,48
textile covers	2	(-)	1	6	(-)	(-)	1	(-)	(-)	(-)	(-)	**10**	4,98
domestic equipm.	(-)	(-)	(-)	(-)	(-)	(-)	3	4	(-)	(-)	(-)	**7**	3,48
shaving	(-)	(-)	(-)	1	(-)	(-)	2	(-)	(-)	(-)	1	**4**	1,99
clothes	(-)	(-)	1	3	(-)	(-)	(-)	3	1	(-)	2	**10**	4,98
hygiene/medicine	(-)	1	1	(-)	(-)	(-)	(-)	1	(-)	(-)	(-)	**3**	1,49
bone non-edible species/hoof/antler	(-)	(-)	1	(-)	(-)	(-)	1	2	11	1	(-)	**16**	7,96
fur	1	(-)	2	1	(-)	(-)	10	11	1	(-)	(-)	**26**	12,94
straw	(-)	(-)	1	1	(-)	2	2	1	1	(-)	(-)	**8**	3,98
packing	(-)	(-)	1	3	1	2	4	1	2	(-)	(-)	**14**	6,97
newspaper	(-)	(-)	(-)	1	(-)	(-)	1	(-)	(-)	(-)	(-)	**2**	0,99
others	1	(-)	(-)	1	(-)	(-)	(-)	(-)	(-)	(-)	(-)	**2**	0,99
Total	**5**	**2**	**14**	**35**	**6**	**10**	**62**	**25**	**23**	**11**	**7**	**201**	100
%	2,48	1	6,97	17,41	2,99	4,98	30,85	12,44	11,44	5,47	3,48	100	

The species structure on the both slope camps concurs with that of the valley camps. Dwarf shrubs (*Ledum decumbens*, *Dryas punctata* and *Empetrum hermafroditum*) and low forms of *Betula nana*, *Salix lapponum*, *S. glauca* and *S. phylicifolia* are among the dominating taxa. At some climatically exposed areas we observed the typical frost boil soils, deprived of vascular plants on the surface and thus open to erosion by water, wind and frost. Initial stages of these rough soils, prepared for possible future coverage by vascular plants, are characterized by algae (*Chlorophyta*, *Cyanophyceae*) and by sporadic juvenile stages of lichens and bryophytes.

5.2. Vegetation in the direct vicinity

Again, the vegetation structure recalls the valley camps, but the overall landscape physiognomy is closer to mountain tundra. Larger areas of shrub vegetation with dominating *Alnus fruticosa* are restricted to protected sections of the slope and to shallow depressions. *Salix* (especially *S. lanata*) covers larger areas around peat-bogs and along brooks. The herbs are dominated by the family *Cyperaceae* (*Carex sp.* div., *Eriophorum sp.* div.) and by various tall herbs.

5.3. Reindeer remains

See Tabs. 7–8.

The bone assemblage from Lower SC, area D, includes two parts given the time of origin. The first part includes fragments of 1 *cornu*, 1 *cranium*, 1 *mandibula*, 2 *coxae*, 2 *humeri*, 1 *radius*, 2 *femori*, 2 *tibii*, 2 *metatarsalia* III and 4 fragments of diaphysis of indeterminate long bones; whole – 2 *vertebrae*, 1 *tibia*, 2 *calcaneii*, 2 *tali*, 1 *os tarsale centrale*, 1 *os malleolare*, 2 *ossa carpi*, 1 *metacarpus* III, 4 *metatarsalia* III, 7 *phalanges* I, 5 *phalanges* II, 2 *phalanges* III and 2 *ossa sesamoidea*. The bones belong to a minimum of 5 adults and 1 juvenile reindeer, and the *mandibula* belongs to a newborn. Presence of the newborn places the accumulation period in spring (Podkorytov 1990). The bones show no traces of fat and muscles, whereas ligaments, preserved on almost all of the bones, are dry. This suggests that the bones were accumulated 1–2 years ago. The second part includes fragments of 1 *cornu*, 1 *coxa* and 1 *humerus*. Since no traces of ligaments are present and the surfaces are covered by moos, these bones were deposited more that 3 years ago. Of importance is the lack of trunk bones (no ribs and only two *vertebrae*). Almost all bone fragments are due to breakage, only one skull and one rib are cut. The complete bones make up 62% of the assemblage, with dominance of *metapodia* and *phalanges*. About 40% of the bones were gnawed by dogs.

The bone assemblage from Lower SC, area A, includes fragments of 1 *cornu*, 1 *cranium*, 3 *costae*, 1 *radius* and *ulna*, 5 fragments of diaphys of *metacarpus* III and 6 fragments of diaphys of *metatarsus* III, belonging to at least 1 sub-adult reindeer. Another *maxilla* belongs to an individual of about 2 years old, probably killed here in spring (Klevezal 2007). All bones show traces of fat and ligaments, suggesting that the bones were accumulated during the last spring (2009). Bones from all parts of the skeleton are present. All bones are fragmented and the majority (about 90%) show gnaw marks from dogs.

The bone assemblage scattered within the Upper SC includes fragments of 2 *cornu* and 2 *crania*, from a minimum of 2 adult individuals. One fragment of antler is

Tab. 7: Slope camps (SC), reindeer bone assemblages from selected areas. *Tab. 7: Svahové tábory, složení sobích kostí z vybraných ploch.*

Site	Bones	Side	Damages
Antler accumulation	2 *corna*, dex. and 2 *corna*, sin. from 2 individuals; 1 *cornu*, dex.; complete; detached from the skulls		3 of the dex have cut the anterior antler
	1 *cornu* and 1 *cornu* from 1 individual; complete; casts	dex & sin	1 of the dex have cut the anterior and posterior antlers
	3 *cornu* from 3 individuals; complete; casts	dex	
	1 *cornu*; complete; casts	sin	cut the anterior antler
Upper Slope camp	cornu, fr.		sawed off, gnawed
	cornu, fr.; dropped		gnawed
	cranium, fr. *os frontalis* & *ossa parietalia*		chopped
	cranium, fr. *os frontalis*, *ossa parietalia* & *os occipitalis*		chopped
Lower Slope camp, area A	*cornu*, fr.		broken
	maxilla, complete, semiadultus	dex	broken
	2 *costae*, fr., upper half	dex & sin	gnawed
	costa, fr., middle part	sin	gnawed, broken
	ulna + *radius*, upper half	sin	gnawed, broken
	5 *metacarpalia* III, fr. of diaphysis		gnawed, broken
	6 *metatarsalia* III, fr. of diaphysis		gnawed, broken
Lower Slope camp, area C–F	*cornu*, fr.		gnawed
	cornu, fr.; dropped		
	cranium, 3 fr. *os frontalis* & *ossa parietalia* from 1 individual		chopped
	maxilla, 2 fr. from 1 individual, adultus	dex & sin	broken
	mandibula, 2 fr. from 1 individual, newborn	dex	gnawed
	vertebrae cervicales, 2 specimens from 1 individual, complete, juvenile		gnawed
	coxae, 2 fr. from 1 specimen	sin	gnawed
	coxa, fr.	dex	gnawed, chopped
	humerus, distal end	dex	broken
	humerus, fr. of diaphysis	dex	broken
	humerus, fr. of diaphysis	sin	gnawed, broken
	ulna, fr. of diaphysis	dex	gnawed, broken
	femur, lower half	dex	gnawed, broken
	femur, fr. of diaphysis	dex	gnawed, broken
	tibia, complete	dex	
	tibia, 2 lower half	dex & sin	broken
	2 *tali* + 2 *calcanei*, complete	dex & sin	
	os tarsale centrale	dex	gnawed
	os malleolare, complete	dex	
	2 *ossa carpi*, complete	sin	
	2 *metacarpalia* III, complete	dex & sin	
	4 *metatarsalia* III, complete	dex	1 gnawed
	metatarsus III, fr. of diaphysis	dex	gnawed, broken
	metatarsus III, complete	sin	
	5 *phalanges* I, anterior, complete		1 gnawed
	2 *phalanges* I, posterior, complete		
	3 *phalanges* II, anterior, complete		1 gnawed
	2 *phalanges*, posterior, complete		
	2 *phalanges* III + *sesamoid*, posterior, complete		
	Long bones – 4 fr. of diaphysis		gnawed, broken

Tab. 8: Slope camps, individual reindeer bones (*Rangifer tarandus*) from selected areas. *Tab. 8: Svahové tábory, jednotlivé části sobích skeletů (Rangifer tarandus) z vybraných ploch.*

Bones	**Lower "SC, area C–F"**		**Lower "SC, area A"**	
	NISP	%%	NISP	%%
cornu	1	2	1	6
cranium	5	10	1	6
vertebrae, costae	2	4	3	17
scapula, coxae	2	4	0	0
humerus, ulna+radius, femur, tibia	8	16	1	6
carpalia, tarsalia, sesamoidea	10	20	0	0
metapodia	8	16	11	65
phalanges I, II, III	14	28	0	0
Total	50	100	17	100

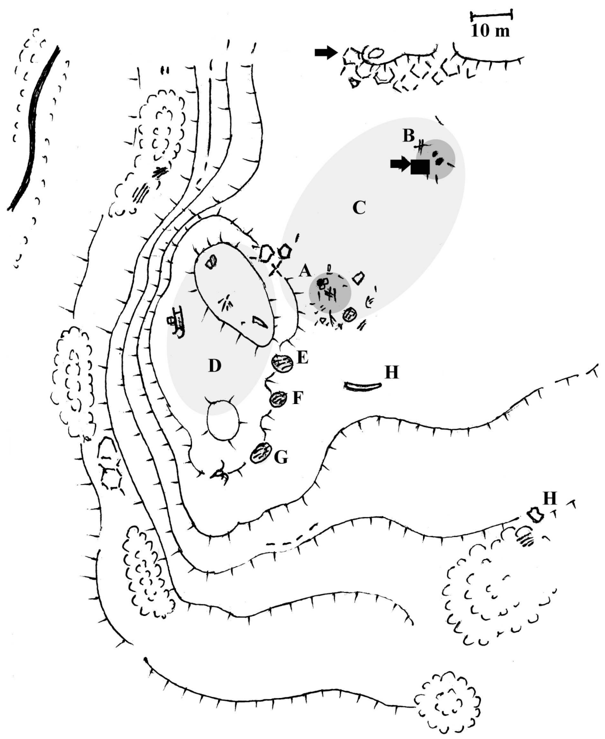

Fig. 8: Yangana Pe, plan of the Slope camp – lower, facing north. Dark circles A, B: interior domestic areas ("chums"), light zones C–D: exterior activity areas, E–G: peripheral toss areas, H: periphery. The arrows point to the upper rock (with a large bottle inserted in a fissure) and an interior children´s playground (black square inside B). *Obr. 8: Jangana Pe, plán Svahového tábora – spodní část, orientace k severu. Tmavé kruhy A, B: interiérové sídlení zóny (čumy), světlé ovály C–D: exteriérové zóny aktivit, E–H: periferní odpadové zóny. Šipky ukazují horní skalisko (s velkou lahví vsunutou do skalní pukliny) a interiérovou dětskou zónu (černý čtverec uvnitř B).*

Fig. 9: Slope camp – lower section, with sledges in front. *Obr. 9: Svahový tábor – spodní část, v popředí sáně. Foto M. Holub.*

sawn off, another skull fragment has cut off antlers. Both skull fragments are cut in order to get to the brain. They are covered by moos, show no ligament remains, and were accumulated more than 3 years ago.

A separate antler accumulation on the highest top of the Upper SC included 11 pieces, 7 right and 4 left, originating from 8 adult individuals. These include three couples from three individuals and single pieces from 5 individuals. 8 pieces are naturally discarded, while 5 pieces were broken off from skulls of three individuals before the natural discard. This suggests that these antlers were intended to be assembled. Some pieces are covered by moss and lichen, suggesting that the accumulation period may have exceeded 5 years. Possibly, one or both antlers of one individual were added into the cache each year. All distal parts of the branches show gnawing by reindeer, and one left antler shows branch breakage. Some antlers have various branches sawn-off by humans. Reindeer males discard antler in winter, females do so 4–7 days after birthgiving (Podkorytov 1995), that means in spring, but it is difficult to determine male and female antler in this case. Anyhow, given the fact that Nenets families stay in this region in spring, summer, and fall, these pieces were probably collected and deposited in the cache in spring. Nenets usually deposit antler at sacred places (Chomich 1995), and the Upper SC may be one such location of a migrating family.

In conclusion, bones from the Lower and Upper SC compose three assemblages of various ages: spring 2009 (Lower SC, area A), 1–2 years ago (larger part of Lower SC, area D), and more than 3 years ago (3 bones of Lower SC, area D, and Upper SC). The two assemblages from

Tab. 9: Material composition of objects in the abandoned Slope camps. A–H: Lower camp, I: Upper camp. *Tab. 9: Složení materiálu ve Svahových táborech. A–H: spodní, I: svrchní.*

Material	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**Total**	%
wood	42	7	1	6	18	14	7	11	3	**109**	23,95
ash	1	(-)	(-)	(-)	(-)	(-)	2	(-)	(-)	**3**	0,67
bone	17	8	18	3	12	17	5	4	14	**98**	21,54
antler	1	(-)	(-)	1	(-)	(-)	(-)	4	11	**17**	3,74
fur	3	11	1	(-)	(-)	(-)	2	3	(-)	**20**	4,39
straw	4	1	(-)	(-)	(-)	(-)	(-)	(-)	1	**6**	1,32
paper	3	7	(-)	(-)	1	(-)	4	8	4	**27**	5,93
glass	4	9	(-)	(-)	2	12	(-)	2	2	**31**	6,81
porcelain	(-)	1	(-)	(-)	(-)	(-)	(-)	2	(-)	**3**	0,67
plastic	17	4	(-)	(-)	3	2	1	5	10	**42**	9,23
metal	6	8	(-)	(-)	3	7	(-)	1	8	**33**	7,25
textile	18	10	2	1	8	1	3	10	1	**54**	11,86
TetraPak	3	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	**3**	0,67
others	4	(-)	(-)	(-)	(-)	(-)	(-)	4	1	**9**	1,97
Total	**121**	**66**	**22**	**12**	**47**	**53**	**24**	**54**	**55**	**455**	100
%	26,59	14,50	4,83	2,64	10,33	11,64	5,27	11,86	12,08	100	

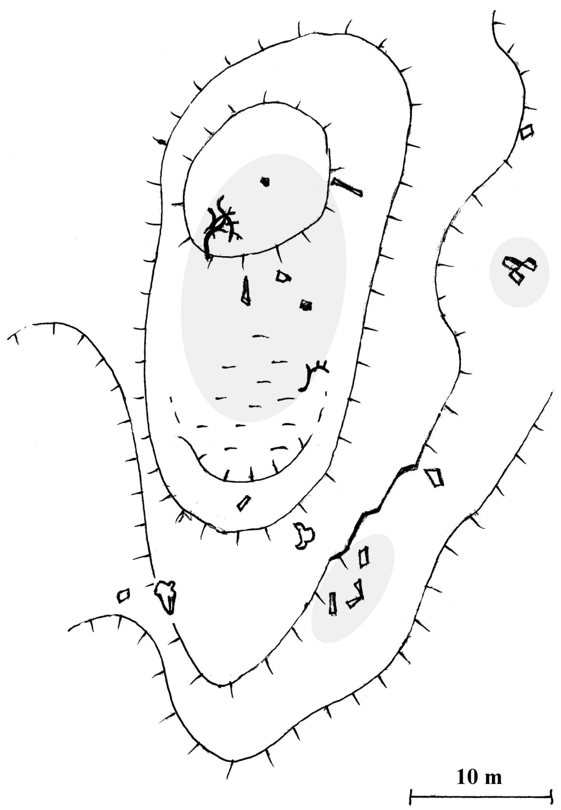

Fig. 10: Yangana Pe, plan of the Slope camp – upper section, facing north. *Obr. 10: Jangana Pe, plán Údolního tábora – horní část, orientace k severu.*

Lower SC are large enough for a characterisation, showing that bones of the trunk are very rare (vertebrae, ribs), whereas distal parts of the legs are much more numerous (such as *metapodia*, *phalanges*, *ossa carpi* and *ossa tarsi*). Lower SC, area A, includes one juvenile reindeer, whereas area D includes minimum of 5 adults and 1 juvenile reindeer. No complete bones were recovered from area A, whereas in area D they make up more than half the assemblage. Dog gnawing is visible on almost all bones from area A, whereas in area D they make up less than a half.

In terms of taphonomy, bones from the Lower SC, area A, constitute one complex – all are food remains. Bones from area D may be separated into three groups. The first group includes a skull, vertebrae, ribs and long bones, as food remains. The second group includes metapodia, phalanges, and antler fragments as remains of a technological process, namely the production of „kamus“. The third group includes remains of a newborn baby. Bones from the Upper SC result from several taphonomic complexes, with skull fragments as food remains, an antler fragment as remains of a technological process, and the antler accumulation as a specific case of deposition, possibly symbolic.

5.4. Structure of the Lower Slope camp

See Fig. 8, Tabs. 9–11.

The lower camp is larger (100 m × 70 m) and may be divided into several zones. The upper (northern) margin is marked by a rock formation, the southern margin by an oval-shaped elevation dominating above the brook valley. Pentagonal sorted circles are developed below the upper rock as well as on the slope below the site. On the plain connecting the rock and the elevation, two circular domestic areas, possibly “chums”, were recorded. The first one (A) has no visible hearth, but a relatively high concentration of objects (wood, bones, cans, textiles, cordage, straw). The second one (B) has traces of a hearth in the center, and a children´s area inside (paper images of animals, a child´s ring). The plateau between these features (C) yielded individual dispersed objects, but discrete activity areas could not be distinguished.

Tab. 10: Types of food in the abandoned Slope camps. A–H: Lower camp, I: Upper camp. *Tab. 10: Složení potravy na Svahových táborech. A–H: spodní, I: svrchní.*

Nutrition	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**Total**	%
bone – edible species	17	8	18	3	12	17	5	4	14	**98**	55,68
cereals/pasta	(-)	1	(-)	(-)	(-)	(-)	(-)	(-)	(-)	**1**	0,57
instant	(-)	(-)	(-)	(-)	(-)	(-)	1	2	(-)	**3**	1,69
milk	3	2	(-)	(-)	2	2	(-)	(-)	5	**14**	7,95
candy	2	(-)	(-)	(-)	(-)	(-)	(-)	2	7	**11**	6,25
preserves	4	2	(-)	(-)	(-)	13	(-)	1	2	**22**	12,50
alcohol	2	9	(-)	(-)	(-)	3	(-)	1	(-)	**15**	8,53
juice/limo	3	(-)	(-)	(-)	(-)	(-)	(-)	(-)	1	**4**	2,27
cigarettes	2	(-)	(-)	(-)	(-)	(-)	(-)	3	(-)	**5**	2,84
vegetables	2	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	**2**	1,13
others	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	1	**1**	0,57
Total	**36**	**22**	**18**	**3**	**14**	**35**	**6**	**13**	**30**	**176**	100
%	20,45	12,50	10,23	1,69	7,95	19,89	3,40	7,37	17,04	100	

Fig. 11: Slope camp – upper section, the antler deposit at the highest elevation, possibly has a symbolic meaning. *Obr. 11: Údolní tábor, horní část, akumulace parohů na nejvyšším místě, zřejmě symbolického významu. Foto J. Svoboda.*

On the top of the southern promontory (D) is an accumulation of bottles, complete sledges with a pot on them were observed on the plateau below, and animal bones were dispersed all around. Three restricted toss accumulations (E–G) were deposited along the eastern margin of this elevation.

Isolated objects are located on the peripheries (H), including parts of sledges, a reindeer skin, and other objects discarded on the slope. The remarkable rock above the camp has a fissure with a large bottle inserted inside. In the bushes surrounding the camp and along the brook between the lower and upper camps, we recorded several small cleared areas from woodcutting.

5.5. Structure of the Upper Slope camp

See Figs. 10–11.

The upper camp (I) occupies the top of an oval-shaped elevation, about 20 m × 12 m in size. On the highest part of the plateau is an accumulation of reindeer antler, possibly of ritual significance, the lower part is moist. Individual objects dispersed over the plateau include additional pieces of antler, reindeer skulls, fragments of sledges, pieces of textiles, and bottles. Several accumulations of discarded objects are deposited on the slope along the eastern margin of the elevation.

6. The abandoned Oktyaberskaya campsite

See Figs. 12–13.

About 150 km further south, near the city of Labytnangi and the railway, we explored another type of winter camp, closer to civilisation. The Nenets brought their reindeer almost to the city periphery and sold some of the animals, while others were evidently killed on the spot.

6.1. The inside-camp vegetation

This camp is located on the edge of a sparse *Larix sibirica* forest tundra. The shrub layer is dominated by *Betula nana*, sporadically by *Salix phylicifolia*, and very rarely by *Juniperus sibirica*. Among the dwarf shrubs, species of families *Ericaceae* and *Vacciniaceae* (*Empetrum hermafroditum*, *Ledum* cf. *palustre*, *Vaccinium uliginosum*, *V. vitis-idaea* and *Arctous alpina*) dominate. As rare occurrences we noted *Rubus chamaemorus* and *Luzula* sp.

Among lichens we regularly recorded *Cladonia* cf. *rangiferina*, *C.* cf. *silvatica*, *C.* cf. *pyxidata*, *Cetraria islandica*, *Cetraria alpestris*, *Peltigera* cf. *aphtosa* and others, among mosses *Hylocomium splendens*, *Dicranum* sp., *Enthodon schreberi*, *Ptilidium ciliare*, *Polytrichum* cf. *strictum*, *Sphagnum* sp. div., *Pogonatum* sp. dominate but many other taxa are present.

6.2. Vegetation in close vicinity

The tree level is formed by light cover of *Larix sibirica* with individual and mostly juvenile exemplars of *Picea obovata* and *Betula pubescens*. Sporadically and mostly in groups is represented *Alnus fruticosa*, exemplars of *Salix phylicifolia*, groups of *Salix lapponum*, *S. glauca*, and *Betula tortuosa*. The dominant shrub is clearly *Betula nana*, forming the so-called "yerniks", together with *Ledum* cf. *palustre* and *Empetrum her-*

Tab. 11: Types of objects in the abandoned Slope camps. A–H: Lower camp, I: Upper camp. *Tab. 11: Složení předmětů ve Svahových táborech. A–H: spodní, I: svrchní.*

Utilities	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**Total**	%
wood as fuel	35	4	1	6	17	13	6	6	1	**89**	31,9
ash	1	(-)	(-)	(-)	(-)	(-)	2		(-)	**3**	1,08
cord/rope/wire	15	1	(-)	(-)	4	1	3	1	(-)	**25**	8,96
wooden object	5	3	(-)	(-)	1	1	(-)	4	2	**16**	5,73
textile covers	5	5	1	1	4	1	(-)	6	(-)	**23**	8,24
domestic equipm.	2	7	(-)	(-)	(-)	(-)	(-)	2	(-)	**11**	3,94
game/toy	1	(-)	(-)	(-)	(-)	(-)	4	3	(-)	**8**	2,87
shaving	2	(-)	(-)	(-)	(-)	(-)	1	1	(-)	**4**	1,43
clothes	8	3	1	(-)	3	(-)	(-)	4	1	**20**	7,17
hygiene/medicine	2	6	(-)	(-)	2	2	(-)	(-)	4	**16**	5,73
bone non-edible species/hoof/antler	1	(-)	(-)	1	(-)	(-)	(-)	4	11	**17**	6,09
fur	2	11	1	(-)	(-)	(-)	1	3	(-)	**18**	6,45
straw	4	1	(-)	(-)	(-)	(-)	(-)		1	**6**	2,15
packing	2	1	(-)	(-)	1	(-)	1	2	1	**8**	2,87
others	3	2	(-)	(-)	1	(-)	(-)	5	4	**15**	5,38
Total	**88**	**44**	**4**	**8**	**33**	**18**	**18**	**41**	**25**	**279**	100
%	31,54	15,77	1,43	2,86	11,82	6,45	6,45	14,7	8,96	100	

mafroditum, of the *Ericaceae*, and with *Vaccinium uliginosum* of the *Vacciniaceae*. The lowermost level is formed by mosses, bog moss and lichens, and a small club moss *Sellaginella selaginoides*. Of a different character are areas with biotopes exposed to frost, wind, and solifluction, without a compact vegetation cover, scattered here and there inside the larch forest tundra. These form polygons of frost boil soils, in center of which are species such as *Andromeda polifolia*, *Salix polaris*, *Tofieldia pusilla*, *Diapensia lapponica*, *Pinguicula alpina* and *Polygonum viviparum*. The polygon margins are populated by *Loiseleuria procumbens*, *Dryas* cf. *octopetala* and *Arctous alpina*, mosses are represented by *Ptilidium ciliare*, *Rhacomitrium lanuginosum*, *Hylocomium splendens*, *Enthodon* cf. *schreberi*, and depressions are populated by *Aulacomnium turgidum*, *Dicranum* sp., *Polytrichum* sp. etc. Lichens are represented by the tundra species *Dactylina arctica*, *Thamnolia vermicularis* and frequently *Cetraria islandica*, *C. nivalis*, *C. deliseii*, *Cetraria mitis*, *C.* spec. div., *Cladonia rangiferina*, *C. pyxidata*, *C. sylvatica*, *C. alpestris* and others, precisely undetermined mosses and lichens.

6.3. Structure of the camp

See Fig. 12, Tabs. 12–14.

The site is located between a shallow valley with open tundra in the south and a sparse larch forest in the north. It forms an irregular circle, the core of which measures 35 m in diameter, the periphery 65 m in diameter, and individual objects are scattered even further into the tundra, beyond the camp boundaries.

The core area is composed by two domestic areas, possibly “chums” (A, B), with directly adjacent woodcuting areas, a conus and a pile of cut up wood (F), and an area of reindeer bone scatter, possibly of one individual (G). One of the “chums” (A) included interior childrens´ playground (paper cutout, a pencil, a gum).

The frontal (southern) periphery opened towards tundra and consists of woodcutting activity areas with reserve piles of cut up wood (C–E), accumulations of various objects and bones and two scatters of reindeer remains (bones and skins). Extended areas of reindeer excrements and hair are located along the SW periphery, where the animals were obviously kept.

The back (northern) periphery along the forest margin consists of about 8 toss accumulations with discarded bottles, cans, paper boxes, 2–3 ash accumulations, reindeer skins and a reindeer carcass.

Compared to the northern sites, the structure of Oktyaberskoye shows standard character, but the prepared wood piles left at place were larger and cut by a chainsaw (petrol or kerosene canister was left at the site). Cut tree trunks are visible in the nearby forest. There is an evident change in toss structure: the discarded bottles of honey or preserves, predominating in the north, are now being replaced by bottles of vodka and boxes of champagne. The preference for alcohol suggests that the site was dominated by adults, although the identified children´s playground demonstrates their presence.

6.4. Dispersed human traces in the surrounding landscape

In the surrounding forest tundra, we recorded areas of intensive woodcutting by chainsaw. Antler, cans or other vessels, belts and a variety of other objects, possibly symbolic, were attached to individual trees.

7. Interpreting the inventories of abandoned campsites

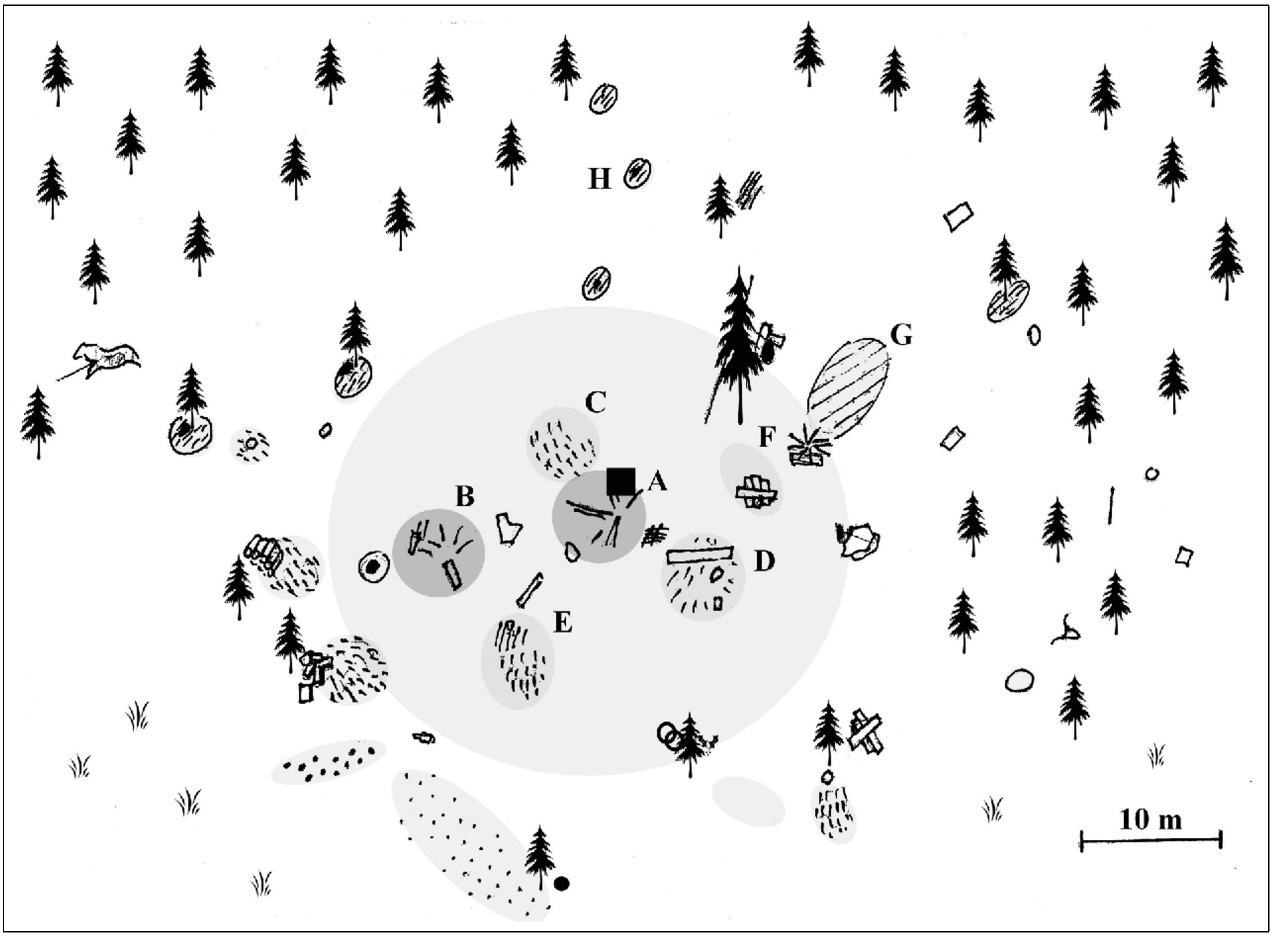

Fig. 12: Plan of the Oktyaberskaya camp, facing north. Dark circles A, B: domestic areas ("chums"), light zones C–F: activity areas, G: dispersed reindeer bones, H: toss areas. Black dots: dispersal of reindeer excrements, light dots: dispersal of reindeer hair, black square inside A: interior children´s playground. *Obr. 12: Okt´aberskaja, plán tábora, orientovaný k severu. Tmavé kruhy A, B: interiérové sídlení zóny (čumy), světlé zóny C–F: exteriérové zóny aktivit, G: rozptýlené kosti soba, H: periferní odpadové zóny. Černé body: rozptyl sobích exkrementů, světlé body: rozptyl sobí srsti, černý čtverec uvnitř A: dětská zóna.*

The catalogue of objects from each camp has been examined based on several criteria. First, we determined the proportions of natural and imported materials (Fig. 17). Second, we categorized several groups according to presumable functions, be it nutriture, architecture, clothing, a variety of indoor and outdoor activities, and related them to the spatial structure at each camp (Fig. 18).

7.1. Nutrition

Basic component of the animal nutriture are the bones of edible animals, dominated generally by reindeer, and only in the VC supplemented by bones of hares. Fishing represents an important activity in summer, but since these are winter camps more distant from the lakes, evidence of fishing was absent. In addition, fish remains are given to dogs and disappear from the record. The lack of evidence also concerns the plant resources which were substituted by imported goods.

Fig. 13: Oktyaberskaya campsite, general view. *Obr. 13: Okt´aberskaja, celkový pohled na tábořiště. Foto J. Svoboda.*

Bone remains from the Valley camps and Slope camps show several common patterns. Only a small portion of items are *vertebrae* and *costae* (3% and 8%, respectively), a large proportion belongs to bones of distal parts of the extremities (*carpalia*, *tarsalia*, *metapodia*, *phalanx* I, II, III; 89% and 64%, respectively), all *phalanges* are complete, a large amount of complete *metapodia* occur (100% and 41%, and similar proportions occur in case of other long bones), a large part of fragments is due to breakage instead of cutting (88% and 83%, respectively), and both assemblages include newborn individu-

Tab. 12: Material composition of objects in the abandoned Oktyaberskaya Camp. *Tab. 12: Složení materiálu v táboře Okt'aberskaja.*

Material	A	B	C	D	E	F	G	H	Total	%
wood	10	14	1	48	12	77	(-)	1	**163**	27,3
ash	1	(-)	(-)	2	(-)	(-)	(-)	(-)	**3**	0,5
bone	17	2	1	22	5	9	54	5	**115**	19,26
hoof	2	1	(-)	(-)	(-)	(-)	(-)	(-)	**3**	0,5
antler	5	(-)	(-)	1	23	(-)	(-)	(-)	**29**	4,86
fur	1	3	1	2	(-)	2	2	1	**12**	2,01
straw	1	1	(-)	2	(-)	(-)	(-)	1	**5**	0,84
paper	9	18	(-)	33	6	1	9	2	**78**	13,07
glass	(-)	2	(-)	1	(-)	(-)	(-)	9	**12**	2,01
plastic	10	31	(-)	24	1	7	(-)	13	**86**	14,41
metal	1	4	(-)	7	(-)	1	2	1	**16**	2,68
textile	5	9	(-)	18	4	2	(-)	(-)	**38**	6,36
others	7	12	1	13	3	1	(-)	(-)	**37**	6,2
Total	**69**	**97**	**4**	**173**	**54**	**100**	**67**	**33**	**597**	100
%	11,56	16,25	0,67	28,98	9,05	16,74	11,22	5,53	100	

Tab. 13: Types of food in the abandoned Oktyaberskaya camp. *Tab. 13: Složení potravy v táboře Okt´aberskaja.*

Nutrition	A	B	C	D	E	F	G	H	Total	%
bone – edible species	17	2	1	22	5	9	54	5	**115**	48,94
cereals/pasta	(-)	(-)	(-)	(-)	1	(-)	(-)	(-)	**1**	0,43
instant	2	6	(-)	1	1	(-)	(-)	1	**11**	4,68
candy	7	13	(-)	9	(-)	2	1	11	**43**	18,3
preserves	1	2	(-)	(-)	(-)	(-)	(-)	3	**6**	2,55
alcohol	(-)	5	(-)	7	1	(-)	(-)	4	**17**	7,23
juice/limo	(-)	2	(-)	2	(-)	(-)	(-)	(-)	**4**	1,7
cigarettes	9	7	1	13	3	1	(-)	(-)	**34**	14,47
vegetables	(-)	(-)	(-)	1	1	(-)	(-)	(-)	**2**	0,85
others	(-)	(-)	(-)	1	(-)	(-)	(-)	1	**2**	0,85
Total	**36**	**37**	**2**	**56**	**12**	**12**	**55**	**25**	**235**	100
%	15,32	15,74	0,85	23,83	5,11	5,11	23,4	10,64	100	

Fig. 14: Straw bunch, multifunctional, Slope camp. *Obr. 14: Slaměný věchet, multifunkční, Svahový tábor. Foto S. Sázelová.*

als. There are differences in the frequency of dog gnawing (52% in VC, and 29% in SC). Taphonomy of these assemblages is similar, as both include three complexes: food remains (*cranium*, *vertebrae*, *costae*, and long bones), remains of technological processes that relate to subchapter 7.7 (*antler*, *metapodia*, *phalanges*, the last ones suggesting „kamus“ production), and remains of newborn babies. Although marrow is highly appreciated in the traditional Nenets nutriture (Evladov 1992), majority of *metapodia* and *phalanges* from both locations show no traces of breakage. Preserves represent an important group in all recorded inventories, including jars from pickled cucumbers (all camps), several jars from jams, especially strawberry, peach, apricot and an apple (VC, SC) and ketchup bottles (VC, OC). Since all Nenets are fond of sweets, we recorded at all camps wrappings from various kinds of caramels, fruit caramels, confectioneries, burley sugars, etc. and plastic sticks from lollipops. Variability of candies, chocolates or biscuits increased considerably at the Oktyaberskaya camp, whereas at Yangana Pe, candies are replaced by milk (including tins from condensed sweet milk, two sacks of dried milk and two crucibles from yoghurt). This evidence, together with other indications, suggests that an older child (4–7 years) lived at Oktyaberskaya camp and at least one small child (0–

Tab. 14: Types of objects in the abandoned Oktyaberskaya camp. *Tab. 14: Složení předmětů v táboře Okt´aberskaja.*

Utilities	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Total**	**%**
wood as fuel	9	14	1	24	9	76	(-)	1	**134**	37,02
ash	1	(-)	(-)	2	(-)	(-)	(-)	(-)	**3**	0,83
cord/rope/wire	1	(-)	(-)	5	(-)	1	(-)	(-)	**7**	1,93
wooden object	1	(-)	(-)	23	3	1	(-)	(-)	**28**	7,73
textile covers	1	5	(-)	6	1	1	(-)	(-)	**14**	3,87
domestic equipm.	(-)	1	(-)	6	(-)	(-)	(-)	(-)	**7**	1,93
game/toy	(-)	11	(-)	(-)	(-)	(-)	(-)	(-)	**11**	3,04
shaving	(-)	(-)	(-)	1	(-)	(-)	(-)	(-)	**1**	0,28
clothes	2	2	(-)	11	3	(-)	(-)	(-)	**18**	4,97
hygiene/medicine	(-)	6	(-)	5	(-)	1	4	1	**17**	4,7
bone non-edible species/hoof/antler	7	1	(-)	1	23	(-)	(-)	(-)	**32**	8,84
fur	1	3	1	2	(-)	2	2	1	**12**	3,31
straw	1	1	(-)	2	(-)	(-)	(-)	1	**5**	1,38
packing	6	9	(-)	16	1	3	1	4	**40**	11,05
newspaper, etc.	1	3	(-)	10	2	(-)	5	(-)	**21**	5,8
other	2	4	(-)	3	(-)	3	(-)	(-)	**12**	3,31
Total	**33**	**60**	**2**	**117**	**42**	**88**	**12**	**8**	**362**	100
%	9,12	16,57	0,55	32,32	11,6	24,31	3,31	2,21	100	

Fig. 15: Wooden snow knife, found on the shores of lake Taunt. *Obr. 15: Dřevěný nůž na sníh, nález na břehu jezera Taunto. Foto S. Sázelová.*

3 years) lived at the camps of Yangana Pe. In addition, the category of beverages includes paper boxes and sacks of black tea, non-alcoholic drinks such as lemonades and juices and alcoholic drinks, such as tins of local beer (*Arsenalnoe*, *Baltika*), bottles or fee stamp from vodka, wine and champagne. Again, the concentration of alcohol increased radically at the Oktyaberskaya camp. Frequently, the packings from Tetra Pak boxes, plastic bottles or tins from beverages were cut in center and worn out to be re-utilized as vessels. The last group includes personal habits artifacts, and it includes cigarettes (SC, and especially OC), individual matches, boxes of matches, and a lighter (OC).

The following differences between the individual camps were recorded. At Valley camp we have found a tin from marine *algae* and a sack from buckwheat, at Slope camp there was a jar from honey, a sack from pasta and from instant noodle soup and in the toss zone were two mouldy onions and a margarine tub. More special objects were counted at Oktyaberskaya, such as a small caviar jar, a flour paper bag, two plastic dishes of "Byznysmen" instant food, two potato purée bags and an instant noodle soup, one bottle from Tchibo coffee, one boxboard of sect, one mayonnaise tub, chewing gum packaging, and a sack from lemons.

7.2. Architecture

Reindeer and hare furs were used with the winter coats preferred. The remains recorded vary from complete reindeer skins at SC and OC to individual bunches of hair. Traces of sewing are visible on certain pieces, and some were transformed to products such as a child boot (plus one fragment) from the VC. However reindeer furs also serve as cover for winter "chums" and the Nenets always prefer two layers, one of them with trimmed hair. Several tufts of trimmed hairs and a piece of fur with cut hair was also recorded at SC, where the context suggests that it was a part of children´s play. In case of the summer "chums", coverage of rough canvas is used (same as sledge covers). Parts of canvas sometimes have felt loops along edges.

The collection of cords, ropes, and wires, including hand-knitted cords and ropes from polyethylene fibers of various colors, may be related either to "chum" construction or to load fastening on sledges. However, we cannot exclude that some of these cords or ropes were used during manipulation with reindeer (even if the lasso for catching reindeers, "tinzjan", is traditionally knitted from reindeer skins). Cords and ropes occur at all camps, whereas parts of wires were sporadically observed at SC and OC only. Several wooden posts (VC) or pegs (SC, OC) might be connected with the architecture or with activities associated with breeding reindeer or dogs.

Fig. 16: Child´s fur shoe, Valley camp. *Obr. 16: Dětská kožešinová botka, Údolní tábor. Foto S. Sázelová.*

Fig. 17: "Ngali" – reindeer neck pendant, prevents the animal from escaping. Found on the upper plateau of Yangana Pe. *Obr. 17: "Ngali" – závěsek na sobí krk, zabraňuje zvířeti v útěku. Nalezen na náhorní plošině Jangana Pe. Foto S. Sázelová.*

The skeleton of "chum" is composed by approximately 25–30 wooden poles (one of them was leaning against a larch at OC). On both sides of the hearth, the Nenets first place several wooden planks on the ground (found on periphery of the VC), than straw over it and finally a layer of reindeer furs. Here, women perform their everyday activities and the whole family sleeps on it at night. During winter, the open fire in the center is replaced with a stove (we have found an iron desk with nails from it at SC, and a pipe from a stove´s chimney at OC). In the area opposite to "chum´s" entrance (in front of the zone forbidden to women) is a small table and boxes with dishes.

Location of the central hearth in an abandoned camp is sometimes difficult to identify due to ash being discarded at the camp peripheries. Some of the associated objects, however, were recorded at all camps: parts of a table cover with a sunflower pattern, a broken vessel and a broken cup at VC, a pot with drilled holes on each side, through which a wire was inserted, fastened on sledges at SC, a boiler of 10 litre capacity, an aluminium kettle of 20 litre capacity, a crock from a cup with a flowery pattern, and a broken saucer, all at SC. At OC we photographed a kettle for preparing tea, and a metal bowl with a flowery pattern (not included in the record).

Specific features were recorded in the VC, with two piles of stones (one of 7 pieces and the other of 11 pieces), all of sandstone. Two similar stones were present in the domestic zone, showing traces of burning and remaining ash in between – an *in situ* cooking facility from a hearth. As individual occurences we recorded pieces of insulation and a part of linoleum at VC, chipboard at SC, and a part of wooden box pallet, one hacked bunch with an engraving ИМ, and one box from post at OC.

7.3. Clothing

The Nenets clothes for cold seasons are traditionally produced from furs, whereas the warmer season dresses are usually purchased. This includes female clothing articles, for example, skirts or blouses with flowery patterns, documented by fragments found at all camps (some of these items were re-used and their strings were twisted into a thin cord). Other garment parts encountered in all camps include pieces of utility gloves with nonskid adjustment on the surface, some with traces of technical oil. The last group of clothes belong to children, such as two boots sewn from reindeer fur, discovered in the VC toss zone, part of a green track suit plus sweat shirt, a terry glove with pink stripes, a white child's sock (SC), knickers belonging to a girl of 4–7 years old, a pink hair ribbon, and a used child's sock (OC).

At SC there were fragments of various textiles of blue and white colour or white with blue stripes, and pieces of jumper or mat. At OC, we recorded a tie from jeans, a paper cover from socks (men 23–31), an appending label from clothes, one handkerchief, and female underwear ("bloomers").

7.4. Hygiene, medicine

In the toss zones at all camps, residues of toilet paper, napkins (VC, SC), and a sanitary towel (SC) were discarded. However, straw plus dried mosses were traditionally used for hygienic purposes, as documented at all camps. At VC, we recorded a bottle of cologne; at SC there was a white terry towel with a red stripe, a paper box from tooth paste. At OC we recorded a yellow plastic soap box, a piece of polyporus (which could be used as tinder or for healing) an elastic band on hairs. Medicaments are represented by baled linen as finger-bandage, a grouting point and its cover, capping strip and two ampoules – one with a pellucid solution and the other with white powder (both without any legend) at SC, and three tablets of Paracetamol (two 200 mg for children), a tablet Baralcin M, a tube from Fastum Gel, and box from Diroton (Lisinopril, 10 mg) at OC. However, paper boxes could be also reused for mailing, as indicated by addresses visible on some of them.

7.5. The children´s zones

At two camps, SC and OC, we identified children´s zones with remains of games. At Slope camp, this zone

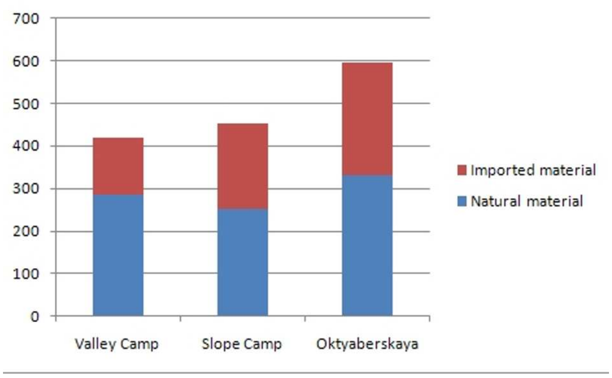

Fig. 18: Graph showing proportion of natural and imported materials in the individual campsites. *Obr. 18: Graf znázorňuje vztah přírodních a importovaných materiálů na jednotlivých tábořištích.*

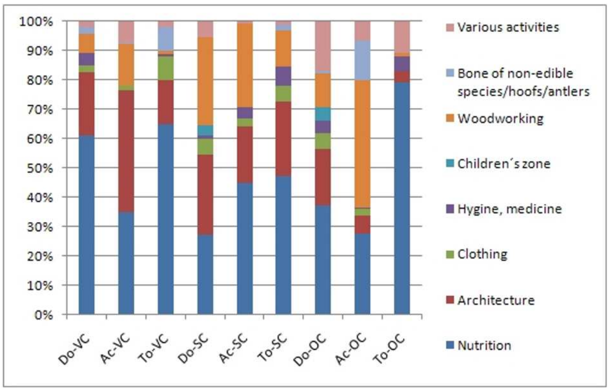

Fig. 19: Graph showing structure of objects in relationship to zonality of the individual campsites. *Obr. 19: Graf znázorňuje strukturu předmětů ve vztahu k zonalitě tábořišť.*

included a part of blue plastic toy, a sprig with a tied rope, several cutouts in the shape of reindeers with cuttings, several white beads on an elastic band (ring?) and two fragments of reindeer fur – one of them with a green dot from felt tip and other with cut hairs and several hair tufts. At Oktyaberskaya camp, the children´s zone included a rubber in the paper with unspecified drawings, part of softened yellow plastic with a pierced hole and traces from human nails on surface, several cutouts in the shape of triangles ("chums"?) from candy packaging, a plastic letter Я and two pencils.

7.6. Woodworking

As fuel for the hearths, collecting wood (especially from larch and alder) in nearby bushes is a typically female activity (Fig. 19). Only at Oktyaberskaya camp, we expect that males cut the larger larch trunks as they were cut using a chainsaw, whereas further preparation of fuel from it was again left to women and girls. At these areas, pieces of birch-bark and dried moss, which could be used as tinder, are usually present in association. A typical feature at all camps are circular concentrations of shavings from reparation of various kinds of wooden objects, especially sledges (at all camps, broken sledge parts were present). These shawings could be also used for heating or placed on the "chum" floors.

7.7. Bone of non-edible species/hoofs/antlers

This group includes complete reindeer hooves and antlers. Hooves were usually joined to the limb bones and placed in toss zones as butchering waste. The otherwise common habit of using reindeer hooves and phalanges as symbols of complete animals in children´s games (museum collections in Salekhard and Sos´va) found no support in our study. At all camps we recorded a mixture of naturally dropped reindeer antlers and antlers cut away from the skulls (and skulls with cut-off antlers were dispersed on slopes and valleys of Yangana Pe), part of them showing traces of gnawing by reindeer or carnivores, in search for minerals.

7.8. Various activities

Two woolly tassels (VC, OC) and scarce fragments of wool of a variety of colours (all camps) might be linked to decoration of human dress or reindeer harness. Various kinds of wrappings (of paper, alluminium, polythene, cellophane etc.) cannot be related to specific activities. Pieces of newspapers were dispersed at all camps. In addition four 1,5 V batterries – Panasonic, Toshiba, Kosmos and Enerljuks and two tins from kerosene or petrol were situated at SC and OC. At VC, there was also a fired shot gun 12/70 (a very cheap model) cartridge, at SC we have found a part of tarry and two handmade patches. A piece of sello tape, part of plastic stake (as from a party tent), several pins, and anti-slip tradle from a scooter were located at OC.

7.9. Symbolic activities

Symbolic meaning may be attributed to an antler cache deposited on a remarkable elevation at the Upper Slope camp (Fig. 11), and in cases of various objects attached to trees in the forest tundra, north of Labytnangi (Fig. 20).

8. Comparisons and conclusions

There is a range of differences between Upper Paleolithic Central Europe, where cultural systems functioned independently, and the contemporary Polar Ural, influenced politically and economically by modern-day civilization centers. In addition, we compare semi-nomadic early hunters with nomadic pastoralists, fishers and hunters. In living camps, "structures évidentes" and "structures latentes" of classical French paleoethnology cannot be separated as clearly as in archaeological sites: the context is systemic, and both structures and objects may be removed from central areas towards peripheral toss zones.

The camps documented in the actual tundra and forest tundra were inhabited in winter or early spring, when the society concentrates on reindeer and when the other natural resources (available in summer) were to a large extent substituted by imported items purchased from shops. There are general similarities in structure of the objects recorded in the three camps, whereas certain variation could be caused by distance from camp to camp and from

Fig. 20: Woodcutting area near the campsites (typically a female task), usually does not exceed 3 × 3 m, to allow easy regeneration of the shrubs. *Obr. 20: Těžba dřeva nedaleko táborů (typicky ženská práce) většinou nepřesáhne prostor 3 × 3 m, což umožňuje snadnou regeneraci křovin. Foto J. Svoboda.*

Fig. 21: Oktyaberskaya, objects attached to a tree near the campsite, possibly of symbolic significance. *Obr. 21: Okt´aberskaja, předměty zavěšené na stromě u tábořiště, zřejmě symbolického významu. Foto J. Svoboda.*

the nearest shop, by demographic structure of the site and by habits of its occupants (Figs. 18, 19). Compared to the camps at Yangana Pe, the Oktyaberskaya campsite displays a remarkable difference in structure of the recorded objects, because of its location close to a railway and the city of Labytnangi where reindeer are being sold and a massive influx of imported goods was recorded. Other differences might be caused by the demographic structure of the camp inhabitants, their economic status (after selling reindeers) or by their personal habits (for example, smoking cigaretes at Slope camp or Oktyaberskaya).

Of what nature are the ethnoarchaeological analogies, if any? Theoretically, both the past hunters´ camps and actual pastoralists´ camps are structured into discrete zones: the interior living areas, exterior activity areas, inner peripheral zones and outer peripheral zones, and dispersed objects and activity traces in the adjacent landscape.

8.1. The interior living areas

The dynamics of human behavior creates obstacles to a clear-cut separation of the individual zones. The hearths, the location of which is considered basic at archaeological sites (Leroi-Gourhan, Brézillon 1972; Stapert 1989; Cziesla 1991), are rarely preserved in their original position at the ethnologically documented sites. Rather, we encounter here areas of ash redeposition on the peripheries. When preserved in its original position, a hearth is usually equipped with two flat stones for cooking. Area around such a hearth ideally corresponds to a “chum”, and the scarce inventory includes fragments of textiles or cords, bone fragments, wood splinters and twigs, straw and straw wisps. The area boundaries are difficult to define, however.

At Slope camp and Oktyaberskaya camp, we localized children´s zones inside the presumed “chums”, with several paper cutouts, a pencil or a gum, and associated objects. This evidence suggests at least one child approximately 0–3 years old and another one around 5 years old at Slope camp, and one child 4–7 years old at Oktryaberskaya. Although we were unable to identify a children´s zone in the interior living area at Valley camp, children could have been present at this site as well, and the evidence just discarded into toss. Napkins and a fur shoe (Fig. 16) belonged to a child approximately 0–3 years old, and another one around 5 years old. Presence of children is also recorded by Binford (1991, 43) at the fall site at Kongumuvuk. Locating interior childern´s play zone in fall, winter and spring camps is natural, because children do not run around as in summer camps, and they tend to play in groups inside.

8.2. The exterior activities areas

Activity zones expand in front of the „chums“ and between them. Especially wooden wood splinters and shavings are being dispersed in circular shapes, as a relict of woodcutting or construction of sledges. In addition, there are fragmented reindeer bones, while complete body parts in anatomical position are rare (and tend to be moved to site peripheries). Some trends were observed in activity zones of the individual sites. At Oktyaberskaya, woodworking using chainsaws markedly predominates over other activities; at this same site, we may reconstruct reindeer butchering within the activities areas, whereas in the other camps such remains were usually discarded. At the lower Slope camp, a higher concetration of medications may be related to treating reindeer during breeding. At upper Slope camp, we identified an accumulation of 11 antler pieces at the highest spot of the camp (Fig. 11). In the Polar Ural region, antler is being offered to the Matress of the Mountains, Pe-ervne (Lar, Kharyuchi, Okotetto 2007). Large accumulations of antler are deposited at various places in Yamal, and especially on Beliy Island. Caches of discarded antler were also recorded at several Upper Paleolithic sites of North Eurasia, as in the Medvezhya Cave in Northern Ural, and the open-air sites of Mal’ta, Buret’ and Mezin.

8.3. The inner and outer peripheries

The toss zones lie in the rear peripheral zone or on adjacent slopes just below the camp. There are accumulations of bottles, cans, pieces of paper or fur, and straw. Expiry dates on cans may indicate the date of the occupation or of repeated stays during the past few years (Table 1). The following trends were observed on the peripheries: at Oktyaberskaya, there is a huge accumulation of purchased food packaging; in peripheries of the Valley camp and the Slope camp, toss zones may overlap spatially with objects conserved for further usage; and, even if traces of woodworking do not enter the toss zones normally, one such case was recorded in the Slope camp.

8.4. Open landscape around

In the tundra surrounding the Slope and Valley camps, we observed restricted areas of manual woodcutting, always limited to zones of about 3 × 3 m, to enable easy regeneration of the shrubs (Fig. 20). In the forest tundra around Oktyaberskaya, a chainsaw was used to cut down larch trees. Individual objects dispersed in the surrounding tundra or forest-tundra may either be prepared at location for subsequent use (sledges, boats, fishing nets), or represent items of ritual and/or symbolic significance (objects attached to individual trees, antler depositions on the ground), or be just randomly discarded objects (Fig. 21).

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Resumé

Využití etnologických analogií je od počátku součástí paleolitického výzkumu, rekonstrukce a interpretace, ale teprve od 60. a 70. let 20. století se s takovými analogiemi pracuje systematicky, s použitím planigrafie tábořišť a prostorové distribuce předmětů a aktivit (Yellen 1977; Binford 1978; 1987; Gamble a Boismier, eds. 1991). V létě 2009, v rámci výzkumu něněckých sídelních strategií (Jamalo-něněcká autonomní oblast, SV Sibiř) jsme dokumentovali aktivní letní tábory u jezer a opuštěné zimní a jarní tábory v otevřené tundře (horský hřeben Jangana Pe) a v lesotundře (Okt'aberskaja, severně od Labytnangi). Z přehledu rostlinných i živočišných zdrojů těchto krajinných typů vyplývá, že poživatelné rostliny a ryby jsou dostupné spíše v létě, zatímco sobi přicházejí jako hlavní potravinový zdroj na podzim, po návratu z letních pastvišť výše na severu, a část jich zůstává až do jara. Chybějící součásti stravy doplňují Něnci nákupy. Míra mobility jednotlivých rodin závisí na tom, zda vlastní dostatečný počet sobů.

Dokumentované tábory jsou strukturovány do určitých zón, což jsou interiérové sídelní prostory (včetně dětských zón), exteriérové zóny s doklady zpracování dřeva, sobích těl a dalších běžných aktivit, na periferii sídliště zóny odpadu a v krajině kolem rozptýlené stopy aktivit (těžba dřeva) a jednotlivé předměty (z nichž některé mohou mít symbolický význam). Ale „evidentní" a „latentní" struktury ve smyslu francouzské paleoetnologie tu lze těžko rozlišit: pevné struktury nevznikají, vše je v pohybu, s tendencí směřovat od centrálních zón k periferním odpadištím.

Rozdíly mezi tábořišti lze vysvětlit prostředím (tundra–lesotundra), vzdáleností mezi tábory navzájem, vzdáleností od nejbližšího obchodu a komunikační sítě, demografickou strukturou lokality, aktivitami obyvatel a jejich finančními možnostmi (například po prodeji části sobů v zimě). Pokud záběr našich komparací rozšíříme o údaje z mladopaleolitických loveckých sídlišť střední Evropy, lze konstatovat, že mají v zásadě podobnou strukturu a zonalitu, přestože výživa, aktivity i předměty jsou samozřejmě podstatně odlišné.

2.4.5 Ethnological approach to Siberian zoomorphs: A search for meaning and implications for the Upper Paleolithic evidence

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ETHNOLOGICAL APPROACH TO SIBERIAN ZOOMORPHS: A SEARCH FOR MEANING AND IMPLICATIONS FOR THE UPPER PALEOLITHIC EVIDENCE

Ethnological analogies derived from studies of recent environments and societies in Arctic and Subarctic regions of Siberia are generally being applied in archaeological interpretative models. The analogies prove to be inspiring, because each of them has the potential to enlarge the scope of static archaeological evidence by including dynamic aspects of social and symbolic systems within recent societies. Here, we analyze electronic databases and literature on zoomorphic and theriantropic figurines collected during the Jesup North Pacific expedition. Subsequently, the social value and mythological context that accompany specific zoomorphic themes were recorded. Some aspects of these paleoethnological implications are partially applicable to the Upper Paleolithic zoomorphs.

Keywords: *Jesup North Pacific expedition, mythology, paleoethnology, Siberia, Upper Paleolithic art, zoomorphic figurine.*

Introduction

Ethnological analogies derived from studies of recent cultural adaptations in Arctic and Subarctic regions of Siberia are generally being applied, with varying degrees of success, to the reconstruction of prehistoric lifestyles. Since the second half of the 19th century, these societies have been used as ethnological parallels for the Upper Paleolithic hunters (Mortillet, 1883; Jochelson, 1908; Abramova, 1995; Marshack, 1991; Owen, 2005; Svoboda et al., 2011). The search for ethnological analogies is usually connected to the reconstruction of everyday life, and is frequently used for interpretations of Upper Paleolithic thinking and symbolism. A comprehensive discussion of their potentials in Upper Paleolithic mobile art is supported by a relatively broad spectrum of represented animal species (such as mammoths, rhinoceroses, reindeer, horses, bison, lions, bears, owls, wolverines, and indeterminate others), and by different materials used in the production of these figurines (namely ivory, bones, soft stones, and ceramics). Therefore, a comparison of the proportion of each zoomorphic theme in figurines and the archaeozoological material at a specific locality is usually realized (Klíma, 1979; Vandiver et al., 1989; Der Löwenmensch…, 1994; Svoboda, 1997; Verpoorte, 2001; Djindjian, 2004; Sauvet, Wlodarczyk, 2008). After that, a specific relation or disproportion of these "natural symbols" is estimated, and each zoomorphic theme is matched with its probable social function. Consequently, we can find four main perspectives in literature:

1) Solving of hunting problems. The zoomorphic theme has to lure a desired animal. Simultaneously, the figurine represents a kind of promise to the prey's spirit that the hunter will not kill more individuals than he actually needs. Another possible interpretation is a symbolic decrease of hunting fever, which might have

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seriously endangered the real hunting. The blows on heart or head on several zoomorphic figurines probably support this interpretation.

2) Obtaining or debilitating of animal power. The humans endeavor to obtain such animal characteristics or qualities as are extra-ordinary to human bodies (such as a mammoth's strength, a reindeer's endurance, a lion's nimbleness). Thus, the zoomorphic figurines represent amulets or other protective charms, which are connected with a source of desired animal power. According to the Upper Paleolithic evidence, we can find several zoomorphs with the traces of attacks or other damage (such as blows and thermal shocks), which are usually interpreted as a sign of human effort to deprive or capture the favorable abilities of the animal (to exclude the largest competitors or to weaken the power of game).

3) Allegoric depiction solves problems and conflicts in the Upper Paleolithic society by transferring their relationships into the world of animals. The allegorical and funny representations are supposed to bring ease and relief in a specific stressful situation.

4) Mythological meaning ascribes to each zoomorphic theme a deeper interpretation, which might be connected with the cosmological concepts of Upper Paleolithic society. Thus, the zoomorphic figurines are supposed to represent totemic ancestors, mythological protectors, or protective and helping spirits (Gerasimov, 1931; Absolon, 1938, 1945; Klíma, 1979, 1989; Gamble, 1982; Hahn, 1986; Delporte, 1990; Gvozdover 1995; Davidson, 1997; Hunters…, 2000; Lewis-Williams, 2002; Borić, 2007; Porr, 2010).

All of these interpretations were inspired by ethnological analogies and have the potential to enlarge the scope of the static archaeological evidence by including dynamic aspects of social and symbolic systems within recent societies (Binford, 1962; Stiles, 1977; Lewis-Williams, Dowson, 1988; David, Kramer, 2001). However, in this paper we do not try to identify similarities between the perception of animals among Upper Paleolithic humans and that of recent societies of Siberia. We concentrate on overcoming our Western cultural attitude to the human-animal relationships, of which recent Siberian societies certainly had a different conception.

Jesup North Pacific expedition: Material description

The Jesup North Pacific expedition was coordinated by Franz Boas and sponsored by Morris K. Jesup during the years 1897–1902. The expedition aimed at mapping contacts and relationships between local ethnics on both sides of the Bering Strait. This article will focus on the Siberian part of this expedition, which started in 1898 and was spread out into three basic teams (Fig 1). The first team was led by Berthold Laufer, and its research in years 1898–1899 was concentrated on the study of Nanai and Nivkh people living in the region around the Amur River and on Sakhalin Island. From 1900, the other two teams were operating in northeastern Siberia; the second was led by Waldemar (Vladimir Germanovich "Tan") Bogoras and his wife Sophia, who were working and collecting objects in the territories of the Chukchee, Koryak, Kerek, Siberian Eskimo, Itelmen and Even people. The third team, led by Waldemar (Vladimir Ilyich) Jochelson and his wife, Dina Brodsky Jochelson, focused on the territories of the Koryak and Yukaghir people (Laufer, 1900; Boas, 1903; correspondence from AMNH archive*).

General aspects of the collection. In our analysis, 1023 objects showing zoomorphic or theriantropic motifs of various ethnic groups were studied via the electronic database of the American Museum of Natural History (AMNH) in New York (Table 1; Sázelová, 2012). All the items can be divided into two groups, according to their shape. The major part of this collection (94.5 %) was shaped by humans, and their production was inspired by a general effort to emphasize specific zoomorphic or theriantropic characters. The rest of the collection (5.5 %) was represented by naturfacts (naturally shaped artifacts) with shapes evoking zoomorphic or theriantropic motifs, their substances and qualities. The cultural attitude, the degree of stylization, the symbolic meaning, and the final use of a whole subject or its particular components were the major influences on whether a whole body or a concrete body part was depicted. With a consideration of these influences, we can observe that almost all objects (96.6 %) represent a zoomorph or therianthrope body with relatively natural proportions. The biggest disproportions,

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*Boas, F. to Laufer, B., 02.05.1898 (from Victoria, British Columbia), 27.10.1898 (from New York, USA), 09.12.1898 (from New York, USA), and 23.01.1899 (from New York, USA).

Bogoras, W. to Boas, F., 30.10.1899 (from St. Petersburg, Russia), 16.04.1901 (from Mariinsky Post, Russia), and 22.12.1900 (from Kamenskoye, Russia).

Bogoras, S. (?) to Boas, F., 14.04.1901 (from Mariinsky Post, Russia).

Jesup, M. to Jochelson, W., 24.03.1900 (from New York, USA).

Jochelson, W. to Boas, F., 21.06.1899 (from Bern, Switzerland), 20.05.1900 (from Vladivostok, Russia), 11.08.1900 (from Kushka, Russia), 03.12.1900 (from Kamenskoye, Russia), 21.07.1901 (from Kushka, Russia), 27.04.1902 (from Yakutsk, Russia), and 04.07.1902 (from steamer Gromoff).

Laufer, B. to Boas, F., 10.07.1898 (from Alexandrovsk, Russia), 18.09.1898 (from Alexandrovsk, Russia), and 04.03.1899 (locality unspecified).

All electronic documents are accessible with courtesy of the Division of Anthropology of American Museum of Natural History in New York.

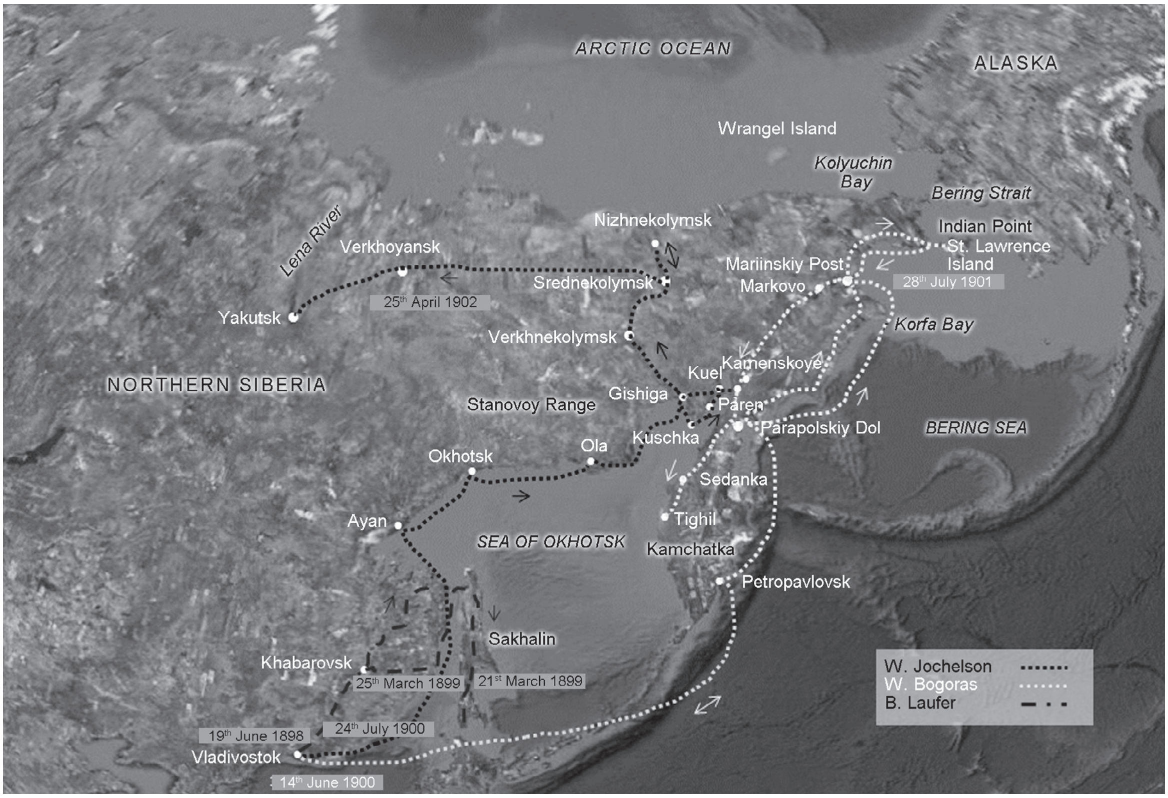

Fig 1. Travel map created by W. Jochelson (1900–1902), W. Bogoras (1900–1901) and B. Laufer (1898–1899). Modified after travel itinerary and travel map from 1902 (Courtesy of the Division of Anthropology, American Museum of Natural History), map published by F. Boas (1903: 72).

Table 1. **The analyzed sample of zoomorphic figurines**

Category	Total		Chukchees		Kereks		Koryaks		Others	
	Q-ty	%	Q-ty	%	Q-ty	%	Q-ty	%	Q-ty	%
Adornments	867	85.8	205	82.7	106	82.8	509	99.4	33	26.8
Charms	88	8.7	30	12.1	0	0	2	0.4	56	45.6
Toys	50	4.9	12	4.8	21	16.4	1	0.2	18	14.6
Utilities	6	0.6	1	0.4	1	0. 8	0	0	16	13.0
Total	1011	100	248	100	128	100	512	100	123	100

such as completely exaggerating the body relative to the head and extremities, were recorded for several toy figurines, which might improve a child's manipulation. The head was the most often separately displayed body part. The extremities were usually accentuated in detail or at least indicated, and less attention was paid to elaboration of hooves, paws or fingers with respect to the stability of a whole statuette (totally suppressed extremities are mostly within the pinnipeds and birds).

Most figurines are static with several exceptions, such as bird depictions carved by Kereks and Koryaks, with moveable wings or on wheels. Sexual dimorphism is observable on both anatomic (depiction of penis among male animals) and behavioral levels (such as offspring welfare, competition between male animals or hunting); however its determination is unclear when the figurine is stylized. The theriantropes are always portrayed as a human-headed creature with an animal body borrowed mainly from marine mammals (such as seals or walruses), birds or other indeterminate pedestrian quadrupeds. Thus we can expect that they are reflecting concrete mythological conceptions, and our suggestion might be supported by a higher occurrence of these figurines between charms.

Material analysis and usage of figurines. Furthermore, the raw materials selected for naturfacts or in the production of artifacts were investigated and can be divided into the following categories:

1) Stable raw materials (durables) include organic materials, such as walrus ivory, antler and bone (especially whale vertebrae or shoulder blades), or metal as an inorganic imported raw material;

2) Unstable materials (perishables) are constituted by three subgroups according to their origin: a) animal raw materials, such as sinews, horn (horns of snow sheep, bird beaks and claws of various carnivores), feathers, leather and furs, b) plant raw materials, namely, wood (mostly birch wood or Arolla pine roots), dried grass or other vegetable fibers; and c) imported materials, such as manufactured fibers, ropes, and textile fabrics (Bogoras, 1907; Jochelson, 1908, 1926; Mitlyanskaya, 1996; Davidson, 1997; Soffer, 2000).

The stable raw materials are usually used in production of adornments and utilities. Thus, these objects are almost exclusively shaped by human hand. Additionally, they can be decorated by drilled animal teeth, feathers, claws, pieces of fur or plant fibers. The depiction of adornments and utilities is therefore very realistic, and thematically reflects everyday life, although mythological inspiration is not excluded. Usually, the adornments and utilities display the whole zoomorph and theriantrope body or realistic shortcuts and stylized initials (especially images of the head). The patterning of figurines on the one hand highlights the details of anatomical components, and on the other hand reflects a wide range of different symbolic meanings (Fig 2). Furthermore, the individual figurines might be intentionally grouped into complex compositions depicting namely: a) daily behavior (such as hair- or feather-care, resting, running, dog or bear fights) and individual moods (such as curiosity, alertness, fear, or defense); b) nourishment (such as hunting and grazing); and c) sexual behavior and parental care (Fig 3).

The adornments are thus designed to bring joy to the owner, and especially women are described as removing figurines from their bags from time to time and enjoying just looking at them (Jochelson, 1908; Narody…, 1956; Mithen, 1991; Guthrie, 2005).

The figurines and naturfacts utilized as charms are visible depictions of a concrete spirit, including its temperament and needs (Fig 4). Thus, each object has to respect all ritual demands in order to fulfill the role as a mediator in human-spirit communication (Gurvich, 1962; Popular Beliefs..., 1968; Taksami, 1976; Vdovin, 1976; Pedersen, 2001). Among sacred naturfacts were recorded wolf skulls, ravens' heads, red fox-fur and puffin's beaks from the Chukchees; a wolf nose from the Koryaks, and several reindeer shoulder-blades from the Russianized natives. All these small fragments represent symbolic abbreviations of a complete animal, with its nature and power for ritual acts.

Artificially-made charm objects are very rough in character, and usually remain unfinished for future modifications. Additionally, it is believed that the more detailed a charm's depiction is, the more easily a man may lose his control over it. Such objects may revive the spirits who inhabit it, or catch unwanted attention from the world of evil spirits who bring diseases and death. Thus, if the charm's owner respects this basic rule and cares for the idol (with bloody and occasionally unbloody offerings), he will certainly profit from the spirit's power. Despite all these human efforts, the power of charms and their incantations gradually disappears, and they might be replaced from time to time (Czaplicka, 1914; Narody…, 1956; Gurvich, 1962; Vdovin, 1976; Shamanism…, 1978).

Finally, the depictions of zoomorphs and therianthropes may be used as toys. Each toy is a best friend, mentor, helper, and teacher of a child. It is endowed with its own voice, character and related behavior that is further developed in games. Nevertheless, the toy may also turn into the feared enemy of the child, especially when it is inhabited by a demon that brings illness or death to the child. Thus it is believed that the life of each toy displays the future and fate of its owner. For this reason, the production of toys follows several strict rules as charms, especially in shaping (Jochelson, 1908; Popular Beliefs..., 1968; Arefyeva, 2008).

Toy figurines are usually stylized with schematic face details. The limbs are often completely or partially suppressed. Toys are mostly produced from unstable plant materials, especially wood, with several exceptions of bone carvings among Kereks. In the game, an individual animal might be replaced by its bone, feather, and piece of fur, or by a twig. Additionally, some toys are equipped with sinews, which serve the children for tying, pulling or hitching their figurines. According to W. Bogoras (1907), children are not restricted in the selection of their toys (except charms and similarly "playing" out ritual acts is restricted); and if they like some ivory adornments, these are given to them for play. Furthermore, the children usually ought to produce toys by themselves and throughout the games they improve in activities for the future (Nelson, 1900; Bogoras, 1907; Jochelson, 1926; Narody…, 1956).

Zoomorphic themes in artifacts, naturfacts, and mythology

The accurate determination of biological species was in some cases extremely difficult, owing to the degree of a figurine's stylization (Fig. 5) (Blix, 2005; Banerjee et al., 2006). Moreover, the assessment and perception of

Fig 2. Walrus-ivory carving representing walrus. Collected by W. Bogoras among Kereks. Dimensions: length 5.4 cm, width 2.5 cm, height 2.5 cm. Courtesy of the Division of Anthropology, American Museum of Natural History, No. 70/6265.

Fig 3. Antler-carving representing reindeer calf. Collected by W. Bogoras among Chukchee. Dimensions: length 3.3 cm, width 1.8 cm, height 1 cm. Courtesy of the Division of Anthropology, American Museum of Natural History, No. 70/6862.

a concrete zoomorphic theme may be influenced by economic, symbolic, or mythological conceptions of each ethnic group (Nelson, 1900; Bogoras, 1907; Jochelson, 1908; 1926; Taksami, 1976; Vdovin, 1976; Ingold, 1994; Krupnik, 1993; Pedersen, 2001; Willerslev, 2004) which may not necessarily overlap with actual taxonomic classifications (Mithen, 1991; Guthrie, 2005). In some cases, we have specified zoomorphic themes in contrast to the AMNH catalogues, especially when a bigger group of different animal carvings was labeled with a single name. Various zoomorphic themes were organized together for a better evaluation of their significance (Table 2). Only the indeterminate group was excluded, because we could only note that these animals are quadrupeds of various shapes and may be inspired by mythology.

Within the collection, we observed several trends: one of them is connected with the geographic and ecological distribution of several animal species. The examples are the group of ursids, where the depictions of polar and brown bears are replicating the North-South gradient of their occurrence in tundra and taiga; or the group of fishes, where the absence of salmonids among Chukchees might be explained by the geography of their territory, with no suitable spawning rivers. Another trend is connected with overhunting of pinnipeds and cetaceans by Russian, American, and Japanese whaling companies, which pressurize Koryaks, Kereks, and Chukchees to use these animals more as an additional nourishment source, and to replace their hunting by fishing and reindeer-herding. Thus, the depictions of these animals

Fig 4. Shaman's charm with bag, made from raven head and wolf skull. Collected by W. Bogoras among Chukchee. Dimensions: length 25 cm, width 37.5 cm. Courtesy of the Division of Anthropology, American Museum of Natural History, No. 70/6559AB.

Fig 5. Wooden toy (?) figurine representing a duck. Collected by B. Laufer among Nivkhs. Dimensions: length 45.1 cm, width 6.4 cm, height 10.5 cm. Courtesy of the Division of Anthropology, American Museum of Natural History, No. 70/1175.

probably reflect the persistence of their symbolic and ritual significance.

The next step is to confront the distribution of zoomorphic themes in figurines and recent mythological contexts collected by W. Bogoras (1910) among Chukchees and by W. Jochelson (1908) among Koryaks (Fig 6). The quantification of zoomorphic themes is complicated by the symbolic concept according to which animals gain zoomorphic form only in the presence of humans. In the meantime, they acquire anthropomorphic form, and they group themselves into units of Animal-People, such as Reindeer-People, Hare-People, Bear-People or Gull-People, who live in their settlements with their own families and pass the time in hunting, fishing, game-playing, and other activities. Moreover, this situation is complicated by the naming by others of particular societies in accordance with the latter's origin, which may reflect their totemic ancestor or other tribe specifics (for example Reindeer-People in Chukchee mythology refers sometimes to Koryak reindeer herders). Thus, only the animals with unambiguous zoomorphic shape were counted in our mythological analysis.

According to our observations, we have estimated three characteristic roles, which help in a better understanding of each zoomorphic theme and its mythological importance.

Economic level is reflected in both mythologies about cetaceans (humpback whales, belugas and orcas), bovids (snow sheep), and leporids (arctic hares). A similar relationship was also observed in the case of fishes, rodents (beaver), mustelids (wolverines and ermines), equids (domestic horses) among Chukchees, and pinnipeds (Steller sea-lions, spotted-seals, ring-seals, bearded seals, and walruses) or marine mollusks among Koryaks. The animals are connected by the nutrition-value of their meat, marrow or blubber. Their bones, sinews, hide and viscera (especially stomachs) are used in dwelling-construction, in clothing, boots and storage-bag production or in trap-construction. Among Chukchees, we encounter rodents and mustelids whose fur is metaphorically associated with worth. In both mythologies, whales, seals, and walruses are harnessed to sledges of Marine spirits.

Economic-symbolic level is accentuated by both mythologies within the groups of cervids (wild and domestic reindeer), canids (wolves, polar and red foxes, dogs), and ursids (polar and brown bears), individually in pinnipeds (Steller sea-lions, spotted seals, ring-seals, bearded seals, and walruses) among Chukchees, and fish (such as salmon, plaice, trout, minnows, and ray-finned fishes) and rodents (mice) among Koryaks. The reindeer, dogs, and bears represent an important source of meat, marrow, fat and organ-meat; their fur, sinews, bones, and antlers are used

Table 2. **Distribution of animal groups in zoomorphs and therianthropes**

Animal groups	Total		Chukchees		Kereks		Koryaks		Others	
	Q-ty	%	Q-ty	%	Q-ty	%	Q-ty	%	Q-ty	%
Canidae	240	25.4	74	31.4	33	26.4	118	23.7	15	17.4
Aves	204	21.6	54	22.9	31	24.8	93	18.7	26	30.2
Pinnipedia	182	19.3	27	11.4	27	21.6	123	24.7	5	5.8
Ursidae	91	9.6	24	10.2	18	14.4	41	8.2	8	9.3
Cervidae	76	8.0	31	13.1	1	0.8	24	4.8	20	23.3
Bovidae	59	6.2	6	2.5	5	4	48	9.6	0	0
Pisces	33	3.5	2	0.8	1	0.8	26	5.2	4	4.6
Mustelidae	17	1.8	7	3.0	4	3.2	6	1.2	0	0
Cetacea	11	1.2	2	0.8	1	0.8	8	1.6	0	0
Leporidae	10	1.1	6	2.5	2	1.6	2	0.4	0	0
Rodentia	6	0.6	3	1.3	1	0.8	2	0.4	0	0
Amphibia, Reptilia	5	0.5	0	0	0	0	0	0	5	5.8
Equidae	4	0.4	0	0	0	0	3	0.6	1	1.2
Insecta	4	0.4	0	0	0	0	3	0.6	1	1.2
Felidae	3	0.3	0	0	1	0.8	1	0.2	1	1.2
Total	945	100	236	100	125	100	498	100	86	100

Note: Indeterminate species were excluded.

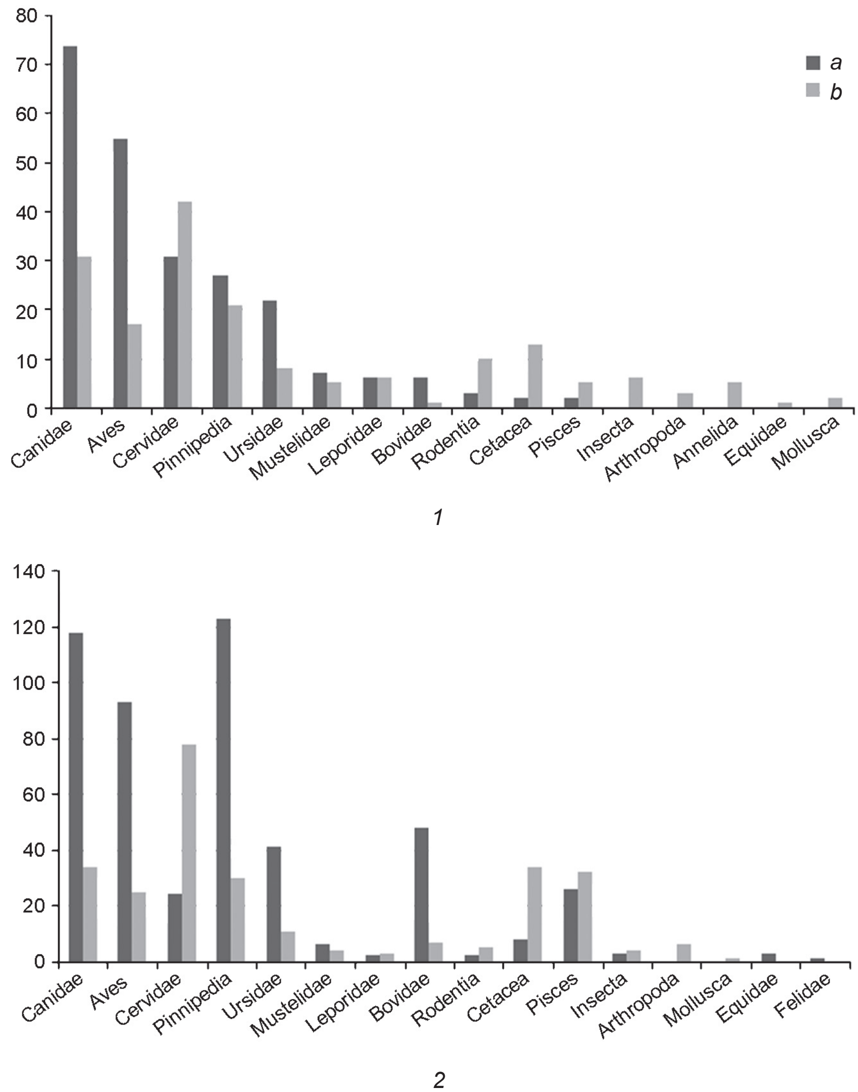

Fig 6. Representation of zoomorphic themes among Chukchees (*1*) and Koryaks (*2*).
a – figural art; *b* – mythology.

in dwelling-construction, production of clothing, boots, personal items or various tools and weapons.

The animal's behavior or physical characteristics serve as a metaphor, for instance rummaging ground like a reindeer, being summoned like a dog or having a toothy snout like a wolf. Moreover, reindeer and dogs are used as draught animals (occasionally mice were described in this role), or specially trained for hunting or racing. Reindeer and dogs are reported as being sacrificed in various rituals, and a walrus, reindeer or dog voice has its ritual importance in the fight against evil spirits. The reindeer, dog and bear body-parts are used for recovery of the animals; their excrement might be also used for modeling of figurines used for divination, or recovered with special incantation.

The supernatural animals are represented by metal/silver or flaming reindeer/fish/mouse, by a reindeer with two heads, by mythological Wolf Hathope, or by an evil and greedy creature, Reindeer-Born, bringing disaster to herders by eating their herds. Finally, a transformation of a human into the wolf or polar bear, and a transition of animal identities when a reindeer or bear appears as a dog were documented.

Symbolic level is reflected in both mythologies within the groups of birds (ravens, eagles, puffins, snowy owls, ptarmigans, gulls, cormorants, grebes, Northern pintail), who appear in the roles of mythological creatures (metal snowy owl, giant bird, and thunder bird among Chukchees) or heroes (Big Raven among Koryaks), and within a transition of human or various human body parts to bird. In both mythologies a symbolic role is ascribed to arthropods (spiders), who help clueless characters with their wise advice; to insects (ants, bumblebee), and to annelids (worms). Additionally, symbolic relationships were also possessed by mammoths among Chukchees, appearing in a story as the powerful spirits made of ancient giant bones; and by mustelids (wolverines, ermines) among Koryaks.

Discussion: Paleoethnological framework

In our traditional western concepts, animals are seen as a part of nature, and thus the particular differences between animal species reflect detailed aspects of nature. Humans, with their biological bodies and cultural minds, are perceived as something extraordinary and consequently more than a match physically for any other being in nature. However, such a relationship is not reflected in mobile societies in Siberia, where human-animal relationships are far from random. These relationships are the result of a large number of complex ritual activities and symbolic approaches to the world where Animal-People are respected like other human nations (Narody…, 1956; Bird-David, 1990; Ingold, 1994; Willerslev, 2004; Nadasdy, 2007). Therefore, the discrepancies in human-animal relationships in both Western and Siberian conceptions provide us with alternative realities, which should be taken into account while formulating archaeological explanations.

Nevertheless, we have to admit that our paleoethnological framework is not able to exhaust completely the changing dynamics in human-animal relationship over the last 30 000 years. The environmental changes were accompanied by the disappearance of some typical glacial species and by the creation of newly domesticated species.

A similar situation has affected the use and symbolic meaning of raw materials, such as mammoth ivory, ceramics, and soft stones. Although mammoth ivory has been recently used in figural production, the perception of mammoths of course has a different importance for recent inhabitants of Siberia than for Upper Paleolithic hunters and artists (Gerasimov, 1931; Ivanov, 1949; Gamble, 1982; Delporte, 1990; Mithen 1991; Der Löwenmensch…, 1994; Abramova, 1995; Gvozdover, 1995; Svoboda, 1997; Hunters…, 2000; Djindjian, 2004; Guthrie, 2005; Owen, 2005; Borić, 2007). The burned clay, soft stones, and other typical raw materials in Upper Paleolithic production enabled the use of figurines in various practical and symbolic activities (Vandiver et al., 1989; Davidson, 1997; Soffer, 2000; Verpoorte, 2001; Svoboda, 2011). However, the ceramic zoomorphic figurines are not common in studied areas of recent Siberia. We have documented a few descriptions of unburned clay figurines, but the ethnologists did not monitor their function, nor their further use, and they supposed that such items had melted in the soaked terrain of tundra. The soft stones (such as talc) are recently used in figural production; however, this is especially due to a lack of other traditional Siberian raw materials, such as walrus-ivory (Nelson, 1900; Jochelson, 1908; Narody…, 1956; Krupnik, 1993; Mitlyanskaya, 1996). In addition, there are visible differences in the artistic style and final polishing of the Upper Paleolithic zoomorphic figurines. When using ethnological analogies, this situation could be partially explained by the expected applications.

Generally speaking, zoomorphic figurines that represent everyday life are crafted with much more realism and detail. They are representing adornments or utilities, and stable materials, such as walrus-ivory, bone and antler are used in their production. The artistic interpretation of charms and toys, which are made especially from wood and horn, is often crude and schematic, in order to avoid the inauspicious attentions of evil spirits.

Finally, the predominance of fragments over whole figurines might be noted for Upper Paleolithic zoomorphic and theriantropic figurines. This fragmentation could be caused by postdepositional processes; however some authors (Klíma, 1979; Králík, 2011) believe that these fragments could also be parts of a larger object, probably made from unstable organic material. Another possible interpretation is that the fragments themselves are complete and thus represent symbolic shortcuts. Additionally, we cannot exclude the possibility that the fragments or whole sculptures were deliberately destroyed (by thermal shocks, targeted damage, and breaking) after fulfilling their function. Such activities were documented for example in Dolní Věstonice I, Pavlov I, Zaraysk and Kostenki I (Absolon, 1938, 1945; Efimenko, 1958; Klíma, 1979, 1989; Delporte, 1990; Abramova, 1995; Soffer, 2000; Hunters…, 2000; Verpoorte, 2001; Dupuy, 2007; Amirkhanov et al., 2009; Svoboda, 2011). When using ethnological analogies from Siberia, the reason for this behavior lies in the fact that the figurines have passed their 'use by date' and will not be needed in the future. Furthermore, their presence would attract the attention of negative energy from the world of spirits or humans, which could interfere with the ritual act (Bogoras, 1907; Jochelson, 1908; Czaplicka, 1914; Gurvich, 1962; Popular Beliefs..., 1968; Taksami, 1976; Vdovin, 1976; Shamanism..., 1978; Pedersen, 2001). Thus, the objects associated with ritual activities are subsequently destroyed, for example by throwing them into a fire. In this sense we could see some parallels to the destruction of Gravettian zoomorphic figurines that was not accidental but rather intentional in nature.

Conclusion

This paper shows the representation of zoomorphic themes within figurines, naturfacts, and mythologies collected during the Jesup North Pacific expedition. The causality between raw materials, artistic style, final polishing, and utilization of the objects was recorded within this collection. Several questions remained still unresolved because of the limitations of the nature of ethnological collection and available descriptions. Our knowledge is thus limited either by an absence of specific archeological elements within recent cultures; or by inadequate explanations due to insufficient interest on the part of particular ethnologists; or by the fact that the researcher has been excluded from such social activities as might be disrupted by unfamiliar presence. Despite these and other problems involved in comparing and identifying ethnological and archaeological records, the paleoethnological framework expands our understanding of the uniqueness and particulars of past and recent societies. Finally, it helps us to realize how dynamic and complex the background accompanying each zoomorphic theme within a specific culture is.

Assessment of the social value of each zoomorphic theme is an almost unpredictable process. Moreover, as we have seen, the human-animal relationships reflect not just the actual situation, but are the essential and sometimes inseparable components of a cultural memory, with a tendency to memorize zoomorphic themes gradually disappearing from the actual environments of recent societies (Connerton, 1989; Assmann, 2008; Porr, 2010).

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3 Příklady z archeologického kontextu

V části věnované archeozoologické analýze se tato práce zaměřuje na studium velké savčí fauny z vybraných pleistocenních a časně holocenních kontextů, tedy na období lovecko-sběračských populací paleolitu a mezolitu. Příklady byly vybrány tak, aby demonstrovaly rozsah možností práce s osteologickým materiálem i případný interpretační potenciál lokalit, které se vzájemně liší metodikou archeologického výzkumu (systematický/záchranný), polohou lidského osídlení (otevřené či vymezené převisem) nebo jeho charakterem (izolované lidské aktivity doprovázené faunou nebo komplexní sídliště). Základem dílčích osteologických analýz bylo nejprve standardní určení materiálu z těchto lokalit, kterou v případě možností doprovází demografická studie věkové struktury populace, distribuce částí zvířecích skeletů v prostoru sídliště i následná dokumentace tafonomických činitelů, včetně lidské manipulace. Stranou této práce zůstává technologická analýza předmětů z tvrdých živočišných tkání, vyžadující svůj specifický metodický protokol.

3.1 Metoda

Z metodického pohledu je archeozoologický materiál nejprve roztříděn podle konkrétních zvířecích taxonů a u jednotlivých kostí i zubů, případně jejich fragmentů, je pořízen anatomický popis. Využívány jsou buďto standardně používané komparativní osteologické atlasy a manuály, jako např. Hue (1907), Kolda (1951); Lavocat (1966), Pales a Lambert (1971), Schmid (1972), Ziegler (2001); Hillson (2005, 2009); France (2009), srovnávací elektronické kolekce kupříkladu Archeozoo.org, Niven *et al*. (2009), nebo fyzické komparativní kolekce, jako např. z Muzea přírodní historie ve Vídni.

Četnost výskytu jednotlivých druhů či skeletálních částí v rámci osteologického materiálu velké savčí fauny je obvykle stanovena na základě celkového počtu kostí přiřazených ke konkrétnímu taxonu (Number of Identified Speciemens – *NISP*), minimálním počtem jedinců zastoupených v daném taxonu (Minimum Number of Individuals – *MNI*), minimálním počtem elementů (Minimum Number of Elements – MNE), které lze přiřadit k jedné kosti, a hodnotou MAU (Minimal Animal Unit – MAU), zohledňující kolik částí skeletu je reálně přítomno v osteologickém materiálu s ohledem na jeho stranovou korekci. Poměrem NISP/MNE pak lze vyjádřit míru fragmentarizace materiálu ve sledovaném souboru a je významným indikátorem v interpretacích lidských zásahů, postdepozičních procesů či samotných biomechanických vlastností skeletů jednotlivých zvířecích druhů (srov. Casteel 1977; Binford 1981; Grayson 1984; Klein, Cruz-Uribe 1984; Clark 1987; Davis 1987; Cruz-Uribe 1988; Lyman 1994, 2008; O´Connor 1996, 2000; Landon 2005; Herrel *et al*. 2006).

V následujícím kroku oddělujeme v materiálu mladé jedince, u nichž provádíme odhad kosterního věku, založeného na rozdílné rychlosti ve srůstání proximálních a distálních epifýz s diafýzami dlouhých kostí, tj. uzavírání růstových štěrbin (srov. Johnston *et al*. 1987; Richardson *et al*. 1995; Ruscillo ed. 2006). Vedle kosterního věku odhadujeme i věk zubní, jenž mapuje rozdílné rychlosti v prořezávání mléčné a trvalé dentice. U trvalého chrupu můžeme dále sledovat stopy po mechanické abrazi okluzálních ploch zubů, kterou lze korelovat s věkem. Přestože samotná abraze může být navyšována, nebo naopak snižována přítomností abraziv v potravě, genetickými predispozicemi či patologiemi, jako například malokluzalitou chrupu, což následně může zkreslit odhadovaný věk jeho nadhodnocením či naopak podhodnocením (srov. Spies 1979; Grant 1982; Hillson 2005; Pike-Tay ed. 2000; Steele 2002; Reitz, Wing 2008). Tam, kde to stupeň zachování kosti dovoluje, provádíme osteometrická měření podle metodik a doporučení, které vypracovala A. von Driesch (1976). V poslední fázi deskripce se zaměřujeme na epigenetické variability či patologické znaky (viz. podkapitola 3.5.3).

Četnost zastoupení zvířecích taxonů, jejich distribuci a kvantitu (zejména s ohledem na velmi drobné kosti i zuby nebo dílčích fragmenty pod 2 cm) je signifikantně ovlivněno metodou exkavace během archeologického výzkumu. Systematický výzkumu je obvykle postaven na planigrafické dokumentaci sídlištních struktur v plošné síti 1 x 1 m, s jednotlivými čtverci dále dělenými na čtyři podčtverce po 50 cm. Uvnitř této sítě je osteologický materiál společně s dalšími archeologickými nálezy a útvary zaznamenáván do 3D sítě v systému osy X, Y a relativní výšce bodu Z (srov. Cziesla 1990; Connor 2007; Hester *et al*. 2009; Šída 2012; Schiffer ed. 2014; Carver *et al*. eds. 2014), čímž je získána poloha předmětu samotného, tak i prostorová distribuce ostatních nálezů vůči sobě. Zbývající sediment je odebírán na suché sítování nebo plavení, ve kterém standardně používáme síta s rozestupy 5, 1 a 0,5 mm (u vybraných vzorků může být volena síť s rozestupem kolem 0,1 mm a méně). V ideálním případě plavíme veškerý objem materiálu za účelem maximalizace získaných nálezů (zejm. mikrofauny, malakofauny, rostlinných makrozbytků či mikrolitů), nicméně rozumně dohlížíme i na průběžnou kontrolu sterilnosti vzorků (Horáček, Sanchéz-Marco 1984; Greene 1996; Renfrew, Bahn eds. 2005; Maschner, Chippindale eds. 2005; Muckle 2006; Kelly, Thomas eds. 2006). U záchranného výzkumu bývá metodický protokol vzhledem k časovým důvodům urychlen, takže mohou být proplaveny pouze dílčí vybrané struktury (např. ohniště, sídlištní objekt), nebo není k plavení přistoupeno vůbec, což se ale promítne například v distribuci živočišných taxonů, která je v takovém případě obvykle nižší. Současně není platné obecně tradované tvrzení, že k systematickému plavení přistupujeme až v dnešní době (s ohledem na aplikaci moderních metodik v archeologickém výzkumu). Z Moravy máme totiž několik případů z přelomu 19. a 20. století, zejména z výzkumů J. Kniese (1901, 1902), kdy byl sediment systematicky proplaven, takže spíše záleží na podmínkách a rozhodnutí vedoucího výzkumu.

3.2 Materiál

Předkládaná osteologická analýza vybraného archeologického materiálu pokrývá období pleistocénu až starého holocénu, tedy lokality lovecko-sběračských společností paleolitu a mezolitu. Zpracováním osteologického materiálu z těchto lokalit autorka vstupuje do interdisciplinárních týmů zabývajících se komplexní analýzou těchto nalezišť a svými výsledky přispívá k deskripci fauny (včetně populační charakteristiky), tafonomické historie nálezové situace i její chronostratigrafie. Od r. 2009 se autorka podílí na vyzvednutí osteologického materiálu během exkavačních prací i na dalších průvodních činnostech (tj. čistění, plavení, třídění, inventarizace a konzervace) vedoucích k jeho uložení ve sbírkách Střediska pro paleolit a paleoetnologii v Dolních Věstonicích Archeologického ústavu AVČR Brno. Na tomto pracovišti je uložena podstatná část materiálu z výzkumů v 80. letech 20. století na lokalitě Dolní Věstonice II a izolované předměty z Předmostí III. Zbývající osteologický materiál se nachází ve sbírkách Moravského zemského muzea v Brně, což se týká výzkumu lokality Pavlova I, vybraných nálezů z lokality Předmostí III a nepoměrné části Dolních Věstonic II.

Z námi sledovaných nalezišť je v práci prezentován osteologický materiál z lokality Horky nad Jizerou (viz podkapitola 3.5.1), která představuje dobře stratifikovanou archeologickou lokalitu se středně pleistocenními sedimenty zkoumánou již v 50. a 60. letech 20. století F. Proškem, J. Kuklou a J. Fridrichem (Prošek 1952a,b, 1954; Fridrich 1982). Z tohoto období pochází i zpráva o několika velmi zvětralých fragmentech kostí velkých savců, které se nám však nepodařilo již dohledat. Kolem roku 2007 začala být lokalita s ojedinělým výskytem lidských aktivit nově monitorována P. Šídou ze Západočeské univerzity v Plzni a z osteologického hlediska měla autorka možnost dokumentovat nálezy savčí fauny z let 2009-2012 z lokality Horky III.

Okruh dalších lokalit sledovaných v této práci pochází z období mladého paleolitu a je řazen do kulturní fáze staršího gravettienu, tzv. pavlovienu (27,5 – 25,0 ky BP nekalibrováno; 33,0 – 30,0 ky calBP). V dané době se lidské osídlení koncentruje podél hlavních říčních toků Dyje (Dolní Věstonice, Pavlov, Milovice), Moravy (Uherskohradišťsko) a Bečvy (Předmostí), u nichž si lidé budují otevřená, různě velká a komplexní sídliště s odlišnou sezónní hierarchií (Absolon 1918, 1938, 1945; Absolon, Klíma 1977; Klíma 1954, 1963, 1981, 1987, 1995; Musil 1955, 1958a,b, 1994, 2001, 2010, 2011a,b, 2014; Soffer 1993; Svoboda ed. 1991, 1994, 2005; Škrdla, Svoboda 1998; Velemínská, Brůžek eds. 2008; Svoboda *et al.* 2007, 2011b, 2014, 2015; Beresford-Jones *et al.* 2010, 2011; Antoine *et al.* 2013; Fuchs *et al.* 2013; Nývltová Fišáková 2013; Revedin *et al.* 2010, 2015; Wojtal *et al.* 2015). Postupně sledujeme následující lokality:

a) Dolní Věstonice II– komplex lokalit, na nichž byly prováděny systematické i záchranné výzkumy (včetně pravidelných povrchových sběrů) v letech 1958 – 2015 Bohuslavem Klímou (do r. 1987) a Jiřím Svobodou (od r. 1987). Z tohoto komplexu autorka zpracovává výzkumy na lokalitě Dolní Věstonice IIa a nejjižnější části z let 1999 – 2015, u studia vlků je pak zaměření rozšířeno i na starší výzkumy z let 1985-1987 (podkapitola 3.5.2 a 3.5.3). Svou prací tak navazuje na dřívejší studie L. Seitla (1995), D. West (2001), M. Nývltové Fišákové (2001), P. Wojtala a J. Wiłczyńského (např. 2015).
b) Pavlov I (podkapitola 3.5.4) – představuje sídlištní palimpsest, na němž byly prováděny systematické i záchranné výzkumy B. Klímou (1952-1972) a J. Svobodou (2013-2015). Autorka se zaměřuje na zpracování osteologického materiálu z nových výzkumů, nicméně vzhledem k objemu odtěženého sedimentu (proplaveno 25 tun a ve 3D bylo zaměřeno přes 13 000 čísel) na něm ještě stále probíhá jeho třídění a inventarizace, takže přiložená studie je velmi

informativního rázu. Svou prací navazuje na dřívější studie R. Musila (např. 1955, 1958a, 1994, 2005) a P. Wojtala a J. Wiłczyńského (např. Wojtal *et al*. 2005, 2012; Bocheński *et al*. 2009; Wojtal, Wiłczyński 2015).

c) Milovice IV – lokalita byla objevena v roce 2009, kdy došlo k propadu stropu sklepení vyhloubeného v 18. století ve spraši, a byla zkoumána až do roku 2010 J. Svobodou. Autorka se zde pod vedením P. Wojtala zabývala svou první analýzou pleistocenního materiálu (podkapitola 3.5.5).

d) Předmostí III – náleží do komplexu sídlišť lokality Předmostí a tato poloha byla několikrát zkoumána v průběhu posledních 30 let B. Klímou, J. Svobodou a Z. Schenkem. Autorka se podílí na zpracování osteologického materiálu ze záchranných výzkumů B. Klímy z let 1982-1983, který však vzhledem ke svému nerovnoměrnému zastoupení živočišných taxonů představuje spíše určitý výběr (podkapitola 3.5.6). Materiál z novějších výzkumů této lokality byl zpracován M. Nývltovou Fišákovou (Nývltová Fišáková Schenk 2006).

Posledním sledovaným areálem jsou staroholocenní lokality z prostoru severočeských pískovců Děčínska a Českolipska, kde probíhá od r. 1997 pod vedením J. Svobody systematický i záchranný výzkum posledních lovecko-sběračsko-rybářských populací mezolitu (před příchodem zemědělství 10,0 -6,0 ky BP) (Svoboda ed. 2003; Svoboda *et al*. 2007; podkapitola 3.5.7). Autorka se podílí na zpracování osteologického materiálu z lokalit Janova zátoka a Údolí samoty, kde byla mimojiné zaznamenána stratigrafická sekvence, pokrývající pozdní paleolit a mezolit. Svou prací navazuje a rozšiřuje analýzy I. Horáčka (2003; 2007) a od r. 2013 vypracovává metodický protokol pro zpracování spáleného osteologického materiálu v tomto mikroregionu, který je díky agresivnosti místních sedimentů mnohdy to jediné, co se zde z fauny dochovává.

3.3 Vliv tafonomických činitelů

Stopy po tafonomických činitelích nám vydají cenné informace o predepozičních, depozičních a postdepozičních procesech, ovlivňujících způsob uložení i míru zachování osteologického materiálu (srov. Skutil, Stehlík 1949; Behrensmeyer, Hill eds. 1980; Lyman 1994; Denys 2002; Alhaique *et al*. 2004; Conor 2007; Prokeš 2007; Wojtal 2007). Základní tafonomické podmínky můžeme rozdělit do dvou hlavních skupin abiotických a biotických činitelů a znalost charakteru jejich projevu nám pak umožňuje odlišit např. stopy po lidské činnosti od ohryzu šelem, zdupání nebo abraze při pohybu v sedimentu.

Míra projevu dílčích tafonomických činitelů je pochopitelně ovlivněna vlastnostmi a morfologií osteologického materiálu, dále věkem, pohlavím a zdravotní kondicí zvířete. Biomechanický charakter je v případě kostí, zubů, mamutoviny či paroží rozdílný, což způsobuje odlišný poměr organické a anorganické složky, tedy kolagenu a hydroxyapatitu, zajišťujících na straně jedné elasticitu a odolnost v tahu a na straně druhé pevnost, tvrdost a odolnost v tlaku (přesto záleží na směru působící síly, tj. osteologický materiál je obecně nejméně odolný k torzním pohybům provázeným velkým zrychlením). Během archeologizace je organická složka procesem fosilizace nahrazována složkou anorganickou, což zachovává původní tvar osteologického materiálu, nicméně rovněž se projevuje ztrátou původní ohebnosti i celkové soudržnosti vedoucí k fragmentarizaci během depozičních a postdepozičních procesů, včetně exkavace samotné (Sikes 1971; Albrecht 1977; Guthrie 1983; Davies 1987; Lyman 1994; Christensen 1999; 2004; Chlopačev, Girija 2010).

3.1.1 Abiotiční činitelé

Zvětrávání modifukuje povrch osteologického materiálu během dočasné či dlouhodobé expozice vnějším podnebným podmínkám (např. dešťové/sněhové srážky, vítr, sluneční záření, aj.), které způsobují prograsivní praskání a štěpení kompaktní kosti, zubní skloviny či svrchních lamel klu; jejich postupné štěpení a loupání, vedoucí k celkové destrukci předmětu (srov. Behrensmeyer 1978; Tappen 1994, 1995; Andrews 1995; Andrews, Armour-Chelu 1998; Fernandéz-Jalvo *et al.* 2002; Janjua, Rogers 2008).

Tlak nadložních sedimentů zvyšuje příčnou i podélnou fragmentarizaci osteologického materiálu a deformuje anatomické uložení, pokud se například skelet nachází v mírně zahloubeném objektu, což způsobilo extrémní skrčení ženy z hrobu DV3 v Dolních Věstonicích I (kde je tato poloha vyloučena přítomností měkkých tkání, stejně jako nemohlo dojít k sekundární manipulaci s tělem, neboť by chyběly některé kosti (zejm. apikálních částí končetin), které by byly disartikulovány po dekompozici měkkých tkání (Svoboda 2014).

Gravitace působí na pohyb sedimentu na svahu (soliflukce), čímž dochází k posunům a deformacím uloženého osteologického materiálu či rozvolnění (rozvlečení) anatomického uspořádání skeletu (např. hromadný hrob z lokality Předmostí Ia; Svoboda 2008).

Ph sedimentu má vliv na chemickou korozi osteologického materiálu, během níž dochází k abrazi reliéfu předmětu vedoucí k jeho úplnému vymizení (v některých případech za vzniku tzv. kostěných stínů). Obecně jsou zásadité sedimenty pro uchování osteologického materiálu příznivější nežli kyselé. Přesto samotnou frekvenci ztráty osteologického materiálu ani míru jeho koroze nelze predikovat čistě na základě pH sedimentu, neboť tu ovlivňují i další faktory, jako např. morfologie skeletu, geografie naleziště či oscilace podzemní vody. Ve spraši se na osteologickém materiálu navíc vytváří vápenaté konkrece ($CaCO_3$), tzv. cicváry, které obalují celou kost, paroh, kel či zub, nebo vyplňují jejich veškeré vnitřní dutiny. Vzhledem k tomu, že tyto konkrece ovlivňují přesnost taxonomického určení, bývají ve vybraných případech opartně odleptány zředěnou 3 % kyselinou chlornou (srov. Fernandéz-Jalvo, Andrews 1992; Fernandéz-Jalvo *et al*. 2002; Andrews 1995; Child 1995; Van Klinken, Hedges 1995; Nicholson 1996).

Abraze remodeluje povrch osteologického materiálu vlivem abraziva s různou klastickou velikostí (např. jílem, pískem, štěrkem, oblázky, apod.) s očekávatelným závěrem, že velikost stop a zlomů je úměrná typu abraziva. Povrchová voda osteologický materiál ohlazuje a leští, nicméně tyto stopy mohou být zaměňovány se stopami po lidské činnosti, pokud není osteologický materiál analyzován jako celek. Při transportu má voda tendenci osteologický materiál třídit na základě jeho velikosti a hustoty, kdy artikulované kosti mají menší potencionalitu transportu nežli disartikulované (tj. pohybují se pomaleji). Důsledkem pak je narušení anatomického uspořádání skeletu i jeho možná dislokace na velké vzdálenosti.

Podzemní voda prochází osteologickým materiálem podobnými fyzikálními procesy jako u sedimentu (gravitací, osmózou, kapilaritou a difúzním gradientem) v místech s odlišným hydraulickým potenciálem, který se může měnit prostrově i časově. Procesy probíhají do okamžiku dosažení rovnovážného stavu s okolním sedimentem za vzniku tzv. dobíjení/vybíjení, kdy při vysychání sedimentu je voda z osteologického materiálu „vysáta“, či naopak „nasáta“ z mokrého prostředí při jejím vyschnutí. Vlivem spodní vody dochází k přijímání uranu, rozpouštění organických molekul a zvyšování mineralizace nebo ke zvětšování mikroskopických struktur (Skutil, Stehlík 1949; Voorhies 1969; Dodson 1973; Behrensmeyer 1975; Boaz, Behrensmeyer 1976; Korth 1979; Hanson 1980; Boyde 1984; Bromage 1984; d´Errico *et al.* 1984; Nelson *et al.* 1986; Andrews 1990, 1995; Fernandéz-Jalvo 1992; Coard, Dennel 1995; Nielsen-Marsh, Hedges 2000).

Kryogenní vlivy: v mrazových podmínkách dochází k aerobní dekompozici a primární mikrobiální atak je zahájen z okolního prostředí (oproti běžným podmínkám, kdy dekompozici zahajuje střevní mikroflóra a fauna). Disartikulace skeletu probíhá ve sledu cerviko-lumbální spojení – costo-vertebrální a sterno-costální spojení – lumbosakrální a sakroiliakální spojení a zakončeno je rozvolněním kyčelních kloubů. Samotná fragmentarizace osteologického materiálu není ovlivněna obsahem vody, nýbrž funkčním a morfologickým typem, a charakter lomu je velmi nepravidelný. Mrazová činnost uvnitř vrstvy může navíc způsobit províření osteologického materiálu a jeho vyzdvihnutí do vrstev nadložních (při rozpínání půdního ledu), či naopak propadnutí do podloží (při jeho tání) (srov. Wood, Johnson 1978; Micozzi 1986; Guadelli, Ozouf 1994).

Na námi sledovaných lokalitách jsme pozorovali několik typů stop zanechaných abiotickými činiteli. Nejvyšší míra fosilizace byla pochopitelně pozorována na materiálu z lokality Horky nad Jizerou, kde na povrchu kompakty byly okem zaznamenatelné křemičité krystaly; na na koňském metacarpu jsme pozorovali machanickou fragmentarizaci způsobenou tlakem nadložních sedimentů. Projevy zvětrávání byly nejzajímavější na gravettském materiálu, kdy nejvyšší stupeň zvětrání v kombinaci s otisky kořínků rostlin jsme dokumentovali na materiálu z lokality Dolní Věstonice II a z Pavlova VI, kde navíc přibývá velmi vysoká míra vápenatých konkrecí. O poznání lépe je na tom materiál z Předmostí III (i Ib) a Pavlov I z nejnovějších výzkumů. Vůbec nejlepší stupeň zachování vykazuje v tomto ohledu osteologický materiál z lokality Milovice IV, což znamená, že byl velmi rychle překryt sprašovou nadložní vrstvou bez expozičních mezifází. Na povrchu osteologického materiálu z Pavlovských vrchů můžeme dále zaznamenat přítomnost manganistých a železitých solí, které se projevují jako tmavé a červené krystaly, často vyplňující nerovnosti povrchu (u některých fragmentů mohou vytvářet dokonce nepravidelně velké skrvny). Zaznamenáváme je zejména tam, kde předpokládáme, že byl osteologický materiál v kontaktu s povrchovou stojatou vodou (srov. Svoboda ed. 1991), nicméně stále se jedná o téma, pro něž budou nezbytné podrobnější chemické analýzy. Míru fragmentarizace (dle poměru NISP/MNE) jsme spočítali pro osteologický materiál z nových výzkumů na lokalitě Dolní Věstonice II z let 1999-2015, přičemž největší míru nacházíme u mamuta srstnatého (*Mammuthus primigenius*) a to nejen v porovnání s ostatními živočišnými druhy, ale i v souboru samotném (Sázelová in prep.). Poměrná část těchto lomů je nových a byla způsobena během exkavace, přesto se domníváme, že starší lomy ovlivňují biomechanické vlastnosti mamutích kostí (které vzhledem k pneumatizovanosti a vláknitosti jsou velmi mineralizované) a lamelární charakter přírůstku klů i stoliček. Nicméně nemůžeme vyloučit ani vliv dalších tafonomických činitelů, a proto budou v tomto ohledu nezbytné další studie (srov. Shipman 1981; Morlan 1980; Johnson 1985; Haynes 1991; Villa, Mahieu 1991; Chlopačev, Girija 2010). Vliv pH sedimentu na zachování osteologického materiálu je nejmarkatnější pod pískovcovými převisy v severních Čechách, které jsou pro zachování organického materiálu většinou velmi nepříznivé (viz. podkapitola 3.5.7). Zachová-li se osteologický materiál v podobném prostředí, pak jedině ve spálené a tedy i více mineralizované podobě.

3.1.2 Biotičtí činitelé

Dekompozice čili rozklad měkkých tkání, začíná v běžných podmínkách jako anaerobní proces, který zahajují bakterie trávicího traktu organismu (nejčastěji se jedná o *Staphylococcus*, sp.; *Clostridium*, sp. a *E. coli*). Tento proces je následován disartikulací, během níž dochází k rozvolňování kloubních spojení právě v důsledku dekompozice měkkých tkání. Jako první je zahájena disartikulace atlanto-occipitálního spojení (hlava, mandibula), kterou následuje rozvolnění cervikálních a lumbálních spojení, dále sterno-kostálního spojení a pubické symfýzy; a jako poslední se uvolňuje spojení končetin, které postupuje ve směru od těla k apikálním částem končetin. Pokud dojde k sekundární manipulaci s rozkládajícím se tělem, může míra rozvolnění jednotlivých kloubních spojení naznačit, v jakém stádiu rozkladu bylo s tělem manipulováno (Kučera 1927; Weigelt 1927; Matiegka 1934; Toots 1965; Hill 1980; Bickart 1984; Blumenschine 1986; Micozzi 1986, Potts 1988; Ellison 1990; Janaway 1990; Bell *et al*. 1996; Davis, Briggs 1998).

Činnost mikroorganismů vedle střevních mikroorganismů mohou rozklad provázet i půdní mikroorganismy používající kolagen jako základní zdroj dusíku. Pokud je zvířecí nebo lidské tělo uloženo v celku, pak se na jeho kostech projeví bakteriální aktivity, které jsou charakteristické pro počáteční stádia dekompozice. Při disartikulovaných fragmentech (např. u kuchyňského odpadu) naopak dochází pouze k činnosti saprofytických hub, které jsou aktivní i po exkavaci osteologického materiálu (srov. Child 1995; Balzer *et al*. 1997; Jans *et al*. 2004). Pod vedením autorky se tímto tématem zabývá magisterská práce Bc. Radky Šmídové, která je postavena na časosběrném experimentu dvou ovcí, pohřbených v roce 2013 Bc. J. Makovičkovou, a komparaci s antropologickým a archeozoologickým materiálem. Výsledky studie můžeme očekávat v červnu 2016.

Ke zdupání (trampling) lidmi nebo zvířaty dochází u osteologického materiálu ležícího na povrchu nebo relativně mělko pod povrchem v prostoru sídliště nebo frekventovaných tras. Během tohoto procesu dochází ke změně orientace osteologického materiálu (chaotizaci), jeho fragmentarizaci a vtláčení pod povrch u vlhkých sedimentů. U kostí se trampling projevuje mělkými subparalelními liniemi o průřezu „U“, nebo může dojít k rozsáhlejšímu odštěpení kompakty, které nelze mnohdy s jistotou odlišit od lidské manipulace (Courtin, Villa 1982; Cook 1986; Behrensmeyer *et al*. 1986; Fiorillo 1989; Olsen, Shipman 1988; Haynes 1991; Blasco *et al*. 2008; Domínguez-Rodrigo *et al*. 2009).

Kontakt s kořenovým systémem rostlin rozrušuje povrch osteologického materiálu za vzniku různě velkých vlnovkovitých otisků (na histologické úrovni kořeny např. zvětšují osteony). Podobné stopy nám naznačují, že se osteologický materiál nacházel po určitou dobu své tafonomické historie poměrně mělko pod povrchem, přestože tomu nemusí odpovídat aktuální nálezová situace (Behrensmeyer, Hill eds. 1980; Andrews 1990; Lyman 1994; Denys 2002; Alhaique *et al*. 2004; Prokeš 2007).

Činnost hlodavců se projevuje ohryzem za účelem zbroušení řezáků, který má charakter mělkého vzoru tvořeného paralelními či subparalelními liniemi: a) vějířovitého typu souvisejícího s fixací horních řezáku na povrchu ohlodávaného předmětu a proměnlivého směru dolních řezáků (např. veverky, *Scirius*, sp.); nebo b) chaotického typu, kdy se horní i dolní řezáky pohybují při ohryzu volně oproti sobě (např. u dikobrazů, *Hystrix*, sp.; či myšovitých, Muridae). Na základě typu ohryzu a jeho velikosti lze odhadnout velikost zvířete i přibližné taxonomické zařazení. Činnost hlodavců může dále ovlivňovat transport (např. akumulace kostí v doupatech dikobrazů) a dislokaci osteologického materiálu, tzv. bioturbace (Shipman, Rose 1983; Klippel, Synstelien 2007).

Predace šelem a dravých ptáků pozměňuje zachování osteologického materiálu, mění jeho počet i zastoupení roztaháním kořisti, akumulací osteologického materiálu v doupatech, hnízdech a na trhaništích. Ohryz šelem se nejčastěji projevuje na apikálních částech dlouhých kostí, v oblasti žeber, páteře či dolní čelisti (extrakce morku), a dále na bázi lební (po extrakci mozku). V některých případech lze na základě velikosti a typu ohryzu odhadnout taxon dravce; a tyto stopy mohou být zaměněny s lidskými aktivitami, například rozlámání lebek hyenami, či po vlčích trhácích při strhávání masa mohou zanechat podobné stopy, jako po kamenných artefaktech. Charakter ohryzu šelem můžeme rozdělit následovně:

a) *proraženiny* vznikají při statickém tlaku čelisti, kdy zub projde kompaktou kosti a může proniknout až do spongiosy;
b) *jamky* se utváří při přímém ohryzu kostí s velmi tvrdou vrstvou kompakty;
c) *jizvy* vznikají na diafýze při jejím otáčení mezi čelistmi šelmy a jsou orientovány příčně k dlouhé ose kosti;
d) *vruby* se pak nachází na epifýzách kosti, kde vlivem mechanického působení špičáků a trháků dochází k odstranění kompakty a obnažení spongiotické hmoty.

Dalším projevem, který můžeme zaznamenat na osteologickém materiálu, je koroze gastrickými kyselinami, které zvětšují osteoblasty, ohlazují kosti i zuby, fragmentarizují je až do úplné ztráty. Experimenty dále prokázaly, že v této korozi mají významnější roli trávicí enzymy, nežli pH žaludečních šťáv či délka trávení obsahu. V souvislosti s ohryzem je zajímavý okus kostí a parohů herbivory, kteří si tímto chováním navyšují příjem minerálních látek, nebo okus člověka, jímž se pod vedením autorky zabývala Bc. Michaela Stančíková (Sutcliffe 1973; Boyde *et al*. 1978; Dodson, Wexlar 1979; Brain 1980; Binford 1981; Haynes 1980; 1983; Maguire *et al*. 1980; Johnson 1985; Andrews 1990; Fernandéz-Jalvo, Andrews 1992; Lyman 1994; Laudet, Fosse 2001; Denys 2002; Laudet, Selva 2005; Blasco, Rossel 2009).

Během osteologického výzkumu na námi sledovaných pleistocenních a holocenních lokalitách nemůžeme trampling vyloučit například u fragmentu femur mamuta srstnatého (*Mammuthus primigenius*) z lokality Předmostí – Vinary intravilán, který byl objeven v roce 2010 Zdeňkem Schenkem a Janem Mikulíkem. Dále jsme příznaky tramplingu pozorovali i v jeskyni Pod Hradem, která sloužila jako zimní hyberniště jeskynním medvědům (*Ursus spelaeaus*) s izolovanými stopami po lidských aktivitých. Četnost výskytu otisků kořenového systému je nejzajímavější na gravettských lokalitách, které byť nejsou od sebe příliš vzdálené, je aktivitami rostlin velmi rozdílná (viz výše) a může být kombinována s dalšími tafonomickými činiteli. Například vlčí *mandibula* z lokality Dolní Věstonice II z roku 1987 nese na linguální straně otisky kořínků rostlin, a na straně bukální naopak stopy po zvětrávání. Oba činitélé tak indikují pohyb i změnu orientace čelisti v průběhu její tafonomické historie na povrchu i uvnitř sedimentu (s největší pravděpodobností v souvislosti se soliflukcí; srov. Svoboda 1991). Stopy po činnosti hlodavců, resp. dikobraze, jsme zaznamenali na blíže neurčitelném fragmentu kosti velkého savce z lokality Mladeč - Ic „Puklinová“, na níž ohryz vytváří sérii velmi výrazných a relativně pravidelných faset (Svoboda *et al.* 2011). Další zajímavé stopy po ohryzu byly zdokumentovány i na horním řezáku bobra evropského (*Castor fiber*) z lokality Dolní Věstonice II – vrch (nalezeného r. 1986), u nichž jsme se v první chvíli domnívali, že se jedná o lidský zásah. Stopy vytváří velmi krátké subparalelní linie a odhalují prvních několik milimetrů okluzální hrany řezáku s expozicí skloviny na linguální straně. Nicméně linie nepřesahují hranu útvaru, a proto se i na základě konzultace s prof. I. Horáčkem domníváme, že u zvířete došlo těsně před smrtí k nadměrné zátěži spodní čelisti a vychýlení při intenzivním ohryzu těžkého předmětu (např. při lapení zvířete v závalu či pasti, z nichž by se snažilo ze všech sil zachránit; Sázelová *et al.* in prep.).

Přítomnost ohryzů šelem na našich gravettských lokalitách je relativně nízká (srov. Wojtal, Wiłczyński 2015), což dokládá i materiál z nových výzkumů na lokalitě Dolní Věstonice IIa z roku 2012 a Milovice IV 2009, odkud pochází vždy jediný doklad; podobně jsme ohryz zatím nepozorovali ani na mezolitickém materiálu ze severních Čech. Nicméně občasné přiživení se šelem na hnijících zbytcích po lidských aktivitách i přes nepřítomnost ohryzu nemůžeme definitivně vyloučit. Analýza patologických projevů orofaciálního skeletu vlků (*Canis lupus*) potvrdila přítomnost periodontických projevů (viz. podkapitola 3.5.3) u velmi starých jedinců mezi 9 a více lety. Vezmeme-li v úvahu i degenerativní změny, projevující se na postkraniálním skeletu, přivádí nás toto zjištění k předpokladu, že se mohlo jednat již o lovecky znevýhodněné jedince. Konzumace hnijícího masa je jednou z příčin vzniku *periodontitis* u vlků, u nichž žvýkání hnijícího kadaveru nezajišťuje dostatečné čistění chrupu a dásní, provázené vznikem vysoce agresivního mikrobiálního prostředí v tlamě zvířete. Přestože nemůžeme vyloučit ani jiné důvody, jako například genetické predispozice, zranění dásně a zubu (které jsme na makroskopické úrovni neprokázali) či zvýšení abraziv v přijímané vodě. Dalším patologickým projevem je doklad prokousnutého patrového výběžku (*processus alveolaris maxillaris*) vlka rovněž z lokality Dolní Věstonice II – západní svah. Z recentních analogií u současných vlčích populací víme, že tento typ zranění není po vzájemných soubojích ničím výjimečným (Sázelová *et al.* in prep.). Ohryzy herbivorů, resp. sobů (*Rangifer tarandus*), jsme pozorovali zejména na osteologickém materiálu z etnologického kontextu mikroregionu Jangana Pe (podkapitoly 2.3.1-2.3.3).

3.1.3 Lidské zásahy na osteologickém materiálu

Člověk, podobně jako další biotičtí činitelé, modifikuje osteologický materiál mnoha způsoby, přesto se na rozdíl od ostatních živočichů sledujících výhradně potravní či funkční zájmy, projevují velmi specificky (srov. Absolon 1934; Skutil, Stehlík 1949; Shipman, Rose 1983; Johnson 1985; Lyman 1994; Choyke, Bartosiewicz eds. 2001; Feugère *et al*. 2008; Jin, Shipman 2009; Chlopačev, Girija 2010; Baron, Kufel-Diakowska eds. 2011).

Bourání zvířecího kadaveru začíná usmrcením zvířete, je následováno rozporcováním do několika kusů (vč. odhození nepotřebných částí); a podle Binforda (1978) může souviset s jejich transportem do prostoru sídliště a končit konzumací zvířete, nebo využitím surovinových částí (např. kožešina, šlachy, kosti, parohy, mamutovina, zubovina ad.) i odhozením odpadních částí (s čímž nesouhlasí Lyman 1994, 295). V rámci naší studie dokumentujeme zářezy a stopy po tříštění kostí:

Zářezy kamenným artefaktem vykazují nepravidelný průřez „V“, kdy jedna strana se prudce zvedá a je hladká, zatímco druhá je pozvolnější s jemnou paralelní striací (srov. Morlan 1980; Shipman 1981; Shipman, Rose 1983; Cook 1986; Olsen, Shipman 1988; Fisher 1995; Greenfield 1999, 2002; Bello, Soligo 2008; Costamagno, David 2009; Galán *et al*. 2009; Domínguez-Rodrigo, Yravedra 2009; Domínguez-Rodrigo *et al*. 2009). Nejčastěji provází zářezy následující lidské aktivity:

a) *stahování kůže*, kdy se sledy nachází na lebce, dolní čelisti, při zadních/dolních končetinách a u prstních článků zvířete;
b) *disartikulaci těla*, u které se zářezy objevují při okrajích kloubních ploch, koncích dlouhých kostí, na povrchu pánve nebo obratlů;
c) *filetování*, u něhož jsou zářezy paralelní s podélnou osou dlouhé kosti;

d) *extrakce šlach*, stopy se nachází na distální ploše metapodií a mohou být provázeny redukcí kostěné hmoty v proximální části;

e) *stopy po vykosťování* jsou charakteristické několika řezy takového rázu, že počáteční je podélně orientovaný a prochází celou vrstvou masa až na kost. Bývá provázen kratšími šikmými zářezy přerušujícími hlavní svalové úpony, což následně umožňuje stáhnutí masa z kostěného podkladu.

K třístění kostí při extrakci morku dochází úderem s velkou rychlostí, kdy je kost vystavena dynamickému zatížení, jež provází tlakové, smykové a tahové poškození. Výsledkem je v případě čerstvé kosti spirálovitá zlomenina s charakteristickým bodem impaktu, u suché kosti dochází k drobným prasklinám se stupňovitými hrankami. Na diafýze dlouhých kostí vznikají radiální fragmenty respektující uspořádání kolagenových vláken s převažujícím délkovým rozměrem (Morlan 1980; Shipman 1981; Johnson 1985).

Spálené kosti jsou v poslední době jednou z nejstudovanějších oblastí v archeozoologii vůbec (srov. Delpech, Rigaud 1977; Shipman *et al*. 1984; Buikstra, Swegle 1989; Nicholson 1993; Roberts *et al*. 2002; Villa *et al*. 2002; Church, Lyman 2003; Cain 2005; Conard *et al*. 2008; Bosch *et al*. 2012; Fladerer *et al*. 2014), přičemž je oproti sobě porovnávána míra přepálení i poměr kompaktní a spongiózní složky kosti, jež mohou indikovat přirozené či naopak záměrné lidské činnosti:

a) přirozený požár či náhodné spálení kostí: spálené i nespálené kosti mají většinou srovnatelný poměr uvnitř dílčích typů kompakty a spongiosy. V prostoru většinou nenalezneme stopy po lidské regulaci ohně, které by dokládaly jeho opakované zakládání, ani doklady jiných aktivit, např. osteologický materiál je bez zářezů, není doprovázen dalším archeologickým materiálem v podobě kamenných artefaktů, ozdob či barviva. K náhodnému přepálení kostí může také dojít při založení ohniště v nadloží, kdy v době jeho aktivity dochází k nepřímému tepelnému propálení vrstev podložních, včetně přítomného osteologického materiálu. U převisu tak může dojít například k nepřímému propálení místa, kde draví ptáci vyvrhovali nestrávené zbytky své potravy. O tom, že došlo k nepřímému spálení ptačích vývržků, nasvědčuje většinou samotná poloha spálených kostí (pod skalní římsou nebo výběžkem) i skladba živočišných taxonů, kdy při zvýšeném poměru žab, drobných savců (jako netopýrů, myší či krtků), se asi těžko jedná o potravu z lidského jídelníčku, přestože specifické kulinářské preference nemůžeme plně vyloučit.

b) extrakce morku a tuku je předpokládána u fragmentů kolem 3 cm, v nichž je vysoké zastoupení kostí bohatých na tuk a morek (vysoké zastoupení spongiotické kosti) s relativně nízkými stupni spálení I-II (hnědá až částěčně černá barva, naznačující karbonizaci až 50 % organické složky kosti).

c) pečení masa provází selektivní výběr osteologického podkladu velmi kvalitní masové porce. Kosti bývají v takovém případě bodově opáleny, nebo může docházet k nepřímému opálení v místě, kde kost nebyla chráněna masitou částí (například u *metapodium*, či distálních část *radius* nebo *tibie*).

d) topení kostmi převažuje preference hořlavých kostí s vysokým poměrem spongiózy, osteologický materiál je provázen vysokou mírou fragmentarizace a spalování je obvykle ve stupni III-VI (barevná škála černá – šedá – až bílá odpovídá úplné karbonizaci organické složky přecházející během dalšího spalování v její úplnou oxidaci).

e) spalování kostěného odpadu provází velmi signifikatní převaha kompakty s vysokou mírou fragmentarizace (často menší jak 1cm) a velmi vysokými stupni spálení IV-VI, způsobujícím vypálení organické složky a zvýšení křehkosti spalovaného materiálu, a tím i jeho celkovou fragmentarizaci). Nicméně pokud máme k dispozici pouze výsledný stav s velmi vysokým poměrem kompakty a ve vysokém stupni přepálení, nemůžeme kromě likvidace kostěného odpadu vyloučit ani žádnou z jiných předcházejících aktivit (srov. podkapitola 3.5.7).

Distribuce zvířecích skeletů v prostoru sídliště či na tzv. místě zabití (srov. Binford 1981; Price 1985; Musil 1955, 1958, 1997, ad.) je dalším velmi důležitým ukazatelem lidské manipulace s těly zvířat v prostoru archeologického naleziště. Tato distribuce se pak může týkat celkového osteologického materiálu a jeho polohy vůči ostatním archeologickým nálezům a strukturám, nebo můžeme mapovat dílčí živočišné druhy, nebo částí zvířecích skeletů oproti sobě, které souvisí s lokalizací procesů zabití, bourání, stahování a porcování, s výrobními procesy či naopak odhazováním zbytků.

Zářezy na kostech související zejména s disartikulací zvířecího těla jsme zaznamenali na lokalitě Milovice IV na sobích (*Rangifer tarandus*) kostech - *tibia, astragalus,* *calcaneus* a *os centroquartale*; a dále na vlčím (*Canis lupus*) krčním obratli. Z lokality Dolní Věstonice IIa pochází jeden zářez opět na *os centroquartale* soba a jeden fragment dlouhé kosti mamuta (*Mammuthus primigenius*) vykazuje stopy po mechanickém odstranění svrchních vrstev kompakty. Z dalších zásahů, které jsme zaznamenali při zpracování vlčího materiálu ze starých výzkumů lokality Dolní Věstonice II jsou tzv. brzdné stopy po pohybu kamenného artefaktu po povrchu diafýzy a proximální epifýzy krkavčí (*Corvus corax*) os femuris, související pravděpodobně s odstraněním svaloviny; a dále stopy po dekarnizaci distálního kondylu téže kosti (Sázelová *et al*. in prep.). Z vlčího špičáku, který se nacházel ve vzdálenosti 1m od hlavy muže DV16 (objekt S1 z Dolních Věstonic II – západní svah), byla několika údery odstraněna sklovina (viz. podkapitola 3.5.3).

Trendy v interpretaci spalovaných kostí jsme se pokusili reflektovat na našich lokalitách. Pilotní studií bylo studium mezolitických lokalit Údolí Samoty a Janova zátoka, kde předpokládáme na základě poměru kompakty a spongiózy i míry přepálení osteologického materiálu, likvidaci kostěného odpadu. Na našich vybraných moravských gravettských lokalitách vypovídá přítomnost spálených kostí o délce jejich osídlení, kdy na sídlištích dlouhodobějšího charakteru převládají spálené kosti nad uhlíky, a naopak na sezónních lokalitách převládají uhlíky nad spálenými kostmi (srov. Beresford-Jones *et al*. 2010 pro lokality Předmostí Ib a Dolní Věstonice II – nejjižnější část). V návaznosti na jeho metodiku bychom dlouhodobější charakter osídlení (kdy na sídlišti předpokládáme celoroční přítomnost alespoň části obyvatelstva) předpokládali také na lokalitě Milovice IV nebo Pavlov I. Naopak sezónní pobyt potvrzujeme pro lokalitu Dolní Věstonice II, kdy zaznamenáváme i odlišnosti v poměrech spálených kostí a stupních jejich přepálení mezi dílčími částmi tohoto sídliště (nejjižnější část vs. DVIIa) (Sázelová in press). Poslední zajímavostí jsou hnědé až tmavěhnědé skrvny potencionálně provázející bodové opálení, které jsou poměrně časté na našich gravettských lokalitách. Přestože nemůžeme v tomto případě vyloučit ani přímý kontakt s barvivem, které by po sobě zanechalo podobnou barevnou změnu povrchu kosti.

K analýze distribuce osteologického materiálu v prostoru sídliště na základě živočišných druhů přispíváme v naší aktuální studii (podkapitola 3.5.3), kde se zaměřujeme na distribuci vlčích skeletů v prostoru sídliště Dolní Věstonice II – západní svah. Plošné uspořádání jejich anatomických částí naznačuje, že v areálu kopaném B.

Klímou se vlčí skelety akumulují u sídlištních struktur K1, K5 a K6 a dále ve vzdálenosti přibližně 3 m od K4, kde se v ploše sídliště nachází koncentrace jednotlivých kostí a zubů o přibližné rozloze 3 x 5 m. Z výzkumu J. Svobody jsme zaznamenali několik koncentrací částí vlčích skeletů – první o průměru 3 x 4 m se nacházela přibližně 13 m od objektu S1; druhá ležela v západní části ohniště a třetí se nacházela v severovýchodním směru nad objektem S1 s mužským pohřbem DV16 (zvýšený význam vlčích pozůstatků v souvislosti s tímto pohřebním kontextem však byl vyloučen).

3.4 Použitá literatura k archeologickému kontextu

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Elektronické zdroje:

ArchéoZoo, http://www.archéozoo.org

3.5 Vybrané publikace k tématu

Základem přiložených publikací bylo standardní určení osteologického materiálu, jeho přiřazení k živočišným taxonům, čímž autorka základním způsobem přispěla ke kolektivním publikacím, dokumentujícím dané pleistocenní a staré holocenní lokality. Celkem jsme vybrali čtyři články z časopisu s impaktovaným faktorem, dva články recenzované a jednu kapitolu v monografii. V detailu se první z prací *Lower and Middle Pleistocene sediments sequence with archaeological finds in Horky nad Jizerou, Czech Republic* (Šída *et al*. 2015 s autorským podílem 25 %) zabývá novými výzkumy na jedné z nejvýznamnějších českých staro - a středněpleistocenních lokalit. Z osteologického hlediska jsme dokumentovali nálezy savčí fauny z let 2009-2012 z Horky III, které byly taxonomicky přiřazeny koni (*Equus*, sp.), přestože se nám je vzhledem k nevelkému počtu kostí, vysoké míře jejich fragmentarizace a zvětrání, nepodařilo blíže druhově specifikovat.

Následující čtyři práce se vztahují k areálu gravettských lovců Dolní Věstonice – Pavlov – Milovice: *Dolní Věstonice IIa: Gravettien microstratigraphy, environment, and the origin of baked clay production in Moravia* (Svoboda *et al*. 2015 s autorským podílem 9 %) prezentuje formování mikrostratigrafie této lokality na základě vybrané části materiálu z výzkumů J. Svobody v letech 1999 a 2012. Z osteologického hlediska bylo zpracováno přes 8000 fragmentů zvířecích kostí a zubů, se zvláštním zaměřením na deskripci spálených kostí. V návaznosti na aktuální diskusi o domestikaci vlka na moravském gravettském sídlišti na Předmostí Ia (srov. např. Germonpré *et al*. 2009, 2013, 2015; Crockford, Kuzmin 2012) jsme se zapojili do projektu *Deciphering dog domestication through a combined aDNA and geometric morphometric approach*, který je veden Gregerem Larsonem z Oxforské univerzity a Keithem Dobneym z Univerzity v Aberdeenu. V přiložené kapitole *The role of large canids: Preliminary variabilities forming the population structure in Moravia* (Perri, Sázelová in press. s autorským podílem 50 %) prezentujeme historický pohled na otázku domestikace vlka na Moravě i předběžné výsledky naší analýzy vlčí populace z lokality Dolní Věstonice II. Následující práce *Pavlov I in time and space. Excavations 2013-2014* (Svoboda *et al.* in press s autorským podílem 25 %) představuje předběžné výsledky nejnovějšího záchranného výzkumu na lokalitě Pavlov I v souvislosti s výstavbou Archeoparku. Pro publikaci byly předběžně popsány vybrané osteologicky zajímavé nálezové situace. Čtvrtý článek je pilotním článkem, neboť se v něm autorka pod vedením doc. P. Wojtala prvně podílela na zpracování pleistocenního osteologického materiálu - *Paleolithic hunting in a southern Moravia landscape: The case of Milovice IV, Czech Republic* (Svoboda *et al.* 2011 s autorským podílem 6 %).

Předposlední práce se váže ke středomoravské gravettské lokalitě *Předmostí - Předmostí III: un site pavlovien de la Porte de Moravie (République tchèque, Europe centrale)* (Polanská *et al.* 2014 s autorským podílem 15 %) představující osteologické zpracování dochovaného materiálu ze záchranného výzkumu B. Klímy, který je uložen ve sbírkách Moravského zemského muzea v Brně a v ojedinělých předmětech je prezentován rovněž na Archeologickém ústavu AVČR Brno – Detašované pracoviště v Dolních Věstonicích. Vzhledem k taxonomickému zastoupení živočichů se domníváme, že se jedná spíše o výběr z nalezeného materiálu. Poslední přiložená práce *Palaeolithic/Mesolithic stratigraphic sequences at Údolí Samoty and Janova zátoka Rockshelters* (Svoboda *et al.* 2013 s autorským podílem 17 %) představuje osteologické zpracování fauny ze severočeských mezolitických lokalit s pilotní analýzou zpracovávající spálené kosti dle aktuálních metodik.

3.5.1. Lower and Middle Pleistocene sediments sequence with archaeological finds in Horky nad Jizerou, Czech Republic

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LOWER AND MIDDLE PLEISTOCENE SEDIMENT SEQUENCE WITH ARCHAEOLOGICAL FINDS IN HORKY NAD JIZEROU (OKR. MLADÁ BOLESLAV / CZ)

At the beginning of the 21st century there are few stratified archaeological sites in the Czech Republic that have been dated to the Middle Pleistocene by their sediments. One of the most comprehensive of these sites is located in the brickyard Horky nad Jizerou (okr. Mladá Boleslav) overlooked for a long time as it was outside the interest of Palaeolithic archaeologists. The brickyard is situated in Central Bohemia, at the coordinates N 50.3302 and E 14.8469 with an altitude of 212-228 m a.s.l. (**figs 1-2**). The loess sediments and soils were originally filling up the side valley leading from the northwest to the main valley of the Jizera river, and were exposed during the quarry activities.

Several assemblages of Palaeolithic chipped stone industry (one larger and four smaller in numbers of pieces) were collected over the last 60 years in five different locations at the site. The first and largest lithic assemblage (known as Horky I) was discovered by F. Prošek on the 31st October 1952, on the western wall of the Old brickyard at a depth of approx. 6 m. The artefacts were deposited in a concentration with a diameter measuring approx. 5 m, and one half of the deposit had been destroyed by quarrying. The objects were accompanied by several heavily damaged and thus unidentifiable animal remains (Prošek 1952a; 1952b). A year later in 1953, F. Prošek excavated and documented the assemblage in its entirety (**fig. 3**; Fridrich 1982, 71). In 1967 J. Kukla and J. Fridrich (Kukla 1967; Fridrich 1982, 71) discovered several new lithic artefacts at the same level as the assemblage found by F. Prošek in 1952. In recent years, this area of the brickyard has been partially buried and covered by vegetation and was not obviously affected by the quarrying; therefore future revisionary excavations can be expected to take place. Whilst he was excavating at site I, F. Prošek also collected several artefacts from nearby the northern wall of the Old brickyard, described as the Horky II site, however, there is still very little known about these finds. Since the brickyard was last visited by J. Fridrich and J. Kukla in the 1960s, the site had ceased to be of any archaeological or geological interest, therefore the following extensive quarrying works in the northern part of the brickyard (towards i.e. New brickyard) from the 1970s and 1980s were not documented. However, between 2000 and the present, this area started to be closely monitored by P. Šída who has detected three smaller accumulations of stone artefacts. The Horky III site, located on the surface of the second storey of the northern part of the brickyard, yielded the first lithic object in 2007, followed by the discovery of animal remains in 2009. Additionally, some sporadic findings were detected at Horky IV, particularly from the surface of the first storey, and several other lithic artefacts and bone fragments were documented on the surface of the inclined track of the brickyard´s northern edge, labelled as the Horky V site. With this most recent knowledge we conclude that the Horky II site is now buried and inaccessible for further

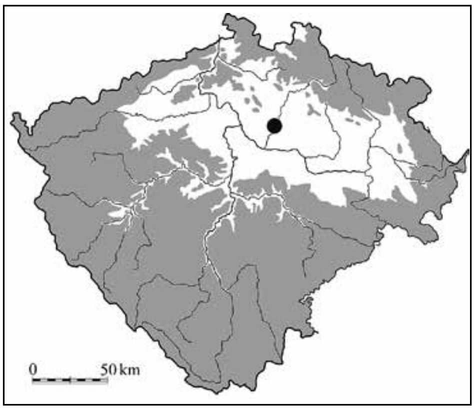

Fig. 1 Horky nad Jizerou (okr. Mladá Boleslav / CZ). Location of the site. – (Illustration P. Šída).

Fig. 2 Horky nad Jizerou (okr. Mladá Boleslav/CZ). Situation of the brickyard. – Legend: **1-2** geological profiles; **old** and **new** geological sections through the Old and New brickyard; **Horky I-V** archaeological sites. – (Illustration P. Šída).

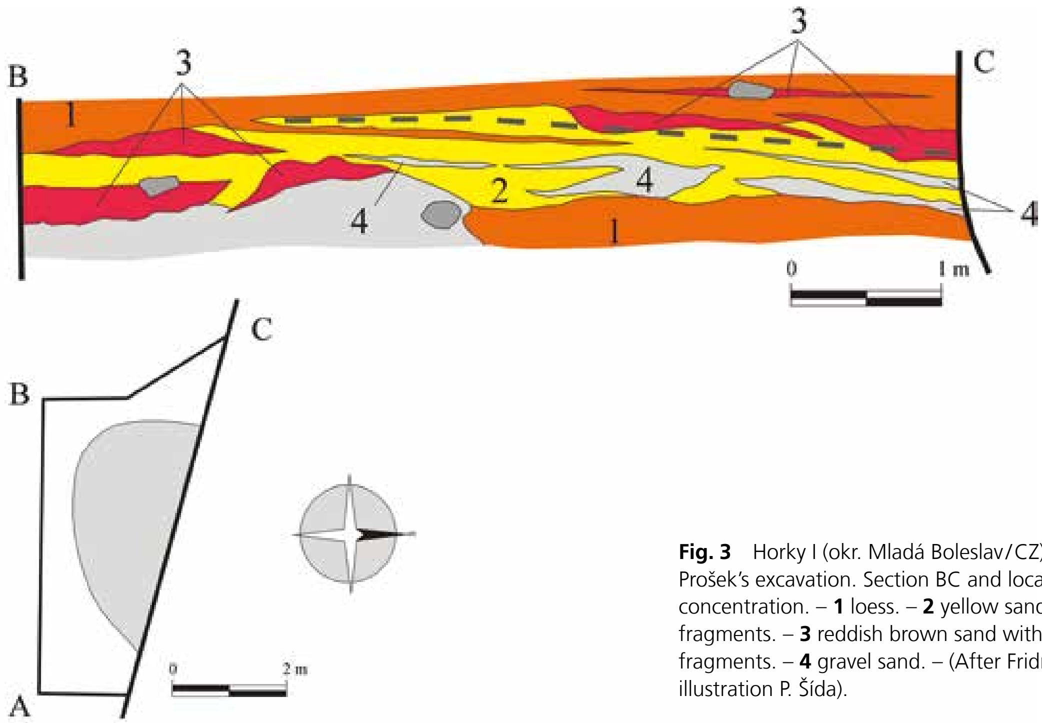

Fig. 3 Horky I (okr. Mladá Boleslav/CZ). Situation of Prošek's excavation. Section BC and location of artefact concentration. – **1** loess. – **2** yellow sand with sandstone fragments. – **3** reddish brown sand with sandstone fragments. – **4** gravel sand. – (After Fridrich 1982; illustration P. Šída).

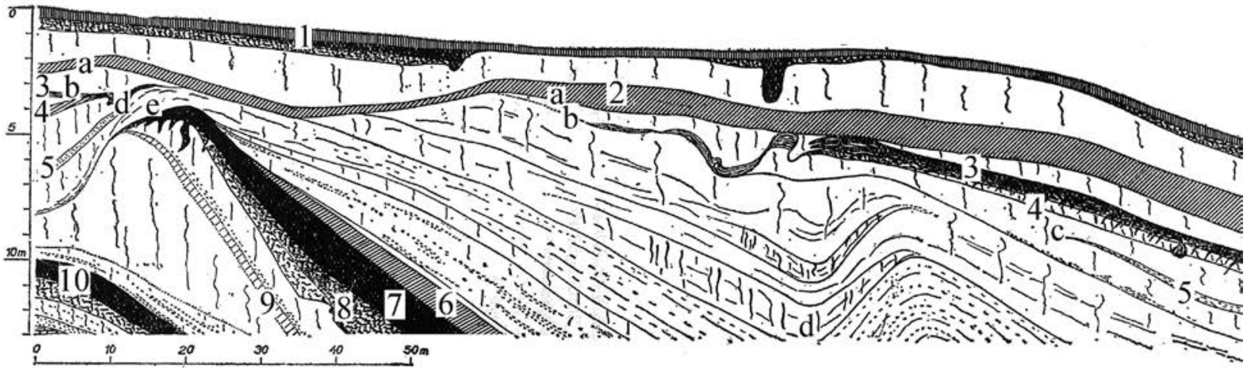

Fig. 4 Horky nad Jizerou (okr. Mladá Boleslav/CZ). Geological section of the Old brickyard. – (After Ložek 1964, with additions).

researches, however, sites III, IV and V are still observed and documented, and site I is still accessible to revisionary excavation. Although the brickyard was studied by many Quaternary geologists (e.g. J. Kukla, V. Ložek) since the 1950s, only selected details were published without comprehensive description (see Kukla 1961; 1966; Ložek 1964, 88; 1971, fig. 1). Therefore, this paper will briefly describe the situation at the Old brickyard, which is not possible to observe anymore, and compare it with the new parts of the brickyard which have roughly the same stratigraphic deposits which were releveled when soil micromorphological analysis was done for the first time.

STRATIGRAPHY AND SITE FORMATION

The stratigraphy of the loess formation at the Old brickyard has been documented and described by several researchers concerned with the Quaternary geology, palaeopedology, malacozoology and archaeology. The first mention of the fossil soils in loess strata was by R. Schwarz and L. Urbánek (1948), who described them as the B horizon soil. Although the earliest attempts of Quaternary geological description were dated to the time of World War II, they were published much later in the 1950s. In 1951, E. Schönhals describes an interglacial chernozem soil most likely transported by solifluction on Riss loess. The podzolised soils (A1, A2, A2G, and B) fit much closer to the interstadial W I/II. Another strongly podzolised soil is developed on the solifluction formation from the W II and is likely dated to the interstadial W II/III. The most recent soil type layer is a brown earth. These observations were reviewed by L. Smolíková in 1960, who described the more recent classification of fossil soil complex system as a pair of strongly developed lessivé with humus soils in the overburden. Contrary to previous researchers, she disagreed with Würmian (Upper Pleistocene) soils and last interglacial soils on the major profiles. Nevertheless, it does not mean that Schönhals' (1951) description of strata is incorrect, but is probably more comparable with soil complex IV in terms of J. Kukla, V. Ložek, and Q. Záruba (Kukla 1961). We do not have the exact position of Schönhals' profile, but it is likely the southwestern corner of the Old brickyard, so the accurate position has been subjected to revision (Prošek/Ložek 1954). According to both authors, the site formation is quite complicated as the Middle Pleistocene loess (Rissian) was divided by degraded chernozem soil (R1/R2) and loamed zone (R2/R3), and the interglacial soil (R/W) was then formed by degraded chernozem soil. Additionally, the malacozoology

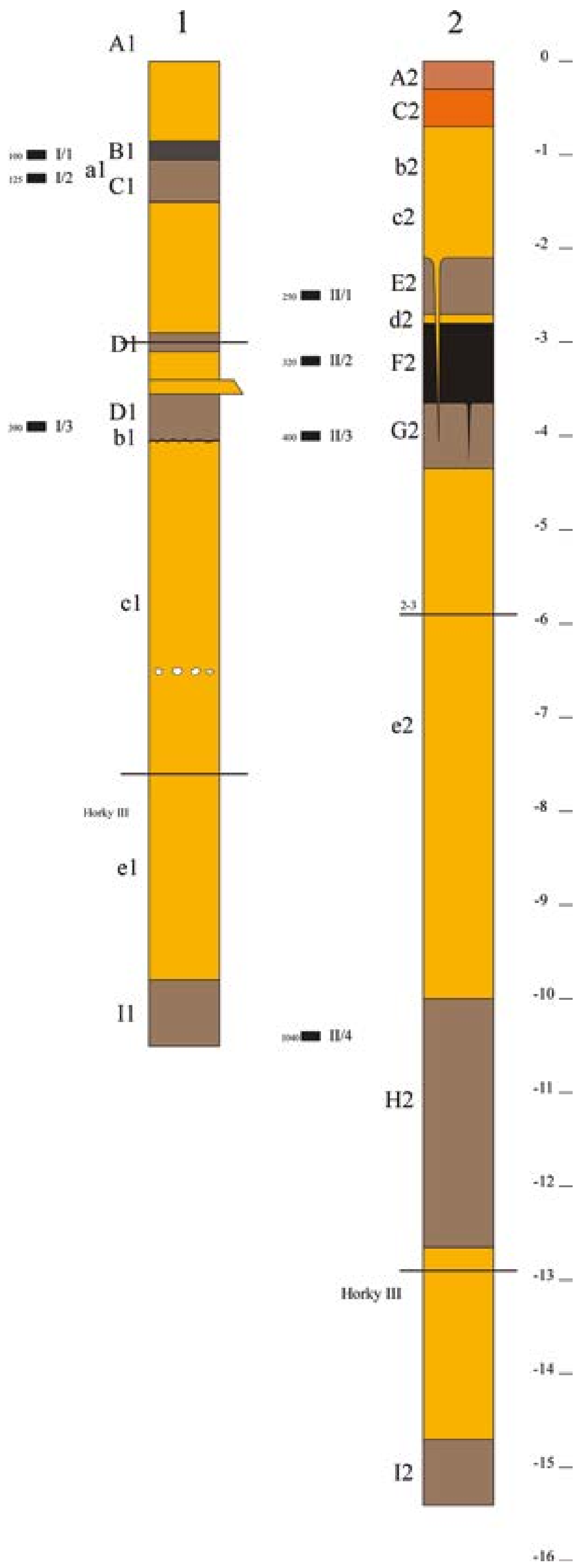

Fig. 5 Horky nad Jizerou (okr. Mladá Boleslav/CZ). Geological profiles 1 and 2 in the New brickyard. – (Illustration P. Šída).

research (Ložek 1955; 1973) does not exclude that formerly described fossil soil from R1/R2 could be redated to the interglacial M/R (Holsteinian). Contrary to these statements, L. Smolíková (1960) came out with her own suggestions that the youngest soils were well developed in the northern wall of the Old brickyard while the development of the southwestern corner is more complicated with several soils dated to older periods. She described a superposition of at least three large soil complexes, the youngest likely corresponding with soil complexes II and III, and two older soils classified by J. Kukla, V. Ložek and Q. Záruba as soil complexes IV and V (Kukla 1961).

Until recently, only one schematic profile of the Old brickyard's northern wall was published by V. Ložek (1964, 88). However, he did provide an important interpretation of fossil soils based on the stratigraphic observations and comparisons in large brickyards from Bohemia and Moravia, namely Sedlec near Prague, Letky near Prague, Červený kopec in Brno, and Dolní Věstonice (Kukla 1961; Ložek 1964; 1971), but unfortunately the ageing of soils was simplified by analogous observations without support of independent micro-morphological analyses. The profile presentation is therefore disunited and contradictory.

As shown on our profile (**fig. 4**), it is possible to observe a total amount of ten soils, eight positions of loess, and five significant erosion interfaces at the site. Soil 1 corresponds to Holocene soil. Soil 2 (Ložek's soil complex I) is poorly developed and the subsoil follows discordantly (erosion interface a). Underneath is the next loess layer followed by loess and two black and brown soils (3 and 4), tapering in the upper part of its formation and passing into a significant erosion affected by cryoturbation (horizon b). In the western part of the stratigraphy the soils are well developed and separated by loess (Ložek's soil complexes II and III). A poorly developed soil (5) is preserved in loess under soil complexes 3 and 4, filling the erosion gully in the western part of the profile. Similar to the upper soils this soil displays tapering and joins an erosion interface (horizon c). This stratigraphic part is followed by a massive loess layer which is intersected by two erosive interfaces (d and e). This extensive erosion created a large erosion valley in the western part of the profile, breaking through the massive complex of soils 6-8 (Ložek's soil complex IV). The next stratigraphic position is characterised by loess layers with one weakly developed soil (9), followed by the last soil complex, 10, previously described as soil complex V, and the weathered Cretaceous pelite subsoil. This Cretaceous subsoil was captured on the base of the western part of the profile as well.

In the case of the New brickyard we have documented in detail two profiles (**fig. 5**) where the micro-morphological samples were taken. A schematic section of the brickyard in the west-east direction was reconstructed parallel to the profile in the Old brickyard and shifted about 250 m northwards, thus making it possible to compare the old and new profiles (for correlations between layers see **tab. 1**).

The surface of the profile (**fig. 6**) is characterised by Holocene soil (A) separated by a narrow layer of loess from a complex of two soils (B and C, intersected by erosion surface a'). This position is followed by loess and soil D strongly affected by solifluction, which passes into erosion interface b'. Then another position of loess appears with another significant soil complex, soil E is resedimented, F and G are braunlehm luvisoils. The substantial erosion interface (c') affected the loess in the overburden and related soils as well. Additionally, another substantial erosion interface (d') is visible in this complex, which is followed by a loess layer also intersected by an erosion interface (e') reducing the subsequent soil (braunlehm soil H). A thin layer of fine loess is present below, followed by the last soil presented at the base (soil I). It is possible that not all of the erosion interfaces were detected in the profiles, especially if they were located in loess as this does not affect the soils; a geochemistry and granulometry will be needed for this study.

Old brickyard	**New brickyard**	**datation**	**archaeology**
soil 1	soil A	Holocene-MIS 1	
loess			
soil 2		SC I-MIS 3	
erosion boundary a			
loess	loess		
soil 3	soil B	SC III-MIS 5	
erosion boundary b	erosion boundary a		
loess			
soil 4	soil C	SC IV a-MIS 7a	
loess	loess		
soil 5	soil D	SC IV b-MIS 7c	Horky V
erosion boundary c			
loess			
erosion boundary d	erosion boundary b		
loess	loess		Horky IV
erosion boundary e	erosion boundary c		
loess	loess		
soil 6	soil E	SC V? removed by solifluction	
	erosion boundary d		
soil 7	soil F	SC V-MIS 9a	
	loess		
soil 8	soil G	SC V-MIS 9c	
loess	loess		Horky I
	erosion boundary e		
soil 9		SC VI?-MIS 11?	
loess	loess		
soil 10	soil H	SC VII+-MIS 13+	Horky II
loess	loess		Horky III
	soil I	SC VIII+-MIS 15+	
Turonian siltstone			

Tab. 1 Correlation of layers in the Old and New brickyard together with datation and position of archaeological layers. – SC: soil complex; MIS: marine isotopic stage.

Finally, a significant correlated horizon between the Old and New brickyard is documented in soils 6-8 and E-G (plus the overlaying sequence) as they are similarly occurring in both profiles (cf. Ložek 1964; Kukla 1967; Fridrich 1982), which can be dated to soil complex V. The problem with the comparisons arises on the level of the subsoil, due to the fact that the sediment base was found only on a small space in both brickworks. Additionally, soil complex VI is missing at the New brickyard, while two braunlehm soils (H and I; at least soil complexes VII and VIII) are present. The less developed soil in the Old brickyard could perhaps correlate with soil complex VI. A distinctive soil complex under this soil could then correspond to soil complex VII, but soil complex VI cannot be definitively excluded.

Fig. 6 Horky nad Jizerou (okr. Mladá Boleslav/CZ). Upper part of the geological profile 1 with soils A, B, C and D and erosion boundaries a and b. – (Illustration P. Šída).

MICRO-MORPHOLOGICAL ANALYSES

In total seven samples from two profiles of horizons bearing signs of pedogenesis were taken for micro-morphological analysis. One of these horizons represents soil sediment, the rest of samples are true soils. In 2014 a new soil horizon was discovered under soil 6, but this sample is not included in the recent micro-morphological description.

Profile 1 (soil B, sample I/1): depth 100 cm (number of thin section 54 137; 7.5 YR 4/4, measured dry), represents: Dark brown-grey, strongly flocculated humic matrix mostly concentrated in the polyhedron tight tracks, some parts retain coprolithic elements of fossil earthworm (*Allolobophora* sp.) showing remnants of the originally aggregate composition. A relatively high amount of sub braunlehm plasma occurs in the matrix which is richly orange with high optical activity, often flanking the walls of supply lines, with a frequently well conserved incremental retaining zone without any occurrence fossil edaphon excretes, causing the significant difference between the colour of biogenically untreated soil mass. The partial braunlehm plasma displays, in some places, fine granulation, the microskeleton corresponds with silt. The large, irregularly radically limited Mn concretions are quite often present here, contrary to the low development of recalcification traces and cracks or fissure networks.

– Strongly developed luvisoil (illimerizzed soil)
– Basal soil of Stillfried A, soil complex III (R/W)

Profile 1 (soil C, sample I/2): depth 125 cm (number of thin section 54 138; 7.5 YR 8/6, measured dry), can be described as: Light ochre braunlehm flocculated matrix with an occurrence of small braunlehm nodules, tiny Mn concretions, and a low proportion of braunlehm plasma. As in the previous case, it borders the walls of supply lines where the observation of incremental zones and fine granulation is possible. The microskeleton reflects perfectly selected granularity of silt dominated by quartz grains. Traces after fossil biogenic activity and decalcification are low.

– Weakly developed luvisoil
– Upper soil of soil complex IV
(Middle Pleistocene)

Profile 1 (soil D, sample I/3): depth 390 cm (number of thin section 54 139; 7.5 YR 5/8, measured dry), is characterised as: Light brown-ochre flocculated matrix containing a higher proportion of sub braunlehm plasma than the overlying soil, its characteristics are analogous. The micro-

skeleton sorting is not as distinct as in the previous case (no. 54 138) as it contains silt and an increased proportion of coarser particles. Besides the partial braunlehm plasma in incoming lines, the various forms of $CaCO_3$ (amorphous, also in the pores of the matrix calcite needles or romboedres), braunlehm concretions (some of which are cracked), and cracks or fissures are abundant.
– Strongly developed luvisoil
– Lower soil of soil complex IV
(Middle Pleistocene, both of these soils correspond to Warm Period »inter Riss« – according to the older division)

Profile 2 (soil E, sample II/1): depth 250 cm (number of thin section 54 140; 7.5 YR 5/8, measured dry), corresponds to: Brown and slightly humic matrix characterised by aggregate composition with intensive activity of fossil earthworm (*Allolobophora* sp.) and pot worm (cf. *Enchytraeidae*). The microskeleton corresponds to silt with other coarser components (e. g. large plagioclases). In the redeposited part numerous braunlehm nodules occur, displaying variability in its construction, such as lumps of partial braunlehm plasma and »mangan-limonite« concretions. The layered material is strongly carbonated with amorphous forms of $CaCO_3$ and calcite crystals.
– Sediment of A horizon of muck soil, soil complex V
(Middle Pleistocene)

Profile 2 (soil F, sample II/2): depth 320 cm (number of thin section 54 141; 7.5 YR 6/6, measured dry), contains: Brown flocculated matrix unequally and slightly humic, containing high proportion of sub braunlehm plasma which is strongly brown grounded and despite lacking the original colour, it is still birefringent and retains the original incremental zones (the best preservation is in the incoming paths). Similar to the overlying position the soil microskeleton is partially sieved including many traces after frequent fossil biogenic activity (prevalence of earthworms – *Allolobophora* sp., less pot worms – *Enchytraeidae*) and number of cracks, fissures, and braunlehm nodules. The recalcification is weak and visible only in supply lines.
– Strongly brown grounded braunlehm luvisoil
– Upper soil of soil complex V
(Upper Holstein – according to the older division)

Profile 2 (soil G, sample II/3): depth 400 cm (number of thin section 54 142; 7.5 YR 5/4, measured dry), corresponds to: Brown slightly humic flocculated matrix with large amount of partial braunlehm plasma occurring in supply lines and the matrix as well. Despite a high degree of brown grounding, incremental zones and optical activity are preserved. In the supply lines the manganese rims are preserved. The grain size is more organised than in the overlying soil and it is richer in mineral composition containing darker minerals such as glauconite and others. Braunlehm nodules are less extended as well as the traces after edaphon activities and amorphous forms of $CaCO_3$. The soil material here is disturbed by mechanical influences as well.
– Strongly brown grounded braunlehm luvisoil
– Lower soil of soil complex V
(Upper Holstein – according to the older division)

Profile 2 (soil H, sample II/4): depth 1040 cm (number of thin section 54 143; 7.5 YR 4/4, measured dry), can be described as: Brown, slightly humic peptized matrix with tight, segregate composition and portion of inner vacancy space. The microskeleton is unsorted and coarse and within the matrix the numerous braunlehm nodules of larger dimensions (if compared to all overlying soils) and manganese concretions are present. Rarely occurring fragments of charred wood with preserved internal structures, signs of decalcification (from amorphous forms of $CaCO_3$ to calcite crystals) and traces of biogenic activity.
– Braunlehm
– Minimal age is soil complex VI
(Warm Period of Elster glacial / Mindel – according to the older division)

ARCHAEOLOGICAL FINDS

Horky I

The concentration of artefacts excavated by F. Prošek was oval in shape and measured about 5 m × 3 m and was half destroyed by quarrying in the brickyard. This concentration was located in a layer of yellow sandy soil with gravel of Turonian sandstones and interbeds of resedimented loess, sand and sunken blocks of sandstone. The plugs of dark brown soil sediment were evident along the cracks and on the surface of the artefacts. The overlaying layers of loess were covered by a lessivé horizon of soil 8 (Kukla 1967; Fridrich 1982, 72), aligned by J. Kukla with soil complex IV.

techno type	quartz	cretaceous quartzite	quartzite	non determined	total	%
fragment	25	2			27	22.3
fragment of core edge	1				1	0.8
flake	62		1	6	69	57
core	4			5	9	7.4
core on flake	1				1	0.8
levalloid core				1	1	0.8
sferoidal core				3	3	2.5
debitage	93	2	1	15	111	91.7
bifacial artefact	1				1	0.8
bifacial knife				1	1	0.8
side scraper	1			4	5	4.1
double ventral side scraper				1	1	0.8
types	2			6	8	6.6
manuport	1				1	0.8
hammer stone	1				1	0.8
others	2				2	1.7
total	97	2	1	21	121	100
%	80.2	1.7	0.8	17.4	100	

Tab. 2 Horky I (okr. Mladá Boleslav / CZ). Composition of collection.

The lithic industry from the Horky I site was first published by J. Fridrich (1982, 72-75) and according to his description, the assemblage consists of 222 objects in total with 16 cores, 145 flakes, 34 fragments, and 27 retouched tools. The raw material of the artefacts was dominated by quartz pebbles, lesser extension should be ascribed to Cretaceous quartzite (4 pieces) and green jasper (1 piece). A portion of this assemblage has been since lost, with only 100 objects are presently accessible. We have added 21 more pieces already displayed by J. Fridrich and evaluated at least in general only by drawings (**tab. 2; list**).

The dominant raw material of the assemblage of 121 artefacts is quartz pebbles (97 objects, 80.2 % of the assemblage), followed by fragmentary Cretaceous quartzite used in production of two artefacts (1.7 %), and the last piece was made from pebble of Palaeozoic quartzite (0.8 %). In the case of the additional 21 objects, the raw material cannot be determined (17.4 % from the whole assemblage, artefacts described by J. Fridrich).

Debitage represents the biggest portion of the assemblage (91.7 %) with 111 artefacts. Most of these are cover flakes (**fig. 7**) of which there are 69 in total (57 % of the collection, 62.2 % of the debitage). Ten of these pieces can be classified as levalloid flakes (14.5 % of the flakes) and a total of 14 flakes bear a retouched base (20.3 % of the flakes), which indicates the adjustment of the impact platform of the core. Moreover, 45 flakes display an untreated base (boulder surface or flat fracture surface, 65.2 % of the flakes) and they originate from the core preparation and reduction. The fragments represent 28 pieces in total (23.1 % of the collection, 25.2 % of the debitage) and one of them was a stroke off from the core edge. Cores represent 14 exemplars in the whole assemblage (11.6 % of the collection, 12.6 % of the debitage).

Finally, we have identified only eight retouched tools (6.6 % of the collection; **fig. 8**), including six side scrapers on flakes from prepared cores (4.9 % of the collection, 75 % of the types). The remaining two pieces are a retouched bifacial knife type (0.8 % of the collection, 12.5 % of the types; Fridrich 1982) and a fragment of a bifacial tool. Additionally, we have to mention two remaining artefacts representing a different lithic industry type, a manuport and a hammer stone. Within the assemblage, prepared cores are the dominant technology with indications of Levallois technique knowledge, in some cases performed on a low quality pebble raw material. The tools are produced on flakes chipped from prepared cores and bifacial

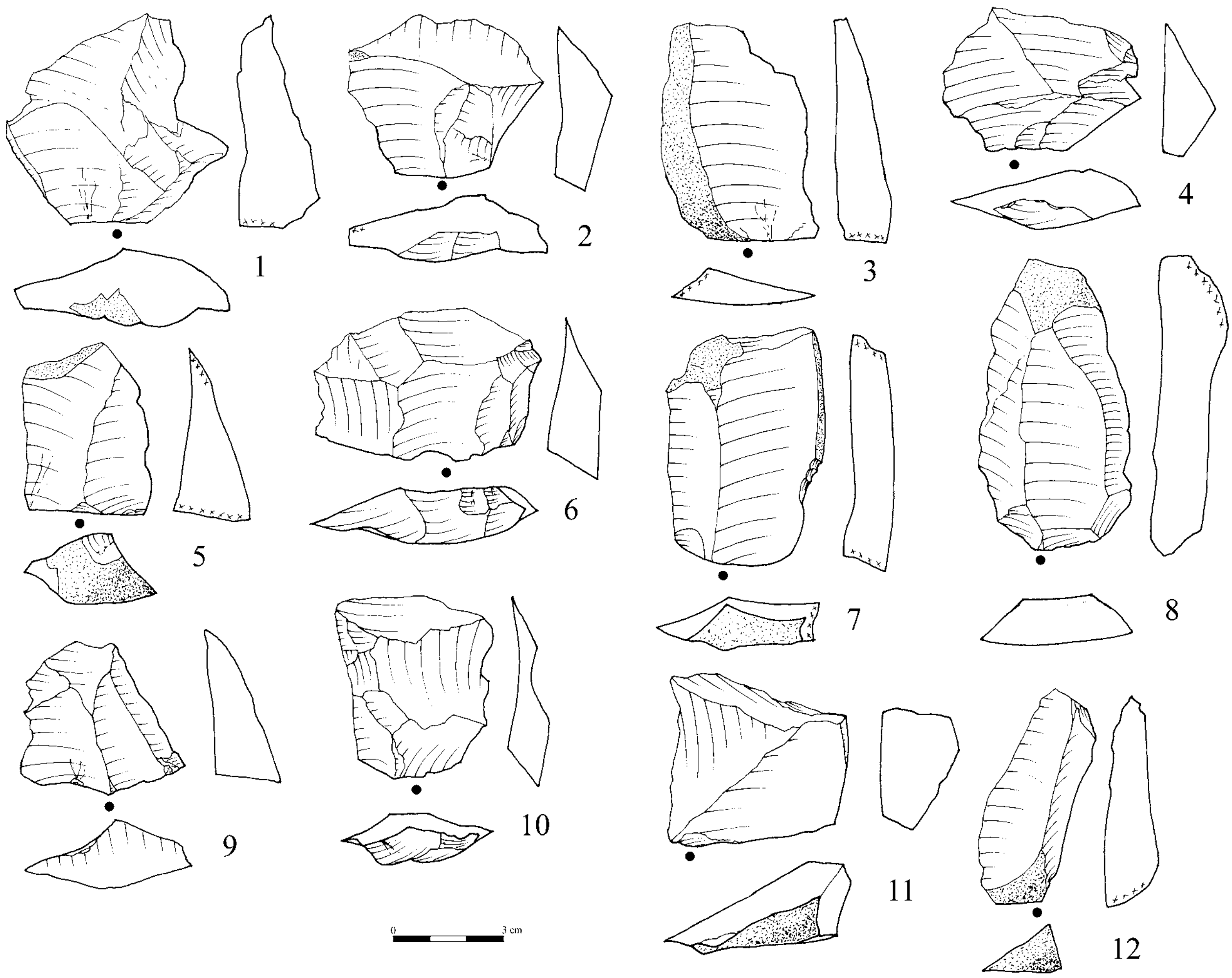

Fig. 7 Horky I (okr. Mladá Boleslav/CZ). Flakes (**1-12**). – (Drawings P. Šída).

technology is present. J. Fridrich (1982) classified this assemblage as »typical middle Palaeolithic« from the Riss glaciation period, comparable to Bečov I (okr. Karlovy Vary/CZ; Upper Acheulean and Lower Mousterian). According to our reviews of the overall data in the brickyard, the revision of its chronological position (see below) seems to be necessary.

Horky II

F. Prošek discovered a small lithic assemblage in soil later described by J. Kukla and V. Ložek (1964) as soil complex V (soil 10 according to our classification). Unfortunately, the artefacts have not survived to the present day, so we are only left with one published description of them (Fridrich 1982, 75). According to this publication, eight objects (2 retouched tools, 1 flake and 5 amorphous fragments) came from this location. The first tool was an atypical bifacially retouched point made of yellow grey patinated silicite with dimensions of 2.5 cm × 2.0 cm × 0.8 cm. The dorsal side of the point was retouched flat, on the edges displayed irregular retouching and notching, and the base was retouched to a straight edge. On the ventral side of the lateral edge a bulbus of a primary flake (from which the flake was made) was evident. The edges on the ventral side were worked out by irregular notched retouching.

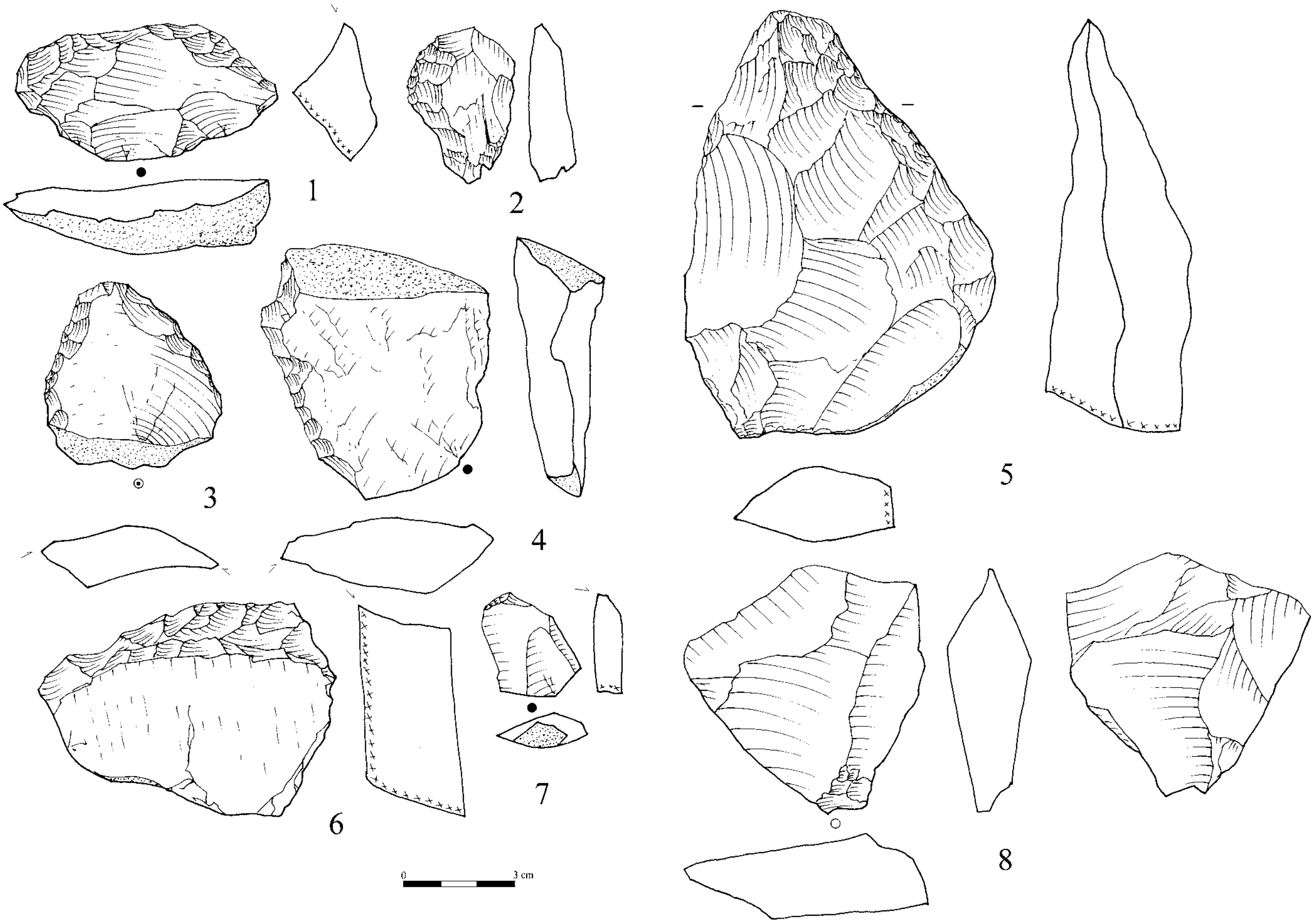

Fig. 8 Horky I (okr. Mladá Boleslav/CZ). Types: **1-4. 6-7** side scrapers. – **5** bifacial knife. – **8** fragment of bifacial artefact. – (1-6 after Fridrich 1982; 7-8 drawings P. Šída).

The second tool was an atypical quartz pebble chopper with dimensions of 3.7 cm × 5.0 cm × 2.7 cm. The chopper was produced on pebble cut in half with a single strike, shaping the lateral edge. The remaining flake was also made of quartz pebble with dimensions of 2.0 cm × 2.0 cm × 0.8 cm and its base was formed by the pebble surface. Alongside the lithic artefacts, charcoals have been found leading some authors to speculate about the presence of a fireplace (Sklenář 1977, 14-17; Fridrich 1982, 75). However, the charcoals may be directly related to the soil horizon as the objects do not bear any evidence of burning and other traces of the fireplace have not been detected. F. Prošek (Prošek/Ložek 1954, 45) classified these artefacts after various comparisons with similar assemblages from Taubach and Ehringsdorf (both Stadt Weimar/D). Most recently the objects have been identified as belonging to the Lower Palaeolithic industry group, however, the precise ageing of our assemblage remains open.

Horky III

Alongside the animal remains, a subsferoide and a side scraper on flake with two indeterminate fragments of quartz pebbles were found on the surface of the second stage of the New brickyard (loess between soils H and I; fig. 9). The subsferoide is made of quartz pebble with dimensions of 3.05 cm × 4.3 cm × 2.0 cm and the side scraper was produced from a massive quartzite flake with dimensions of 4.5 cm × 4.5 cm × 2.3 cm. The surface of both artefacts is slightly eolised with corroded edges. Retouching processes were evident on

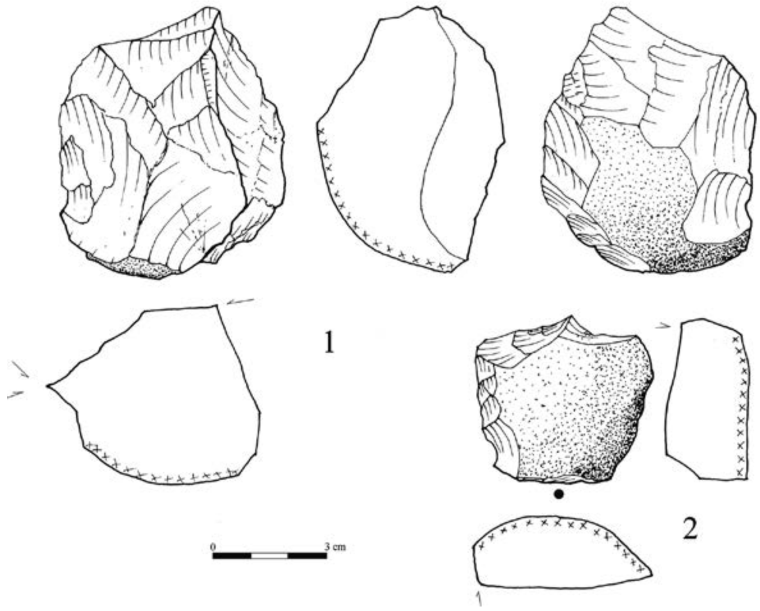

Fig. 9 Horky III (okr. Mladá Boleslav / CZ): **1** subsferoide. – **2** side scraper. – (Drawings P. Šída).

both the left lateral and terminal edge of the side scraper (constricting an angle of 90°). The massive base of the flake carried several negative coarse flakes shaping the striking platform. Its core was simple without traces of previous preparation. The dorsal surface of the flake almost covers an entirely eolised surface of the primary raw material. The presence of the subsferoide and the character of the side scraper production could be dated to the Lower Palaeolithic, although the total number of findings is not extraordinary.

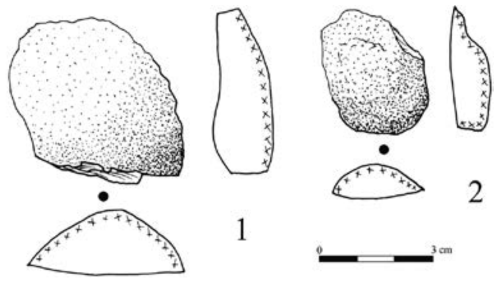

Fig. 10 Horky IV (okr. Mladá Boleslav / CZ). Flakes (**1-2**). – (Drawings P. Šída).

Horky IV

On the surface of the first stage of the New brickyard (the loess above the erosion interface c), two isolated flakes and one indeterminable fragment from a quartz pebble were discovered (**fig. 10**). The first of the flakes has dimensions of 4.3 cm × 4.8 cm × 1.8 cm and the second of 3.1 cm × 3.2 cm × 1.2 cm. The dorsal surface of both flakes is covered by a primary pebble surface, therefore it did not originate from a prepared core. The base of the first flake is simply flat with a straight fracture surface. The base of the second exemplar is the natural pebble surface. Both pieces are slightly eolised with a simple character, therefore a closer cultural classification is preliminary. Faunal remains were not detected here.

Horky V

On the surface of the oblique slant path leading from the first stage directly to the bottom of brickyard´s northern wall (soil D removed by solifluction), three residual cores (**fig. 11**) and a flake with four atypical raw material fragments and one small fragment of heavily weathered bone were discovered. The lithic flake made from quartz pebble has dimensions of 1.3 cm × 1.35 cm × 0.7 cm and its base is the natural surface of the pebble which covers 10 % of the dorsal side as well. The artefact also displays signs of burning and an eolised surface. There were also two cores with eolised surfaces and made of quartz pebble with dimensions of 4.5 cm × 3.8 cm × 2.2 cm and 3.7 cm × 2.6 cm × 1.65 cm (**fig. 11, 1-2**). The third core is made of a jasper fragment strongly eolised and white patinated (**fig. 11, 3**) with dimensions of 2.7 cm × 2.15 cm × 1 cm. This assemblage is not large enough to allow for cultural classification, but the small size of the artefacts might refer to small dimensional industries.

FAUNAL REMAINS

Mammals

During the earlier stages of the excavation (1952-1953) at the Horky I site, several bone fragments likely belonging to larger sized mammals were discovered. However, extensive weathering excluded their closer taxonomical determination (Prošek 1952a; 1953b; Fridrich 1982). The new osteological assemblage discovered at the Horky III site in 2009-2012 consists of 37 fragments of animal bones and teeth (MNE [minimal number of elements] = 24), of which only seven fragments (18.9 % NISP [number of identified species]) were taxonomically determinable as *Equus* sp. (namely third metacarpus and first and third phalanx; **tab. 3**). All of the bones displayed a high degree of fossilization, as the individual crystals may be visible to the naked eye. Moreover, various taphonomic agents were recorded such as weathering as described by A. K. Behrensmeyer (1978) between the 2nd and the 5th degree. He describes the destruction of the bone surface with small and deep inner cracks up to missing parts of compact bone and the whole bone disintegration or root etching as observed at the proximal part of first phalanx. The small black dots regularly dispersed on the bone surfaces are likely due to the chemical composition of the sediment (especially manganese compounds), rather than the irregular dot pattern caused by microbial attack (cf. Lyman 1994). Finally, the smooth edge pattern of breakage excluding precise bone restoration was observed on several bones, namely the horse metacarpus. This evidence supports bone breakage with separate post-depositional and taphonomic history, with fragments found approx. 15 m from each other. This phenomenon influenced slightly the measurements taken from the metacarpal bone, which are a little bit underestimated.

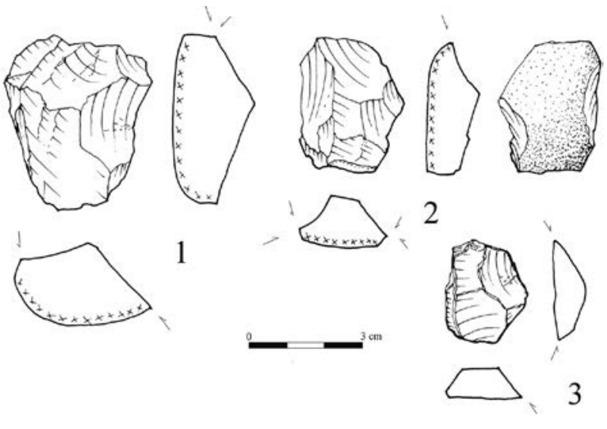

Fig. 11 Horky V (okr. Mladá Boleslav / CZ). Cores (**1-3**). – (Drawings P. Šída).

type of bone	Gl	Bp	Dp	Bd	Dd	SD	other measurements
metacarpus III	235.00*	48.84	31.77	59.98	49.49	–	
phalanx I	82.82	54.37	33.20	47.29	18.30*	37.38	
phalanx III	–	–	–	–	–	–	min. breadth of c. 57.17

Tab. 3 Summary of measurements on *Equus* sp. bones (according to von den Driesch 1976). – Gl: greatest length; Bp: breadth of proximal part; Dp: depth of proximal part; Bd: breadth of distal part; Dd: depth of distal part; SD: smallest diameter of diaphysis; * estimated measurement (the minimal value in mm).

locality	MIS	excavated/collected by	measured by
Achenheim (dép. Bas-Rhin/F)	6	Wernert 1956	Cramer 2002
Ariendorf 2 (Lkr. Neuwied/D)	6	Bosinski/Brunnacker/Turner 1983	Cramer 2002
Bilzingsleben (Lkr. Sömmerda/D)	7	Mania 1991	Musil 1991; Cramer 2002
Horky nad Jizerou (okr. Mladá Boleslav/CZ)	5/6-14	Šída in 2009-2014	Sázelová in 2014
Mosbach (Lkr. Neckar-Odenwald/D)	13/15	Kahlke 1961	Cramer 2002
Lunel Viel (dép. Hérault/F)	15/17	Bonifay 1976	Bonifay 1980
Salzgitter-Lebenstedt/D	6	Staesche 1983	Cramer 2002
Stránská Skála (okr. Brno/CZ)	19	Musil 1971	Musil 1971; 1995
Švédův Stůl (okr. Brno-venkov/CZ)	5a/5e	Klíma 1962	Musil 1962
Taubach (Stadt Weimar/D)	5a/5e	Kahlke 1961	Cramer 2002
Villa Seckendorf (Stadt Stuttgart/D)	5a	Ziegler 1996	Cramer 2002
Wannen bei Ochtendung (Lkr. Mayen-Koblenz/D)	6	Turner 1990	Cramer 2002

Tab. 4 List of localities used in comparative metric data to *Equus* sp. metacarpus III. – From Lunel Viel and Stránská skála only the mean of measurements was used.

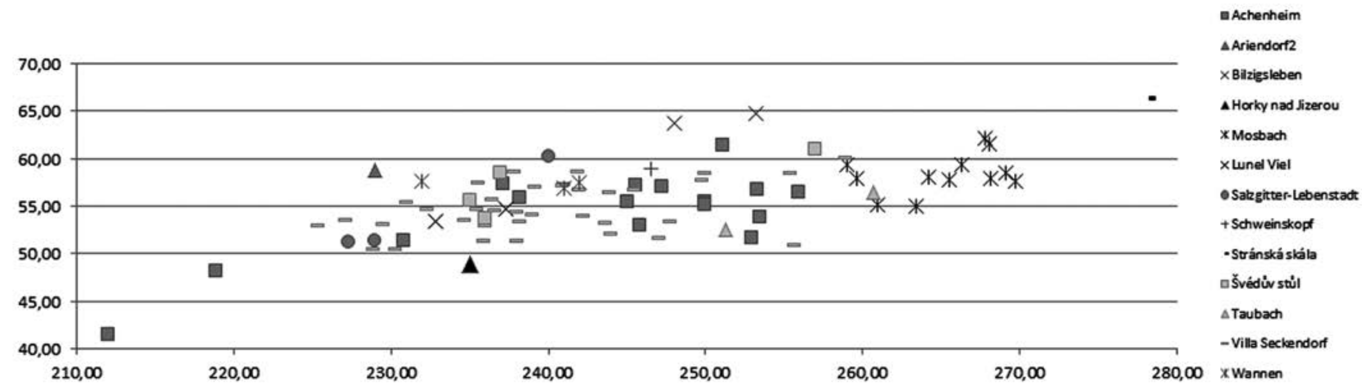

Fig. 12 Horky III (okr. Mladá Boleslav/CZ). Measurements (in mm) of *Equus* sp. metacarpal bones coming from selected Lower and Middle Palaeolithic localities. – GL: greatest length; Bp: breadth of proximal part. – (Illustration S. Sázelová).

The three horse bones from the base of soil complex VII cannot contribute much to the taxonomic status of the Middle Pleistocene caballoid horse discussion. This discussion (Nobis 1971; Eisenmann 1991a; 1991b; Forstén 1998; Cramer 2002) remains controversial, especially in the efforts to define morphological changes causing distinct biostratigraphical units typical of the individual horse species. According to various studies (e. g. Forstén 1993; van Asperen 2012), the horse size and shape seemed to fluctuate around a mean width, so that the relationship between specific horse adaptations and various environments is expected. However, this comprehensive discussion might be inspirational when we are trying to understand the caballoid material from the Horky III site. As shown in the comparison of measurements collected on selected Lower and Middle Palaeolithic horse sites from the Czech Republic, Germany, and France (**tab. 4; fig. 12**), the size and shape of the third metacarpal bone most likely resembles the lineage leading to the *Equus germanicus* rather than the lineage of *Equus mosbachensis* or other species.

Malacology

A new sample was taken from the immediate vicinity near the bone findings (Horky III) from the loess to the base of the braunlehm soil H designated (minimally dated to soil complex VII). The sample volume was 0.25 l in which the following species were determined: *Helicopsis striata*, *Pupilla muscorum*, *P. loessica*, *P. sterri*, and *P. triplicata*. All of the identified molluscs belonged to the terrestrial malacofauna representing the loess fellowship with a prevalence of steppe species such as *Helicopsis striata* and several kinds of *Pupilla*, as well as typical loess species such as *P. loessica*. Other typical loess species, such as *Vallonia tenuilabris* or *Succinella oblonga elongate* are missing, but this might be due to the small amount of analysed sample rather than species absence. The identified malacocenosis indicates the presence of loess steppes, i. e. short blade grass formations without shrubs or trees. This sample (although limited in species) fully corresponds with observations by V. Ložek (1964, 90) in loess positions from the Old brickyard (subsoil 10). The species, detected here, namely, *Helicopsis striata*, *Pupilla sterri*, *P. triplicata*, *P. loessica*, *P. muscorum*, *P. muscorum aff. densegyrata*, *Columella columella*, *Vallonia costata*, *V. tenuilabris*, *Vertigo pseudosubstriata*, *Euconulus fulvus*, *Trichia hispida*, *Clausilia parvula*, and *C. dubia* (Ložek 1964, 90 f.), he described as typical loess cool steppe formation dating to Mindel glaciations. The sandy loam clay above soil 10 contains the interglacial malacofauna (Ložek 1964, 88).

DISCUSSION

Based on new research from the New brickyard at the site of Horky nad Jizerou, including the soil micro-morphology analysis, we are able to open the revision of the situation documented at the Old brickyard in the 1950s and 1960s, particularly addressing the question of individual soil complexes and archaeological finds from the loess sequence dating.

The sediments at Horky nad Jizerou evolved in loess and fossil soil sedimentation, perhaps from MIS 15 to the pleniglacial of the last glaciation (MIS 2). Its development was interrupted by numerous hiatuses evident in the erosive interfaces, causing various problems in orientation and interpretation of the whole sequence. The loess layers with fossil soils are located mainly on the western slope of the north to south oriented valley extending to the main Jizera river valley in Horky nad Jizerou.

Firstly, the base of the loess sedimentary sequence in the New brickyard is composed of two soils (soils H and I), the uppermost corresponds to braunlehm type (soil H, minimally dated to soil complex VII-MIS 13). Perhaps soil 10 from the Old brickyard displays features parallel to this soil complex from the New brickyard as the base of both profiles (below soils 8 and G) can be correlated with certain degree of probability.

Within the overlying layers of the basal sequence we found a very significant soil complex with two soils (brown and black braunlehm, luvisoils) and soil sediment (soils 6-8. E-G). These soils are affected by two generations of ice wedges, the first of which penetrates from the base of soil F into the subsoil and is filled by the material of this soil. The second generation penetrates the whole soil complex and is filled by loess. According to the soil micro-morphology, this soil complex can be correlated with soil complex V (MIS 9) and both brickyards definitely contain this complex. The soil equivalent to soil complex VI (MIS 11) is missing in the New brickyard, while in the Old brickyard it may correspond to soil 9. During the MIS 12-11 stage, the local erosion, affecting the underlying soils, begins to perform and develop substantially in nearby overburden soils corresponding to the MIS 9 stage. In the New brickyard these soils are partially or, in some cases, completely eroded and carried away by erosive processes. The subsequent sedimentation development is documented throughout the whole sequence, although it is obvious that the thickness of layers decreases in the direction of above-lying parts of the valley. Finally, in the New brickyard both soils of soil complex IV (MIS 7) are present, however, the lower one is remodified by significant solifluction and the upper one is at many places located in a para-autochtonnous position as well. From soil complex III (MIS 5) only the upper part, the luvisoil, basal soil of Stillfried A, has survived, contrary to the brown soil of the Eemian interglacial

which was eroded. Similarly, in the Old brickyard this horizon was affected by significant erosion and solifluction. The younger sediments were thicker and preserved only at the Old brickyard (loess with soil complex I and overlying loess of the last pleniglacial).
The oldest archaeological levels (subsferoide and side scraper) were detected at Horky III, in the loess, dating to at least MIS 14, which corresponds with the character of the artefacts. Due to the small size of the faunal assemblage and the high degree of weathering, the accurate age of the bones cannot be confirmed and the morphological evidence in closer horse species cannot be determined.
The small dimensional lithic industry assemblage of Lower Palaeolithic character from Horky II is slightly younger and corresponds to either MIS 13 or MIS 11. The largest lithic assemblage was found in an erosional channel under the loess from MIS 10 and the significant soil complex (MIS 9) at Horky I. The sediment filling in this erosion channel seems to correspond with the beginning of the MIS 10 glacial. Within the corpus of lithic artefacts, the dominant technology is of preformed cores with hints of knowledge of Levallois technique as well as bifacial retouching technology. Both technological characteristics provide evidence that the assemblage from Horky I can be dated to the Upper Acheulean. These characteristics appear in other Middle Palaeolithic assemblages at sites such as Bečov I (Fridrich 1982) and Kůlna 14 (okr. Blansko/CZ; Neruda 2011), and are important factors in understanding the transition between the Lower and Middle Palaeolithic.
This transition may have also been documented at the site of Račiněves (okr. Litoměřice/CZ; Fridrich 2002), where the significantly small dimensional corpus of a Lower Palaeolithic character contained prepared cores and flakes. This assemblage could be dated to the Holsteinian complex of glaciation, particularly to the interglacial MIS 11 or MIS 9. The last Czech assemblage dated to the same period comes from Karlštejn-Altán (okr. Beroun; Smolíková/Fridrich 1984, MIS 11), where there is a lack of evidence for prepared core technology, however, the number of lithics in the collection is quite small and the artefacts are produced using a very low quality raw material. All these sites are contemporary with locations such as Bilzingsleben (Lkr. Sömmerda/D; Fischer et al. 1991; Mania 1995) and Schöningen (Lkr. Helmstedt/D; Thieme/Maier 1995).
Additionally, two flakes from Horky IV lay in the loess corresponding to MIS 8, but are not bearing any significant markers to enable their closer classification. The youngest site is Horky V, with the soil strongly affected by solifluction corresponding to the MIS 7c stage. The lithic assemblage is very small in number and chronologically featureless with only one striking marker of small size, which could connect them with other small dimensional industries from the Middle Palaeolithic linked to interglacial oscillations (e.g. Ehringsdorf or Taubach).
The remaining question concerns the authenticity of the living structure detected by F. Prošek. The artefact position in layers of sand, gravel, or resedimented loess goes against this interpretation (possible assemblage accumulation due to resedimentation?). However, the objects bear no traces of water transport and they are not eolised. Moreover, we do not know the exact position of the archaeological deposits within the formation, so we can only assume that at least the upper part of the stratigraphy has been created by very short material transport. But these processes did not have a power to erode the lower parts of the stratigraphy containing archaeological deposits as during sand deposition the slowly flowing stream of water could not significantly move with artefacts. So the existence of the living structure cannot be definitively denied and future excavation in the undamaged part of the site will be needed.

CONCLUSIONS

The revision of the geological situation at the site of Horky nad Jizerou confirmed the presence of sediments from MIS 15 up to MIS 2 with few partial hiatuses, which represent one of the most comprehensive loess records in the Czech Republic. The analysis of soil micro-morphology allowed for the correlation of all present soil complexes with Central European soil stratigraphy. The review of the geology gives a precision in the dating of formerly known archaeological sites such as Horky I and II and newly discovered sites such as Horky III-V.

The oldest site is Horky III belonging to at least MIS 14 with several artefacts of Lower Palaeolithic characteristics and findings of animal remains (*Equus* sp. molluscs). The collection of small dimensional Lower Palaeolithic industry from Horky II corresponds to MIS 13 or MIS 11. The largest corpus of lithics from Horky I displays Middle Palaeolithic characteristics and corresponds to MIS 10. The prepared cores and their flakes show signs of the Levallois technique and flake tools production from prepared cores. Isolated flakes from Horky IV were situated in loess dated to MIS 8. The youngest collection from Horky V dated to MIS 7c and contains several cores, flakes, and fragments of a small dimensional character.

LIST: HORKY I. LIST OF EVALUATED ARTEFACTS

No. identification; techno type; raw material and type; length × width × height in cm; comment (e.g. butt type)

1. ID: Q; fragment; quartz pebble; 4.3 × 4.2 × 2.7
2. ID: 225, A; fragment; quartz pebble; 5.5 × 5.4 × 2.45
3. ID: 225, H; fragment; quartz pebble; 7 × 5 × 2.7
4. ID: 225; fragment; quartz pebble; 3.9 × 2.7 × 0.9
5. ID: 225; fragment; quartz pebble; 2.8 × 1.9 × 0.7
6. ID: 225; fragment; quartz pebble; 3.6 × 3.1 × 2.2
7. ID: 201; fragment; quartz fragment; 3.4 × 1.5 × 0.7
8. ID: H; fragment; quartz pebble; 6.4 × 5.7 × 2.3
9. ID: 217; fragment; quartz fragment; 6.4 × 3.5 × 2.2
10. ID: 228; fragment; quartz pebble; 5.7 × 3.4 × 1.7
11. ID: 221, A; fragment; quartz fragment; 4.3 × 4.2 × 1.4
12. ID: H; fragment; quartz pebble; 4.8 × 2.9 × 1.3
13. ID: 203, D; fragment; quartz pebble; 8 × 3.8 × 1.9
14. ID: H; fragment; quartz pebble; 5.4 × 5 × 2.15
15. ID: – ; fragment; quartz pebble; 3.5 × 2.2 × 1.4
16. ID: P; fragment; Cretaceous quartzite, concretion; 8 × 5.5 × 1.95
17. ID: H; fragment; quartz pebble; 7.4 × 5.4 × 3.15
18. ID: H; fragment; quartz fragment; 6.4 × 3.9 × 1.5
19. ID: E; fragment; quartz pebble; 7.4 × 4.5 × 3.6
20. ID: 218, 2; fragment; quartz fragment; 5.8 × 2.9 × 2.3
21. ID: S; fragment; quartz pebble; 5.7 × 4.1 × 2.1
22. ID: H; fragment; quartz fragment; 4.5 × 3 × 2.15
23. ID: 207, A; fragment; quartz pebble; 7.5 × 5.7 × 2.1
24. ID: 221; fragment; quartz fragment; 3.5 × 1.3 × 0.4
25. ID: bč; fragment; quartz fragment; 3 × 1.2 × 0.4
26. ID: 73; fragment; quartz pebble; 5.4 × 3.95 × 1.45
27. ID: 74; fragment; Cretaceous quartzite, concretion; 4.9 × 3.5 × 3.4
28. ID: H; fragment of core edge; quartz fragment; 5.7 × 3.15 × 2.3
29. ID: 20; flake; quartz pebble; 9 × 7.2 × 3.1; unprocessed
30. ID: 21; flake; quartz pebble; 6.7 × 6.2 × 2.5; retouched
31. ID: 22; flake; quartz pebble; 4.7 × 5.3 × 2.25; unprocessed; **fig. 7, 11**
32. ID: 23; flake; quartz pebble; 7.9 × 4.3 × 1.9; unidentified; levalloid; **fig. 7, 8**
33. ID: 24; flake; quartz pebble; 7.5 × 5.2 × 2.5; unidentified
34. ID: 25; flake; quartz pebble; 5.3 × 4.2 × 1.5; unprocessed; **fig. 7, 12**
35. ID: 26; flake; quartz fragment; 7.4 × 4.45 × 1.8; unidentified; from core edge
36. ID: 27; flake; quartz pebble; 6.4 × 4.3 × 1.5; unprocessed; **fig. 7, 7**
37. ID: 29; flake; quartz pebble; 4.2 × 5.8 × 1.7; retouched
38. ID: 24; flake; quartz pebble; 7.6 × 5.2 × 2.7; unprocessed
39. ID: 15; flake; quartz pebble; 6.9 × 8.7 × 2.2; unprocessed
40. ID: 16; flake; quartz pebble; 7.4 × 7.95 × 2.45; retouched
41. ID: 17; flake; quartz pebble; 6.9 × 5.15 × 3; unprocessed
42. ID: 19; flake; quartz fragment; 8.4 × 8.2 × 3.8; retouched
43. ID: 206, A; flake; quartz pebble; 5.1 × 6.1 × 1.7; unprocessed
44. ID: 205, H; flake; quartz pebble; 3.2 × 9.7 × 3.3; unprocessed
45. ID: – ; flake; quartz pebble; 6.2 × 9.2 × 4; unprocessed
46. ID: 226, A; flake; quartz pebble; 4.55 × 4.55 × 2.55; unprocessed
47. ID: A; flake; quartz pebble; 7.95 × 5.4 × 3; unprocessed

48. ID: C; flake; quartz pebble; 6.4×5.1×2; unprocessed
49. ID: – ; flake; quartz pebble; 6.7×5×2.1; unprocessed
50. ID: – ; flake; quartz pebble; 3.8×3.3×1.3; unprocessed
51. ID: H; flake; quartz pebble; 5.6×2.85×2.9; unprocessed
52. ID: A; flake; quartz pebble; 3.6×4.15×1.6; unprocessed
53. ID: 140; flake; quartz fragment; 3.1×4.2×0.95; unprocessed
54. ID: 142; flake; quartz fragment; 3.2×2.1×1.2; retouched
55. ID: 134; flake; quartz fragment; 2.5×3.85×1.2; unprocessed
56. ID: 134; flake; quartz pebble; 2.5×1.85×0.5; unprocessed
57. ID: – ; flake; quartz fragment; 2.5×2.5×0.7; unprocessed
58. ID: 444; flake; quartz fragment; 2×2.2×0.7; retouched
59. ID: – ; flake; quartz fragment; 3×2.8×0.95; unprocessed
60. ID: bč1, A; flake; quartz pebble; 6.6×8.25×3.05; unprocessed
61. ID: bč2, H; flake; quartz pebble; 7.6×9×3.65; unprocessed
62. ID: bč3, H; flake; quartz pebble; 5.3×4.9×2.35; unprocessed
63. ID: 46; flake; quartz fragment; 3.8×4.45×1; retouched; levalloid
64. ID: 47; flake; quartz pebble; 3.15×4.75×1.4; unprocessed
65. ID: 48; flake; quartz pebble; 5.1×3.2×1.4; retouched
66. ID: 49; flake; quartz pebble; 5.2×4.7×1.5; retouched; levalloid
67. ID: 50; flake; quartz pebble; 5.8×4.9×2.1; unprocessed
68. ID: 51; flake; quartz pebble; 3.25×4.8×1.6; unprocessed
69. ID: 52; flake; quartz pebble; 4.75×4.55×1.65; retouched
70. ID: 53; flake; quartz pebble; 6.5×4.8×2; unidentified
71. ID: 54; flake; quartz pebble; 4×5.4×2.3; unprocessed
72. ID: 55; flake; quartz pebble; 4.9×3.7×1.6; unprocessed
73. ID: 56; flake; quartz pebble; 6.3×4.05×1.7; unprocessed; **fig. 7, 3**
74. ID: 57; flake; quartz pebble; 5.6×5.2×3; unprocessed
75. ID: 58; flake; quartz fragment; 4.6×4.4×1.85; unprocessed; levalloid; **fig. 7, 9**
76. ID: 59; flake; quartz fragment; 4.1×5.4×1.6; retouched; levalloid; **fig. 7, 4**
77. ID: 60; flake; quartz pebble; 3.7×4.25×2.3; unprocessed
78. ID: 61; flake; quartz fragment; 4.25×6.1×1.5; retouched; levalloid; **fig. 7, 6**
79. ID: 62; flake; quartz pebble; 6.1×3.5×1.7; unprocessed
80. ID: 63; flake; quartz fragment; 5.2×4.4×1.4; retouched; levalloid; **fig. 7, 10**
81. ID: 64; flake; quartz pebble; 3.6×4.3×1.65; unprocessed
82. ID: 65; flake; quartz pebble; 4.95×4.85×2.1; unprocessed
83. ID: 66; flake; quartz pebble; 5.8×5.9×2.25; unprocessed; levalloid; **fig. 7, 1**
84. ID: 67; flake; quartz pebble; 7.3×5.1×2.1; unprocessed
85. ID: 68; flake; quartz pebble; 4.9×3.5×2.25; unprocessed; **fig. 7, 5**
86. ID: 69; flake; quartz pebble; 4.7×5.3×1.65; retouched; levalloid; **fig. 7, 2**
87. ID: 70; flake; quartz pebble; 4.9×4.6×1.7; unprocessed
88. ID: 71; flake; quartz pebble; 5.3×5×2; unprocessed; levalloid
89. ID: 72; flake; quartzite pebble; 5.1×4.5×1.45; retouched
90. ID: 75; flake; quartz pebble; 4.4×4.6×1.75; unprocessed
91. ID: 76; flake; quartz pebble; 4.95×3.9×2; unprocessed
92. ID: – ; flake; Fridrich 1982, fig. 87
93. ID: – ; flake; Fridrich 1982, fig. 88
94. ID: – ; flake; Fridrich 1982, fig. 90
95. ID: – ; flake; Fridrich 1982, fig. 91
96. ID: – ; flake; Fridrich 1982, fig. 91
97. ID: – ; flake; Fridrich 1982, fig. 91
98. ID: bč4, P; core; quartz pebble; 7.6×6.7×4.4
99. ID: bč5, YE; core; quartz pebble; 6.5×7.4×3.95
100. ID: bč6, A; core; quartz pebble; 4.4×6.9×3.2
101. ID: bč7, P; core; quartz pebble; 5×4.8×3.7
102. ID: – ; core; Fridrich 1982, fig. 84
103. ID: – ; core; Fridrich 1982, fig. 85
104. ID: – ; core; Fridrich 1982, fig. 93
105. ID: 12; core on flake; quartz pebble; 6×5.5×4.2; unprocessed
106. ID: – ; sferoidal core; Fridrich 1982, fig. 83
107. ID: – ; sferoidal core; Fridrich 1982, fig. 83
108. ID: – ; sferoidal core; Fridrich 1982, fig. 86
109. ID: – ; levalloid core; Fridrich 1982, fig. 82
110. ID: – ; core; Fridrich 1982, fig. 82
111. ID: – ; core; Fridrich 1982, fig. 87
112. ID: A; bifacial artefact; quartz fragment; 6.5×6.6×2; **fig. 8, 8**
113. ID: – ; bifacial knife; Fridrich 1982, fig. 90; **fig. 8, 5**
114. ID: 140; side scraper; quartz pebble; 2.8×2.6×0.9; unprocessed; **fig. 8, 7**

115. ID: – ; side scraper; Fridrich 1982, fig. 89; **fig. 8, 1**
116. ID: – ; side scraper; Fridrich 1982, fig. 89; **fig. 8, 2**
117. ID: – ; side scraper; Fridrich 1982, fig. 89; **fig. 8, 4**
118. ID: – ; side scraper; Fridrich 1982, fig. 92; **fig. 8, 6**
119. ID: – ; double ventral side scraper; Fridrich 1982, fig. 89; **fig. 8, 3**
120. ID: 200; manuport; quartz pebble; 3×2.5×1.05
121. ID: 202; hammer stone; quartz pebble; 5.3×4.8×2.7

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Zusammenfassung / Summary / Résumé

Eine alt- und mittelpleistozäne Sedimentfolge mit archäologischen Funden aus Horky nad Jizerou (okr. Mladá Boleslav / CZ)

Dank der neuen Kartierung und Untersuchung der Mikromorphologie an der Neuen Ziegelei von Horky nad Jizerou war es möglich, die dort in den 1950er und 1960er Jahren nachgewiesene Sedimentfolge an der Alten Ziegelei neu zu beleuchten. Die Folge von Horky nad Jizerou dokumentiert die Lösssedimentation mindestens von MIS 15 bis zum Höhepunkt der letzten Eiszeit (MIS 2). Die Entwicklung der Lössfolge war mehrfach unterbrochen, wie erodierte Oberflächen zeigen. Seit den 1950er Jahren wurden mehrere archäologische Komplexe an fünf verschiedenen Orten aufgesammelt. Dabei stammen die ältesten Fundensembles von der Fundstelle Horky III aus einem Lössbereich, der mindestens in MIS 14 datiert werden kann. Funde aus diesen Schichten wie ein Subspheroid und ein Schaber zeigen Merkmale, die genauso wie das Vorhandensein von Pferdeknochen auf diese Zeitstufe verweisen. Eine begrenzte Sammlung von klein dimensionierten Steingeräten altpaläolithischen Charakters aus Horky II ist etwas jünger und entspricht entweder MIS 13 oder MIS 11. Das größte Fundensemble aus Horky I stammt aus einer Erosionsrinne unter dem Löss von MIS 10, bedeckt von einem ausgeprägten Bodenkomplex, der mit MIS 9 korrespondiert. Die Sedimentverfüllung dieser Erosionsrinne scheint dem Beginn der Vereisung von MIS 10 zu entsprechen. Das Ensemble ist insofern charakteristisch, als es sich bei den Hauptformen um Kerne mit Präparationen handelt, die Hinweise sowohl auf die Kenntnis der Levalloistechnik als auch auf das zweiseitige Retouchieren geben. Zwei Abschläge von Horky IV waren in Löss eingebettet, der MIS 8 entspricht. Die jüngste Fundstelle Horky V befindet sich in einem Boden, der stark durch Solifluktion beeinflusst ist und mit MIS 7c korrespondiert. Hier ist das Fundensemble sehr klein und chronologisch nicht aussagekräftig.

Lower and Middle Pleistocene Sediment Sequence with Archaeological Finds in Horky nad Jizerou (okr. Mladá Boleslav / CZ)

Due to the recent mapping and study of soil micro-morphology of the New brickyard at Horky nad Jizerou we were able to revise the sequence documented in the 1950s and 1960s in the Old brickyard. Sediments from Horky nad Jizerou document the evolution of loess sedimentation from at least MIS 15 to the pleniglacial of last glaciation (MIS 2). The development of loess sedimentation was interrupted by numerous hiatuses, evidenced by erosive interfaces. Since the 1950s several archaeological assemblages from five different locations were collected. The oldest archaeological levels are at the site of Horky III, situated in the loess which has a minimum age of MIS 14. Artefacts such as a subspheroide and a side scraper from these levels have characteristics which correspond to this period well as the presence of horse bones does. A limited collection of small dimension stone industry of Lower Palaeolithic character discovered at Horky II, is slightly younger, corresponding to either MIS 13 or MIS 11. The largest assemblage from Horky I was found within an erosion channel under the loess of MIS 10 which lay under a significant soil complex, corresponding to MIS 9. The sediments filling this erosion channel seem to correspond to the beginning of the glacial MIS 10. The collection is significant as the dominant forms are of preformed cores with hints of knowledge of Levallois technology as well as evidence of bifacial retouching. Two flakes from Horky IV lay in the loess corresponding to MIS 8. The youngest site is Horky V situated in soil strongly affected by solifluction and corresponding to MIS 7c. The assemblage is very small and chronologically featureless.

Une séquence sédimentaire du Pléistocène ancien et moyen avec des découvertes archéologiques à Horky nad Jizerou (okr. Mladá Boleslav / CZ)

Suite à une cartographie récente et des études de micromorphologie des sols de la nouvelle briqueterie de Horky nad Jizerou, il a été possible de revisiter la coupe de l'ancienne briqueterie qui avait été documentée dans les années 1950 et 1960. Les sédiments de Horky nad Jizerou documentent la sédimentation lœssique depuis au moins MIS 15 jusqu'au Pléniglaciaire de la dernière glaciation (MIS 2). Le développement de la sédimentation du lœss a été interrompu lors de nombreux hiatus, attestés par des surfaces d'érosion. Depuis les années 1950 des assemblages archéologiques sont collectés à cinq emplacements différents. Les niveaux archéologiques les plus anciens sont le site de Horky III situé dans des lœss avec pour âge minimum le stade isotopique MIS 14. Parmi les artefacts de ces niveaux, un sub-sphéroïde et un racloir caractéristiques, ainsi que la présence d'os de cheval, sont en accord avec cette interprétation. Un assemblage un peu plus jeune a été découvert à Horky II, il s'agit d´un assemblage composé d´artefacts lithiques de petites dimensions de type paléolithique ancien qui correspond à MIS 13 ou MIS 11. L´assemblage le plus riche est celui de Horky I qui a été mis au jour dans un paléochenal sous le lœss MIS 10, lui-même situé sous un pédo-complexe correspondant à MIS 9. Les sédiments comblant ce chenal semblent correspondre au début de la glaciation de MIS 10. La collection est significative, dans la mesure où les formes dominantes sont des nuclei mis en forme indiquant une connaissance des technologies Levallois, et que la mise en forme de l´outillage par retouche bifaciale y est également attestée. Deux éclats en provenance de Horky IV étaient dans le lœss correspondant à MIS 8. Le site le plus jeune est Horky V, situé dans un sol très affecté par la solifluction et correspondant à MIS 7c. Le mobilier est pauvre et non diagnostique.

Traduction: L. Bernard

Schlüsselwörter / Keywords / Mots clés

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3.5.2 Dolní Věstonice IIa: Gravettien microstratigraphy, environment, and the origin of baked clay production in Moravia

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Dolní Věstonice IIa: Gravettian microstratigraphy, environment, and the origin of baked clay production in Moravia

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ABSTRACT

Creating an overall scheme of Gravettian stratigraphy and chronology in the Middle Danube area is a matter of current debate. This paper addresses the formation of microstratigraphies at large open-air sites, evidence of the earliest Gravettian occupation in the Dolní Věstonice-Pavlov area, and occurrence of early ceramics from this context. The case presented here is a complex early Gravettian microstratigraphy of charcoal deposits at Dolní Věstonice IIa with a sequence of AMS dates between 28.4 and 31.7 ka uncal BP (30–33 ka cal BC) and two middle Gravettian (Pavlovian) dates from the nearby living floor. The associated environmental evidence of charcoal, pollen, molluscs, and vertebrates shows that climatic development through the six horizons was relatively stable, but with a certain variability in moisture and extension of forest. In horizon 3c, the molluscs and both small and large vertebrates indicate an episode of restricted forest formation around 28.4 ka uncal BP (30–31 ka cal BC). Baked clay ("ceramic") fragments from horizon 3c represent the earliest dated items of this kind in the Gravettian. Microstratigraphies of this type demonstrate the complexity of cultural deposits at the large Gravettian sites and throw light on the hitherto poorly understood time-period of the early Gravettian in Moravia.

1. Introduction

Creating an overall scheme of Gravettian stratigraphy and chronology in the Middle Danube area is a matter of current debate (Svoboda et al., 2000; Haesaerts et al., 2010; Jöris et al., 2010; Moreau, 2012). Whereas the key stratigraphic sections such as Willendorf II in lower Austria document sequences of Gravettian layers clearly separated by loess interlayers (Nigst et al., 2008), the large south Moravian settlements were mostly interpreted as extensive occupation palimpsests formed in areas of restricted loess sedimentation.

Dated microstratigraphies and especially the complex multiphased hearths, as elemental units of Upper Paleolithic settlements, are places of accumulation of anthropogenic sediment, wood or bone fuel, and artefacts (Goldberg et al., 2007; Holliday et al., 2007; Svoboda, 2008; Karkanas, 2010; Higham et al., 2011; Peresani et al., 2011; Fladerer et al., 2014; Händel et al., 2013). Using the new evidence from Dolní Věstonice Iia (excavation 2012), this paper examines in more detail the biography, time-depth and nature of a particular findspot and its spatial context. Specifically, we address possible implications of this situation for the Gravettian chronological scheme and the beginning of the earliest baked clay ("ceramic") production in south Moravia.

2. Dolní Věstonice II

As other sites of the Dolní Věstonice-Pavlov-Milovice area, the extensive site cluster of Dolní Věstonice II (DV II) occupies one of the loess elevations at an altitude of about 220–240 m a.s.l., rising above the Dyje river and sloping further south towards the top of

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1040-6182/

Pavlov Hills (550 m a.s.l.) (Figs. 1 and 2). Archaeological exploration at DV II was initiated during the 1930s, slightly later than at the nearby classical site DV I, by surface surveys in the uppermost part (sub-site IIa) and by studies of the key loess section in the old brickyard at the foot of the site (Klíma et al., 1962; Antoine et al., 2013). In the 1980s, the industrial exploitation of the extensive loess deposits located between these two sub-sites unearthed a large Gravettian settlement almost completely and yielded evidence of its inner structure. The main salvage excavations were organised between 1985 and 1989 (Svoboda, 1991, 2001; Klíma, 1995), while the smaller additional excavations took place in 1991, 1999, and 2005.

Compared with the other Gravettian sites in south Moravia, Dolní Věstonice II is extended over a considerably larger area (about 500 m^2), is more structured spatially and chronologically, and shows a clear association and contemporaneity with relicts of an extensive mammoth bone deposit in the adjacent gully. As the bottom of this gully is now eroded by an active brook and additional mammoth bones were scattered at several places along the slopes, it seems probable that the extension of the bone accumulation was originally larger. On the northern and western slopes, the site has a typical pattern composed of individual settlement units, each about 5 m in diameter with a central hearth and a system of pits around it. In 1986, the most spectacular discovery was the triple burial (DV 13–15) located at the top of the site, and another human burial (DV 16) was found one year later on the western slope of the same site (Trinkaus and Svoboda, 2006). By contrast, symbolic and decorative items and the baked clay pellets (Vandiver et al., 1989) are very rare. In addition to mammoth, reindeer, and hares, smaller carnivores represent an important part of the faunal material (West, 2001), indicating that systematic fur and hide working was involved, and the use-wear analysis (Šajnerová, 2001) seems to confirm his hypothesis. The floating results from two hearths previously excavated at DV II also provided charred parenchyma fragments, conifer needles, and seeds (Mason et al., 1994; Beresford-Jones et al., 2010).

3. Sub-site Dolní Věstonice IIa

Dolní Věstonice IIa (DV IIa, also named Lahmhöfe or Pod Lesem) is a separate sub-site attached to the DV II complex from the south. The Gravettian layer lies in a shallow position or just below the surface (whereas in the bricketerry at the foot of the elevation it lies about 5–7 m below the surface and in central parts of site II at 2–3 m depth). As such, the sub-site IIa was disturbed by ploughing and easily discovered by archaeological surveys and test trenching as early as 1932 by Emanuel Dania (Klíma et al., 1962).

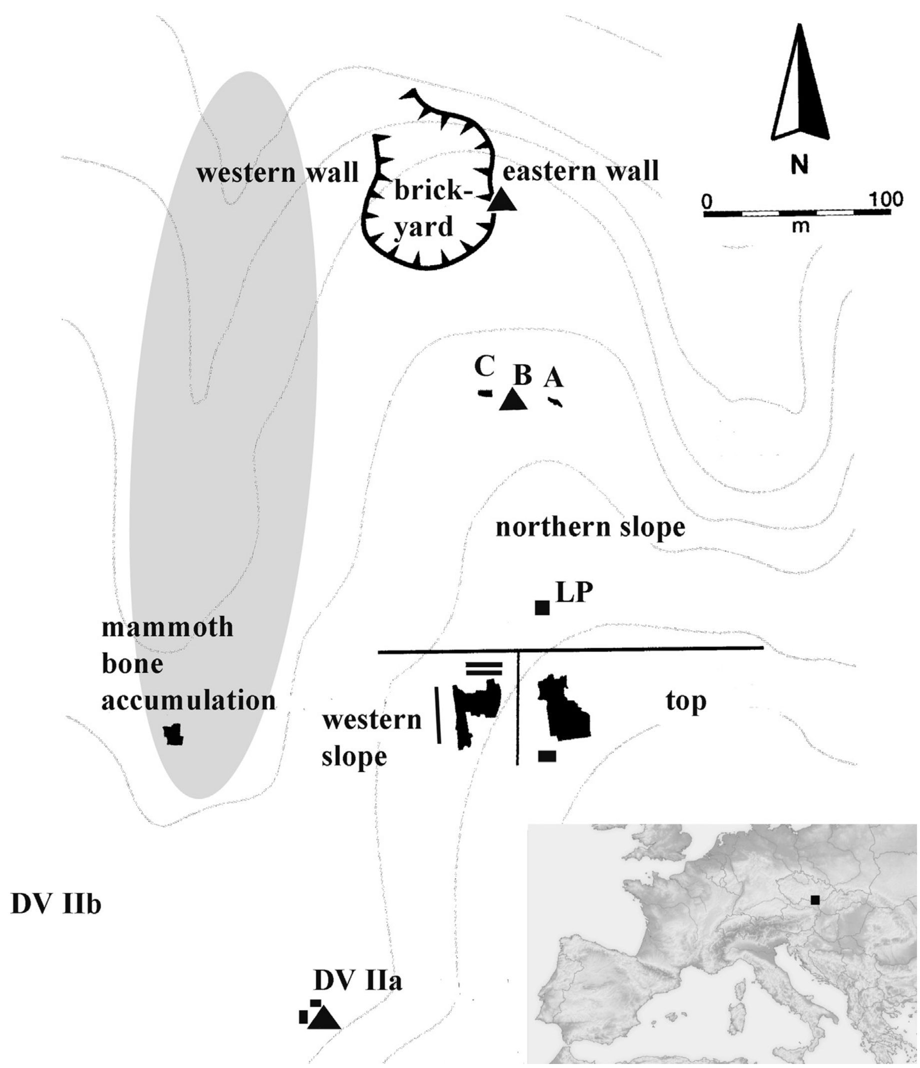

Fig. 1. Dolní Věstonice II: structure of the site showing the position of site IIa in the southern part. The grey oval shows the bottom of the side gorge, now mostly eroded, with remains of mammoth bone accumulation at the side; the triangles show the earliest Gravettian locations.

Fig. 2. Dolní Věstonice II: birds-eye view of the site from the northwest. The arrow points to site IIa; site II is to the left; the bricketerry is at the extreme left. Photo: Petr Pokorný.

After our trial trenching in 1997, a larger salvage excavation was organised in 1999. We located four trenches, A–D, at places damaged by ploughing. In trenches B–D, the cultural layer occurred in a shallow location below the surface where the depositional circumstances of charcoal, bones, and artefacts were largely disturbed. Two excavated zones within trench A, higher on the slope, appeared more promising because the intact cultural layer penetrated below the loess (Svoboda, 2001). The aim of the 2012 fieldwork was to complete the previously excavated areas with a focus on trench A. The surface prepared for excavation was divided by a 5 × 9 m grid and further subdivided into 50 cm^2 subsquares. It showed a gentle inclination from southeast to northwest. The coordinates of the NW corner are N 16°39′10.3″, E 48°52′57.8″. In the western part (zones A–C) the cultural layer occurred in a shallow position below the actual surface, and the archaeological situations were disturbed by earlier digs and ploughing, as in the adjacent trench C (excavated in 1999). Towards the southeast, that is, against the slope, the layer continued deeper under the loess and reached its maximal depth of 1.60 m at the eastern end (zones E–I). There was an interspace separating these two parts (zone D).

From this context, we separated one regular settlement unit in the eastern part of trench A, about 5 m in diameter, with a complex central hearth and a concentration of charcoal, bones, and artefacts around it, and selected it as the object of the present study (Fig. 3).

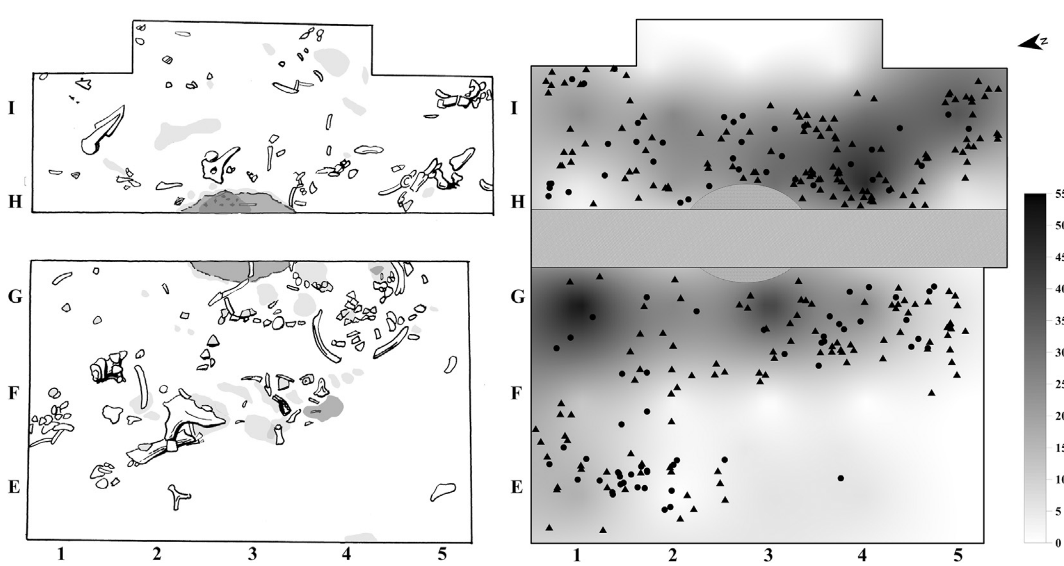

Fig. 3. Dolní Věstonice IIa, squares E–H/1–5: plan of the hearth area and its periphery (left) and spatial distribution map of finds (right). Majority of the finds relate to horizon 3c. Key: density of lithics (small fraction collected during wet sieving; 1–55 artifacts per sector 1 × 1 m) combined with a map of individual piece-plotted lithic artefacts (black dots) and bones (black triangles).

4. Stratigraphy

Compared with the classical Upper Pleistocene section at the foot of site DV II (Klíma et al., 1962; Antoine et al., 2013), the stratigraphic section at site IIa only represents a restricted portion of the last loess cover, a complex anthropogenic deposit below, and redeposited clayish layers of Neogene origin at the base. The overall sequence may be combined from two sections at the site periphery (zone F, excavation 1999) and in the centre (zone G, excavation 2012, Figs. 4 and 5); the relationship of the deposition is visible on the overall longitudinal section (zone 5, Fig. 6).

Periphery – section F:

1. Arable soil (0–30 cm)
2. Light grey loess with rusty bands and spots; at the base a brownish gley horizon, 2a (30–100 cm)
3. Cultural complex (100–125 cm). Loessic material is interstratified by several charcoal microlayers interlain with bluish clay and brownish soil microlayers, elevated from the subsoil. Their inclination grades upwards along the slope. Two charcoal microlayers, 3a and 3b, were AMS dated
4. Clayish bands of various colourations (yellow, grey, brown) with sharp-edged limestone and sandstone fragments

Centre – section G through the hearth:

1. Arable soil (0–10 to 30 cm)
2. Light-grey loess with undulated rusty bands and spots and gley horizon at the base (10/30–80/100 cm). MS = 0.17
3. Cultural complex formed by brownish-grey soil sediments interlain with charcoal bands, accumulated without visible side removal and inclined upwards along the slope. In the upper part it is interstratified by yellowish or greyish clay bands with small-sized limestone debris; in the lower part, by brown-greyish and light greyish clay bands, with visible effect of gleyification (80/100–110/130 cm). Inside the body of the central hearth three charcoal microlayers, 3c, d, and e, were AMS dated; MS = 0.2.
4. Stratified clay bands of brown, yellow, and grey colouration, with sandstone debris and charcoal (below 110/130 cm). A charcoal band is visible at the base of the above hearth, and was AMS dated. MS = 0.17

As at other recently excavated sites, our strategy was to preserve the hearth section in place for future revisions.

5. Situation

The settlement unit described above provides an ideal groundplan with a central hearth and related bone deposits and artefacts around it (Figs. 2 and 3). With the standard diameter of about 5 m, it offers another exemplary picture of the basic living unit that made up the nearby settlement clusters (as at Pavlov VI, Svoboda et al., 2009). However, a more detailed microstratigraphic insight, using the AMS dates, shows that this situation has accumulated gradually,

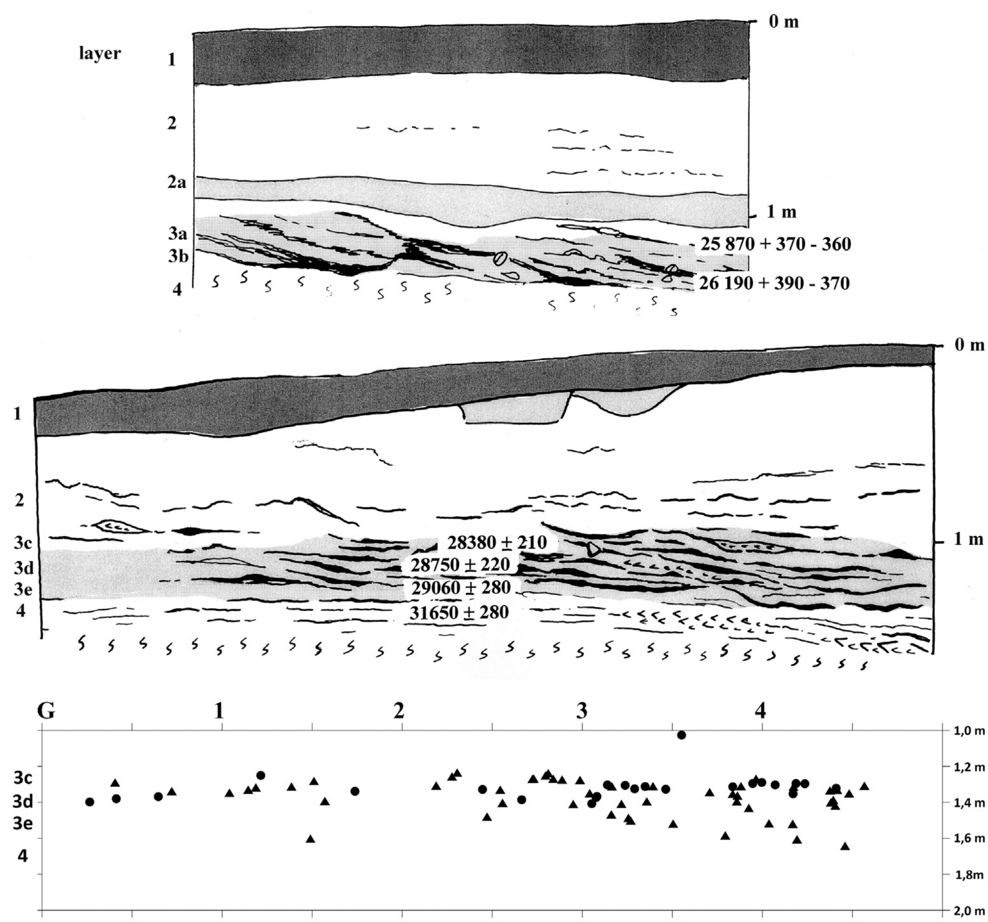

Fig. 4. Dolní Věstonice IIa: stratigraphic sections in squares F (periphery) and G (centre) and vertical distribution of artefacts (black dots) and bones (black triangles) in section G.

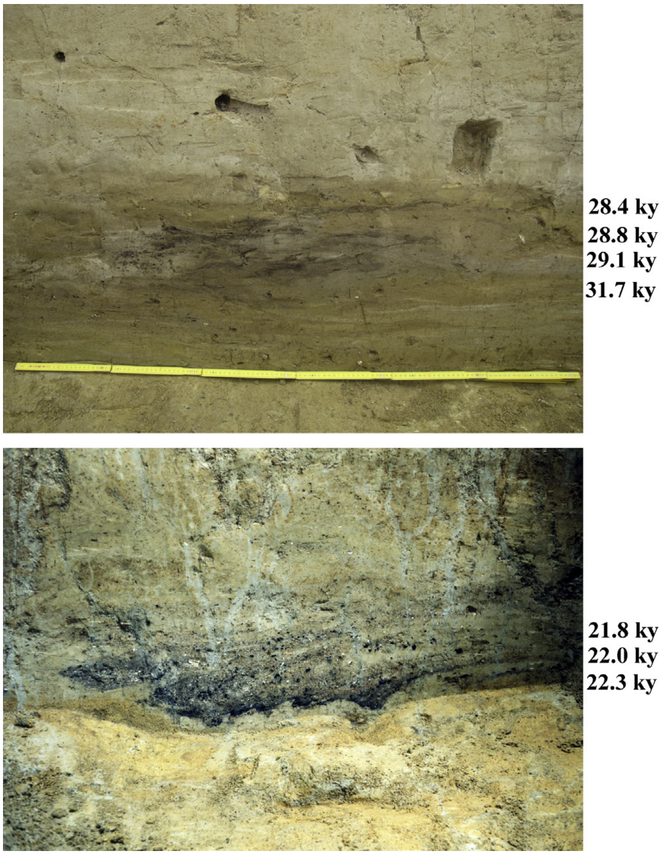

Fig. 5. Section photos of the compared microstratigraphies of Dolní Věstonice IIa and Petřkovice I, with the position of the uncalibrated C14 dates (ky BP) indicated.

during a longer timespan and at intervals of irregular rhythm. The two dates obtained from the uppermost superposed charcoal microlayers in the NW periphery grade in the interval of the centuries between 25.9 ka uncal BP and 26.2 ka uncal BP and correspond with the dominant occupation horizon at DV II labelled Evolved Gravettian (Figs. 4 and 5; for calibration see Fig. 13).

The dominant feature in centre of the analysed area was a series of several superimposed microlayers of dark soil sediments with charcoal lenses, 110–120 cm in diameter and 25–30 cm thick, interpreted as a multilayer hearth. We did not observe red-burnt loess in this context. The individual microlayers were sampled for AMS dating, soil micromorphology, pollen, and other analyses in intervals of about 10 cm. The AMS dates grade in intervals of centuries between 28.4 and 29.1 ka uncal BP; a date from the base reached 31.7 ka uncal BP (for calibration see Fig. 13). Therefore, the hearth sequence as a whole is earlier than the surrounding occupation traces.

The horizontal spatial distribution of lithic artefacts (Fig. 3) is simple given the low artefact density in all horizons. Artefacts were concentrated around the hearth in scatter patterns; animal bones show a similar pattern, while the burnt clay pellets are located even closer to the hearth. A gradual decrease in object density from the hearth towards the peripheries is visible, as at Pavlov VI, for example. It is typical for small and isolated settlement units in the open air, with no evidence of architecture.

The dominance of wood charcoal (and lack of burnt bone) relates this hearth to others from site DV II (in contrast to the dominance of burnt bone at Předmostí I or Milovice IV; Beresford-Jones et al., 2010; Svoboda et al., 2011). In contrast to the other hearths at the south Moravian sites, neither boiling pits nor other types of depressions (common in other places) were found around.

6. Soil micromorphology

Micromorphology enables detailed study of the undisturbed sediments in thin sections. At site DV II, this method has previously been applied to the section with human skeleton DV 16 (Smolíková, 1991). At site DV IIa, two samples were taken in zones D and E, corresponding to archaeological layers 3a and 3b, and one sample originates from zone G from the upper layer of the hearth (3c). Their thin sections are described as follows.

6.1. Horizon 3a (sample 2, 10 YR 8/2)

This sample is specific in that it has a high share of coarse material and the presence of mollusc shell fragments and charcoal fragments with well-preserved growth zones and a more intensive recalcification. This layered matrix also includes some deep brown redeposited soil particles, partly with small coprogenous elements of fossil *Enchytraeidae*.

6.2. Horizon 3b (sample 3, 10 YR 8/4)

This layered position is composed of unsorted material as well. Walls of the income fissures are richly coated with Mn concretions and then covered with amorphous $CaCO_3$; rarely, the empty cavities are filled by calcitic rhombohedrons. Although the dark minerals are mostly represented by biotite in all analysed samples, sample 3 also contains glauconite. Larger pieces of charcoal with preserved cellular structure were present as well.

6.3. Horizon 3c (sample 1, 10 YR 8/3)

Light ochreous basic mass is flocculated and its microskeleton corresponds to a silt. It generally contains grains of quartz, plagioclase, orthoclase, biotite, muscovite, and rarely augite, amphibole, and others. Larger charcoal fragments, some with relicts of cellular structure, are observed as well. The basic mass is penetrated by numerous broad fissures and richly recalcified (amorphous $CaCO_3$ and calcite rhombohedrons). The walls of some of these cavities were coated with Mn concretion before recalcification.

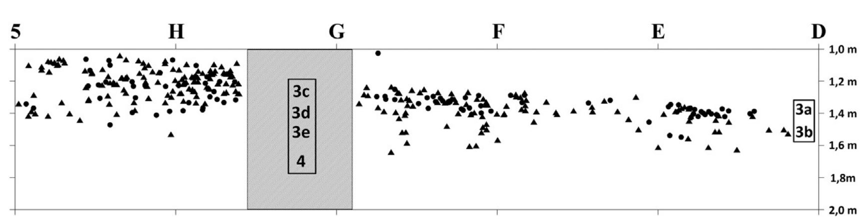

Fig. 6. Dolní Věstonice IIa: vertical distribution of artefacts (black dots) and bones (black triangles) in longitudinal section in square 5.

Wood ash was not recorded in these thin sections. In terms of soil micromorphology, all three samples (as well as the previously analysed samples; Smolíková, 1991) correspond to fossil soil sediments originating from either loess or initial palaeosols.

7. Environmental context: stability and change

Evidence of palynology, charcoal analysis, malacozoology and vertebrate micropaleontology through the individual layers enables the reconstruction of changes in the surrounding landscape during the Gravettian.

Table 1
Dolní Věstonice IIa, AMS data from the surrounding area (1–2), from three microlayers of the central hearth (5–7) and from its subsoil. All from conifer charcoal. Calibration by OxCal 4.2.3, using calibration curve IntCal13, Jan. 31, 2014.

Sample	Horizon/depth	Date (BP)	Deviation	Date (cal BC)	Probability (%)
GrN-15134	3a-periphery/100 cm	25,670	370	28,788–27,068	95.4
GrN-15132	3b-periphery/l20 cm	26,190	390	29,101–27,591	95.4
OxA-27331	3c-centre/100 cm	28,380	210	31,015–29,645	95.4
OxA-27332	3d-centre/110 cm	28,750	220	31,595–30,124	95.4
OxA-27255	3e-centre/120 cm	29,060	280	31,906–30,568	95.4
OxA-27333	4-centre/130 cm	31,650	280	34,210–32,991	95.4

Table 2
Petřkovice. AMS dates from the Gravettian hearths H8, H7, and surroundings. All from conifer charcoal. Calibration by OxCal 4.2.3, using calibration curve IntCal13, Jan. 31, 2014.

Sample	Horizon/depth	Date (BP)	Deviation	Date (cal BC)	Probability (%)
GrA-35446	Hearth H8/70 cm	21,790	110	24,306–23,861	95.4
GrA-35447	Hearth H8/90 cm	21,970	110–100	24,531–23,991	95.4
GrA-35449	Hearth H8/105 cm	22,260	110–100	24,976–24,200	95.4
GrA 891	Hearth H7/cca 100 cm	23,370	160	25,866–25,386	95.4
GrN 19540	No evidence	20,790	270	23,728–22,415	95.4

In the 2012 charcoal samples generally (Table 3), the dominant tree was larch or spruce (*Larix/Picea*; *cf. Larix*), followed by pine (including Swiss stone pine – *Pinus* cf. *cembra*) and individually by birch (*Betula*), juniper (*Juniperus*), and common sea-buckthorn (*Hippophae rhamnoides*). These species are characteristic indicators of a parkland forest-steppe vegetation. Analysed coniferous taxa were characterised by a much denser structure of narrow growth rings, which suggest unfavourable climatic conditions; at site DV II, comparable patterns were already recorded by Opravil (1994) and later analysed by Beresford-Jones et al. (2011). The horizon 3c contained the highest amount and weight of the charcoals. This horizon was characterised by the dominance of larch or spruce (*Larix/Picea*; cf. *Larix*), followed by pine (including Swiss stone pine – *Pinus* cf. *cembra*) and occasionally by birch (*Betula*).

Table 3
Major developmental trend in floral record (in %).

a. Charcoal	3a	3b	3c	3d	3e	4
Larix/Picea	100.00	90.36	79.13	69.23	78.95	100.00
Pinus cf. *sylvestris*	0.00	1.20	10.54	12.64	14.62	0.00
Pinus cembra	0.00	3.61	10.14	18.13	4.68	0.00
Betula sp.	0.00	2.41	0.20	0.00	0.58	0.00
Juniperus sp.	0.00	0.00	0.00	0.00	1.17	0.00
Hippophae sp.	0.00	2.41	0.00	0.00	0.00	0.00

As hearth zones at Dolní Věstonice and Pavlov sites also appear to provide favourable conditions for pollen preservation, one sample from horizon 3c provided pollen-analytical evidence (other samples were negative). These results (Table 4) support a general landscape reconstruction around the Gravettian sites based on the previous pollen analytical investigations (Rybníčková and Rybníček, 1991). A parkland of forest-steppe character is dominated by pioneer trees such as birch (as indicated by *Betula alba*-type pollen), pine (including Swiss stone pine – *Pinus cembra*), and larch (*Larix decidua*). The open areas were generally of a steppic character (*Artemisia*, Chenopodiaceae), but moister locations were covered by shrub tundra (*Betula nana*), possibly with dispersed spruce (*Picea*). Relatively favourable climatic conditions also allowed a sporadic occurrence of temperate arboreal elements such as oak (*Quercus*), hazel (*Corylus*), lime (*Tilia*), and elm (*Ulmus*). However, the presence of redeposited Neogene palynomorphs should be taken into account, demonstrating the complex taphonomy of the pollen spectrum and the possibility of long-distance wind transport.

Table 4
Dolní Věstonice IIa, results of pollen analysis of a sample from the hearth, horizon 3c, depth 110 cm. In brackets: absolute number of finds. Analysis by Petr Pokorný.

Trees and shrubs
Alnus glutinosa type (2), *Betula alba* type (26), *Betula nana* type (5), *Corylus avellana* (8), *Fagus sylvatica* (1), *Hippophaë* (1), *Juniperus* (3), *Larix decidua* (6), *Picea* (11), *Pinus cembra* type (8), *Pinus sylvestris* type (32), *Pinus sylvestris/P. cembra* (38), cf. *Populus* (4), *Quercus* (7), *Salix* (7), *Tilia* (2), *Ulmus* (2)
Herbs
Anthemis type (4), *Artemisia* (8), Asteraceae Subfam. Cichorioideae (41), Caryophyllaceae (1), Cruciferae (13), Cyperaceae (6), Gramineae (58), Chenopodiaceae (46), Labiatae (3), *Plantago* cf. *maritima* (1), *Polygonum persicaria* type (2), *Ranunculus acris* type (1), Rubiaceae (4), Umbelliferae (3), undeterminated herbs (51)
Tertiary palynomorphs (redeposed) and non-pollen objects
Tricolpopollenites (5), Caryapollenites (3), Nyssapollenites (1), Algae – cysts (44), *Pediastrum* sp. (3), Fungi – various types (105), Dinoflagellata (10), Rhizopoda (3), microscopic charcoal fragments (great amount – not quantified)

Malacozoological material is dominated by gastropods (24 species and numerous undeterminable sharp-edged shale fragments), whereas bivalves are represented only by two fragments of *Unio* sp. shales in the uppermost 3a layer (Table 5). Among gastropods, the species *Succinella oblonga* (259 specimens and fragments), *Galba truncatula* (162), *Discus ruderatus* (96), and *Succinea putris* (91) are the most abundant. In the 3e and 3d layers gastropods were relatively numerous, their numbers increasing upwards (3e – 10 species/150 specimens, 3d – 13 species/260 specimens), and the highest numbers both of species (20) and of specimens (341) were noted in the following 3c layer. In contrast, molluscs are markedly less abundant in the lowermost layer 4 and in the uppermost 3b and 3a layers: 4–7 species/20 specimens, 3b – 9 species/42 specimens, and 3a – 13 species/42 specimens. The ascertained molluscs generally differ in their individual paleoenvironmental requirements. For example, species were found that were merely cryophilic (*Vallonia tenuilabris*), more tolerant to temperature changes (*S. oblonga*, *Clausilia dubia*), and even thermophilic (*D. ruderatus*). Absolute numbers of typical loess species (such as *Succinella oblonga*, *V. tenuilabris*, *C. dubia*, *Pupilla* cf. *loessica*) are gradually and markedly growing in the 3e, 3d and 3c layers, reaching their maxima in the 3c layer, and substantially decreasing in the superposed 3b and 3a layers. In the 3e and 3d layers there are relatively numerous species indicating higher moisture (*G. truncatula*, *S. putris*), and in the 3e and 3c layers *D. ruderatus*, preferring forest environments, occurs in high numbers.

Table 5
Dolní Věstonice IIa – Malacozoolocial record.

	3a	3b	3c	3d	3e	4
Gastropoda						
Galba truncatula	2	7 + 1 f.	34	89 + 2 f.	19 + 3 f.	5
Lymnaea sp.	1 + 1 f.	2 f.	2 f.			
Succinea putris	2	1 + 3 f.	12 + 11 f.	25 + 6 f.	24 + 3 f.	
Succinella oblonga	11 + 2 f.	5 + 8 f.	111 + 12 f.	58 + 4 f.	47 + 1 f.	8
Cochlicopa lubrica			3			
Granaria frumentum	1 f.					
Pupilla cf. *loessica*	2	1	19	6	4	
Pupilla cf. *muscorum*			1			
Pupilla cf. *sterri*			2			
Pupilla sp.			2 f.			
Vallonia tenuilabris	2 + 1 f.		12	8 + 2 f.	5	1
Vallonia sp.	2 + 2 f.	10 f.	12 + 1 f.	2 + 1 f.	1	
Truncatellina cf. *costulata*				1 f.		
Truncatellina cylindrica			2			
Clausilia dubia	1 f.	2 f.	3 + 18 f.	2 + 12 f.	1 + 4 f.	1 f.
Cecilioides acicula	3		3			
Discus ruderatus			52	6 + 4 f.	28 + 5 f.	1
Discus sp.	1 + 3 f.		4 + 12 f.	6 + 2 f.	1 + 3 f.	1 f.
Euconulus fulvus			2			
Perpolita hammonis				4		
Oxychilus inopinatus		1				
Fruticicola fruticum	6 f.	1 f.	3 f.		1 + f.	
Euomphalia strigella			3 f.	5		
Helicopsis striata	1 f.		2	5		3
Bivalvia						
Unio sp.	2 f.					
Mollusca						
Mollusca indet. – fragments	x	x	x	x	x	x
Others						
?bones			3	1		

Vertebrate microfauna (Table 6) is represented by 22 fragments of mostly isolated teeth belonging to at least 18 individuals of five species of small ground rodents (Fig. 7). In terms of MNI these are: two *Spermophilus* cf. *citelloides*, five *Clethrionomys* cf. *glareolus*, two *Microtus gregalis*, one *Microtus* cf. *agrestis*, one *Microtus oeconomus*, seven cf. *Microtus* sp., and one to two *Dicrostonyx* sp. Although the sample is too fragmentary for detailed stratigraphical or palaeoecological inferences, it clearly demonstrates two facts: first, it is essentially composed of the typical elements of the glacial communities (*M. gregalis*, *Dicrostonyx*, *Spermophilus* cf. *citelloides*), yet in contrast to other assemblages of that type it exhibits a very high representation of *Clethrionomys glareolus*, that is, the index element of the woodland habitats. The m1 pattern differs from the typical m1 morphotypes of extant mid-European *C. glareolus* (also for its quite large size), which also excludes post-sedimentary contamination. Although *C. glareolus* appears almost regularly in mass glacial assemblages of Central Europe, it is quite rare and its percentages in these assemblages do not exceed one to a few percent as a rule (Horáček and Sánchez, 1984), while in the site under study, particularly in layer 3c, it seems to represent even a dominant element. In any case, this fact suggests that at the time of deposition of layer 3c, besides an open ground steppe environment (comp. *M. gregalis*, *Dicrostonyx*, *Spermophilus*), the habitat context also included patches of woodland and marshy habitats (comp. *M. oeconomus*, *M.* cf. *agrestis*) at least in a wider vicinity. The regular appearance of *Spermophilus* cf. *citelloides* in the most recent layers (3a,b) suggests for them rather a predominance of dry steppe habitats, as also confirmed by the palaeobotanical studies.

Table 6
Microfaunal record.

Vertebrate microfauna	3a	3b	3c	3d	3e	4	Total NISP
Clethrionomys cf. *glareolus*			4		1		**5**
Dicrostonyx sp.			1				**1**
Microtus cf. *agrestis*			1				**1**
Microtus gregalis			1				**1**
Microtus oeconomus			1				**1**
Microtus sp.		1		1		1	**3**
cf. *Microtus* sp.			2				**2**
Spermophilus cf. *citelloides*	2	1					**3**
cf. *Spermophilus* sp.			1				**1**
Total NISP in layer	**2**	**2**	**11**	**1**	**1**	**1**	**18**

8. Patterns of human activity

Effects of human activity are commonly recorded in the large faunal remains and lithic artefacts. The associated archaeozoological material includes 8189 larger animal remains (Table 7, Fig. 8). The assemblage was highly fragmented (84% are indeterminable fragments smaller than 3 cm), and only 9.23% of the total amount could be classified according to taxon. The remains of woolly mammoth (*Mammuthus primigenius*, MNE = 132) were well distributed in layers 3c (54% NISP) and 3b (31% NISP), diminished slowly in layers 3a and 3d (7% NISP), and were underrepresented in layers 3e and 4 (less than 0.5% NISP). The most frequent anatomical parts were the cranial, costal, and vertebral fragments, long bone fragments, and distal parts of fore and hind limbs (the molar lamellae and tusk fragments were excluded from the MNE estimation due to their natural inclination to fragmentation). One mammoth bone bears traces of polish. The reindeer remains (*Rangifer tarandus*, MNE = 44), including fragments of antler, cranial and mandibular fragments, vertebras, and selected parts of hind limb, were present especially in layers 3b and 3c (between 40 and 50% NISP). The wolf (*Canis lupus*, MNE = 23) remains were represented by teeth fragments and distal appendicular parts; these were concentrated in layer 3c (more than 60% NISP) and progressively decreased towards the peripheral layers 3a and 3b (18–15% NISP). The horse (*Equus ferus*, MNE = 17) was anatomically characterised by teeth, jaw, and scapular fragments and by a part of the lumbar area. These remains were detected in layers 3b and 3c (54–40% NISP) and gradually diminished within layers 3a and 4 (less than 3% NISP). The hare (*Lepus*, sp., MNE = 11) was found exclusively in layer 3b, where it was represented by jaws and teeth. The number of fox teeth (*Vulpes vulpes*/*Vulpes lagopus*, MNE = 7) decreased from layer 3a to 3c (71–14% NISP). Red deer (*Cervus elaphus*, MNE = 2) is represented by antler fragments in layer 3a (86% NISP) and by axis fragments in layer 3c (14% NISP). One maxillary fragment of cave lion (*Panthera leo spelaea*, MNE = 1) was in layer 3b. In contrast to other Gravettian localities, such as Předmostí Ib or Milovice IV (Beresford-Jones et al., 2010; Svoboda et al., 2011), only 18% of the whole assemblage was burned and most of these fragments were smaller than 3 cm (99.5%). Various burning stages were observed, mostly between stages III and IV, and the majority of the assemblage (69%) consisted of compact bones. Thus, various but occasional human activities might be expected such as bone grease manufacture or waste removal (see also Bosch et al., 2012; Fladerer et al., 2014).

Table 7
Archaeozoological record.

Archaeozoology	3a	3b	3c	3d	3e	4	Total NISP
Mammuthus primigenius	39	160	280	37	1	2	**519**
Equus ferus	1	20	15			1	**37**
Cervus elaphus	12		2				**14**
Rangifer tarandus		41	33	7		1	**82**
Cervidae		22	17				**39**
Canis lupus	6	5	20	1			**32**
Vulpes vulpes/Vulpes lagopus	5	2	1				**7**
Canidae			1	1	1		**3**
Panthera leo spelea		12					**12**
Lepus sp.			10	1			**11**
Total determinate NISP	**63**	**261**	**379**	**47**	**2**	**4**	**756**
Extra large sized mammal	1	2	18				**21**
Large to extra large sized mammal	4	1	7	1			**13**
Large sized mammal	1	8	11	1	1		**22**
Middle to large sized mammal	1	40	10			1	**52**
Middle sized mammal	45	48	110	16	3	1	**220**
Small to middle sized mammal	1	5	8	1		1	**16**
Small sized mammal	14	7	41	11			**73**
Indeterminate (>3 cm)	5	29	76	2	3	6	**121**
Indeterminate (<3 cm)	1188	353	4351	814	59	127	**6892**
Total indeterminate NISP	**1260**	**493**	**4632**	**846**	**66**	**136**	**7430**
Total NISP in layer	***1323***	***754***	***5011***	***893***	***68***	***140***	***8189***

The associated lithics (a total of 578 artefacts) were separated into six chronostratigraphic horizons (3a–e and 4), where horizons 3a (15% of all lithics) and 3c (75% of all lithics) provided the largest samples (Table 8). The raw material composition shows slight variation throughout the sequence. The artefacts were predominantly made of white-patinated flint from glaciofluvial deposits (49%), followed by radiolarite (22%), mostly of greenish to reddish-brown hues. These two basic materials are supplemented by various types of cherts and spongolite and rarely by quartz and quartzite (especially in the horizon 3c assemblage). A part of the artefacts (8%) was burnt in fire (mainly in horizon 3c).

Table 8
Dolní Věstonice IIa, developmental trends in lithic industry.

	3a		3b		3c		3d		3e		4		Total
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	
Cores	1	1	0	–	3	0.7	0	–	0	–	0	–	4
Fragments & chips	58	69	6	–	364	84.5	30	–	3	–	15	–	476
Flakes	5	6	0	–	13	3	3	–	1	–	0	–	22
Blades	12	14.3	3	–	46	10.7	0	–	0	–	0	–	61
Partially retouched	0	0	0	–	2	0.5	0	–	0	–	0	–	2
Retouched tools	7	8.3	1	–	2	0.5	0	–	0	–	0	–	10
Burin spalls	1	1.2	1	–	1	0.2	0	–	0	–	0	–	3
Total	84	100	11	–	431	100	33	–	4	–	15	–	578

In all assemblages, the most numerous items are small chips, flakes (less than 1 cm), and irregular fragments, followed by groups of blanks, including non-retouched blades and flakes. Cores (if present) are generally small, with lengths ranging between 32 and 47 mm, and predominantly with a single platform. One single-platform flake core of radiolarite was found in horizon 3a. Three other cores are from horizon 3c, including two microblade cores in an advanced stage of reduction (Fig. 9: 9, 10) and one spongolite core in an initial stage. The non-retouched blades (Fig. 9: 1, 2, 5–8) including numerous microblades up to 9 mm in width (about 67% of all blades) are predominantly non-cortical, originating from advanced stages of core reduction and mostly preserved as fragments. When complete (about 25% of all blades), the blades display a triangular or trapezoidal cross-section and a straight profile with length ranging between 10 and 67 mm. In horizons 3a and 3c the blades predominate over the flakes, but the blades are missing in all other assemblages; flakes are absent in horizons 3b and 4. The number of retouched pieces does not exceed 2% of the total collection, with the highest proportion in horizons 3a and 3c (they are absent in horizons 3d, 3e, and 4). Horizon 3a provided a proximal fragment of a backed microblade followed by simple burins made on broken blades and retouched blades, almost all unilateral and preserved as fragments. In 3c, the typical artefacts are a chisel laterally retouched from the ventral face (Fig. 9: 3), and a simple burin (Fig. 9: 4). Throughout the layers, the assemblages are completed by fragments of sandstone plaques and small fragments of mineral dyes.

In terms of raw materials and typology, the lithic assemblages are of Gravettian character as a whole, with the dominance of simple burins, blades, and microblades, but the only diagnostic Gravettian tool types are one backed-blade fragment in horizon 3a and one chisel in horizon 3c.

9. Clay pellets

The pellets of burnt clay, altogether 19 pieces and all from horizon 3c, deserve special attention in this context. These are small pieces of heat-consolidated loess of ochreous-greyish, light brown or dark brown coloration. The maximal size interval is 3.5–20 mm, while four items exceed 10 mm. All pellets rub on paper and are therefore insufficiently burnt. Sometimes the inner mass includes microscopic particles of charcoal. The largest object shows a concave imprint from a tubular object, probably a small branch of a tree (Fig. 10). Several small openings with a diameter smaller than 1 mm are visible on its surface. Microscopic examination of the other pellets, using an Olympus SZH10 stereoscopic microscope, showed the presence of such hollows or cavities in at least two other cases. The inner structure of the largest pellet was imaged using an X-ray (micro-)computed tomographic (μCT) station GE Phoenix v|tome|x L 240, using the following measurement parameters: an accelerating voltage of 80 kV, tube current of 50 μA, and no filter. The voxel resolution achieved was ~7 μm. μCT images (Fig. 11) revealed a large number of small cavities, varying within the range of 62–367 μm (the median of 120 measurements was 149 μm; the standard deviation was 70 μm). Because the oval shapes of hollow places in the μCT sections are probably due to diagonal cuts through the hollows of approximately cylindrical shape, we measured their smaller diameter, which probably reflects the true transversal diameter of the hollows.

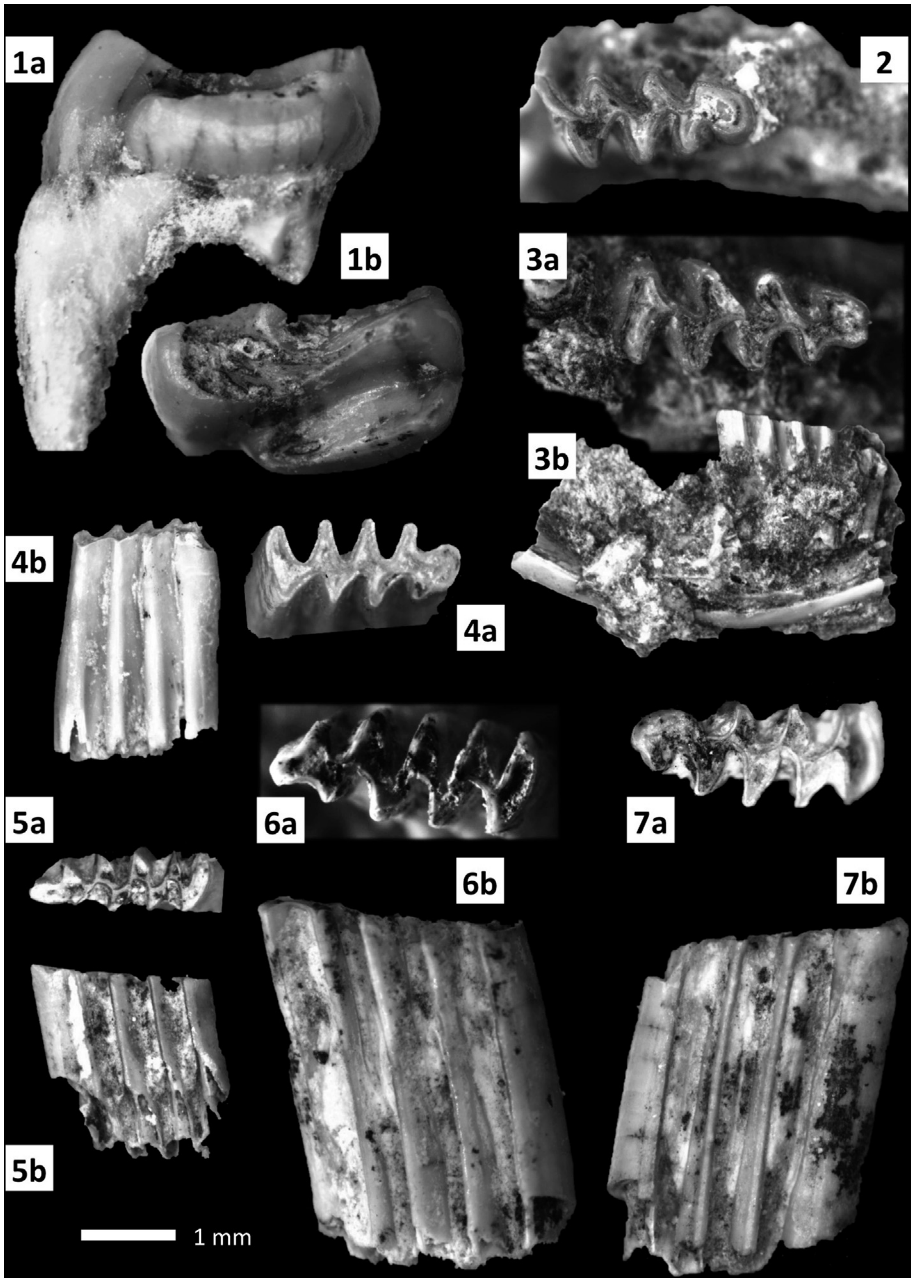

Fig. 7. Selected remains of small ground mammals from layers 3b (1), 3e (2), and 3c (3–7): 1ab – *Spermophilus* cf. *citelloides*, 2–4 *Clethrionomys* cf. *glareolus*, 5ab – *Microtus gregalis*, 6ab – *Microtus* cf. *agrestis*, 7ab – *Microtus oeconomus*.

Fig. 8. Dolní Věstonice IIa: faunal remains as found in situ: a mammoth vertebra (maximal length 40 cm), part of a mammoth skull (maximal length 30 cm), a red deer antler (maximal length 32 cm).

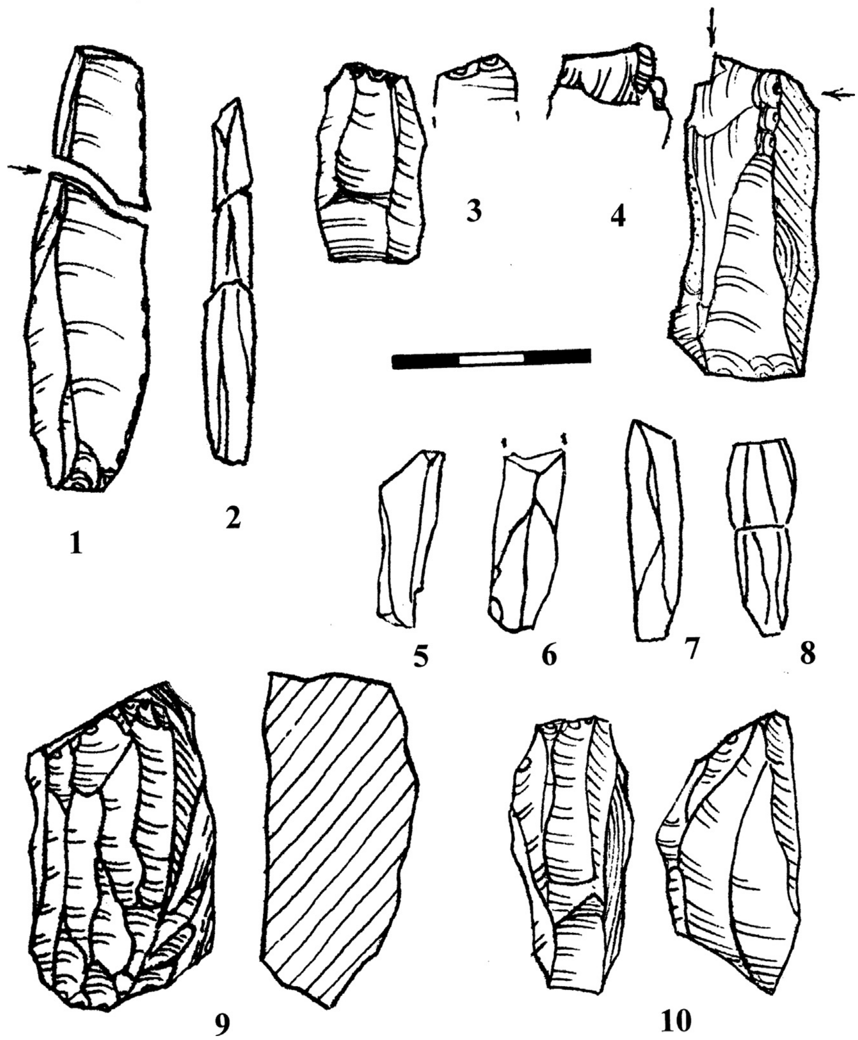

Fig. 9. Dolní Věstonice IIa: selection of Early Gravettian lithic artefacts from the central area, all from horizon 3c.

These pellets/lumps can be interpreted as a result of some human activities around the central hearth, with which they are clearly associated. Most of them probably originated from secondary post-depositional disintegration of unintentionally fired sediment under or in close vicinity of the fire. The pellets are comparable to a larger assemblage of badly burnt, non-figurative, and irregular pellets, with unclear interpretation, as documented at the chronologically later Gravettian sites in Central Europe – Dolní Věstonice I, Pavlov I, Dolní Věstonice II and III, Pavlov II, Krems-Wachtberg, Jarošov, Boršice, Spytihněv, Předmostí, Petřkovice, Cejkov, Kašov, Moravany-Lopata (Králík et al., 2008). The total number of ceramic objects found in the Central European Gravettian sites so far was estimated at more than 10,000 pieces and a large portion of the assemblage are just pellets or lumps of this kind. As the outer shape of the pellets does not offer many clues and might (at least in part) be a secondary result of post-depositional processes and/or excavation and washing, we looked for other clues and variables of these objects. One of these might be the small openings located on their surface. Previously, we have observed similar openings on dozens of these pellets/lumps from other sites of the South Moravian region. In the case of artificially unmodified clays they can only be naturfacts – openings of pedogenic voids and/or cavities after the decay of plant roots or from activity of soil microorganisms. The dimensions of the openings found on the pellets from the DV IIa site do not exclude such an interpretation. Even in case of kneaded and compacted clay prepared for intentional modelling (which is not the case), where the original pedogenic voids cannot be retained, small cavities from natural impurities in raw clay (roots of plants, plant debris or other organic matter) may remain after firing. In previous studies, however, similar cavities and tubular imprints on two pellets from the site Pavlov VI were identified as imprints of reindeer (*Rangifer tarandus*) guard hair (Králík et al., 2008; Svoboda et al., 2009; Králík, 2011). Natural cavities in fired clay objects still do not exclude an additional content of anthropogenic origin (whether it was introduced into the object accidentally or intentionally) in cultural layers.

Two-dimensional thin-sections do not by themselves help much in determining the origin of cavities, because natural cavities in soil (voids, holes after roots) widely overlap in size and cross-sectional shape (tubular) with anthropogenic objects such as animal hairs from fur processing. (Moreover, with regard to preservation of these objects for future studies it is not appropriate to apply invasive methods on them.) Therefore we look for other clues in the objects that may determine further characteristics of these cavities such as variability in size and shape along an individual cavity, variations between cavities, the density of cavities per unit volume, direction/course of cavities and its changes (curvatures), their

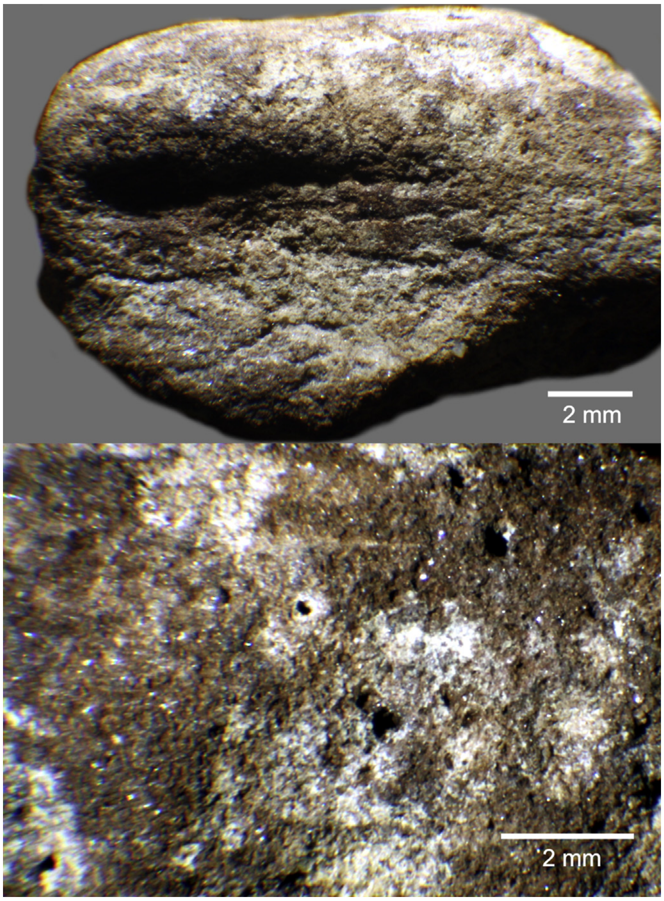

Fig. 10. Surface on the largest clay pellet with concave imprint (upper image) and openings of small cavities on the pellet's surface (lower image). Scale: 2 mm.

interlacing, branching, etc. Therefore, we applied non-invasive visualisation of the internal cavities of the largest object and created their 3D model.

The 3D model of internal structure of the largest pellet shows that the most common cavities are of medium thickness, they run in different directions and are slightly wavy (Fig. 12), and some seem to be branching. The thickest cavity is relatively straightforward and runs across the whole pellet. The cavities open more frequently on the convex surface of the pellet (as if they naturally continue out of the pellet), while in the inner mass closer to the concave surface (i.e. closer to the imprint mentioned above) they are significantly less numerous. Smolíková (1991, this paper) also observes natural cavities in soil samples from the same site, but we are not aware of any comparative study of 3D distribution of natural cavities in the soil or loess samples or in fired clay pellets. Although the thickness of the cavities does not exclude animal hair/fur, they are most likely natural cavities after roots of plants or activities of soil microorganisms.

10. Comment on site formation processes

The situation at DV IIa results from complex site formation processes. We present a sequence of six dates from several charcoal microlayers forming one clearly defined settlement unit at site DV IIa (Fig. 13). Dates in the periphery sequence and the hearth sequence follow each other in intervals at a scale of centuries, and one date from the subsoil is separated by a millennium-scale interval. Following these dates, the activity areas on peripheries mainly preserve the latest occupation stage. In contrast, the charcoal microlayers in the center suggest that the hearths have been founded repeatedly at the same spot, and are preserved as a complex microstratigraphy. The soil-and-charcoal microlayers forming the main body of the DV IIa microstratigraphy provided a sequence of four early Gravettian dates between 28.4 and 31.7 ky BP. If this was a central hearth, this situation evokes the theoretical question of why it was founded at the same spot repeatedly. What is logically predetermined by the specific rock morphology in caves and rock shelters becomes more difficult to resolve at the open air sites. However, our systematic excavations on the slopes of the Pavlov Hills show that the Neogene surface below the cultural layer was less regular than today, and furrowed by numerous streams from fossil springs. In such situations the hunters would tend to resettle similar spots, given their advantages for settlement and observation of landscape around, protection from the winds, the remains of previous occupations visible on the surface, and some kind of a tradition of place.

The soil-and-charcoal microlayers forming the main body of the DV IIa microstratigraphy provided a sequence of four early Gravettian dates between 28.4 and 31.7 ky BP. In terms of cultural determination, the sequence of occupations at a single findspot is of Upper Palaeolithic and early Gravettian character around the central hearth, as supported by the typical fauna (mammoth, carnivores), lithic materials (flint and radiolarite), and technology/typology (a blade/microblade industry with some burins and a chisel), and an evolved Gravettian (Pavlovian) occupation continued on the periphery (with a backed microblade fragment). Given the low number of diagnostic tool types and the early dates, we cannot exclude interventions of other Upper Palaeolithic entities such as the Aurignacian in the lower horizons 3d–e and 4, but any direct argument for such a diagnosis is missing.

11. Comment on seasonality

The time-depth and complexity of these formation processes also show how difficult the question of seasonality at a particular site may be. Based on the intensity of the occupation, supported by the intensity of use-wear on the analysed lithics from the 1999 excavation at DV IIa, Šajnerová (2001) suggested rather a short-term occupation which, however, occurred repeatedly and over longer time-spans. Conclusions about a site's seasonal use cannot be made on the basis of only one selected indication, be it the tree-rings (Opravil, 1994), thin sections of animal teeth (Nývltová Fišáková, 2013), evidence for fur working (West, 2001; Šajnerová, 2001), or the location of activity areas in either the interior or the exterior of the presumed dwellings (Svoboda et al., 2000). Although the summary of this evidence may generally suggest a whole-year occupation and activities at DV II/IIa, with an emphasis on colder seasons (tree-rings, fur working), the structure of individual episodes was even more complex and not all seasons are readable in the archaeological record.

12. Gravettian microstratigraphies and multi-phased hearths in Moravia and Austria

Microstratigraphies at the large open-air sites in Moravia and Austria occur more rarely compared to certain cave sequences. Comparable microstratigraphies of charcoal layers were repeatedly recovered and documented within the settlement of Pavlov I (documentation by B. Klíma) and generally dated between 27 and 25 ka uncal BP but without ^{14}C dates for the individual microlayers. This site is promising for studies of microchronology. Therefore, during the 2013–2014 excavation, we focus on sampling microstratigraphies in more detail and we obtained earlier data,

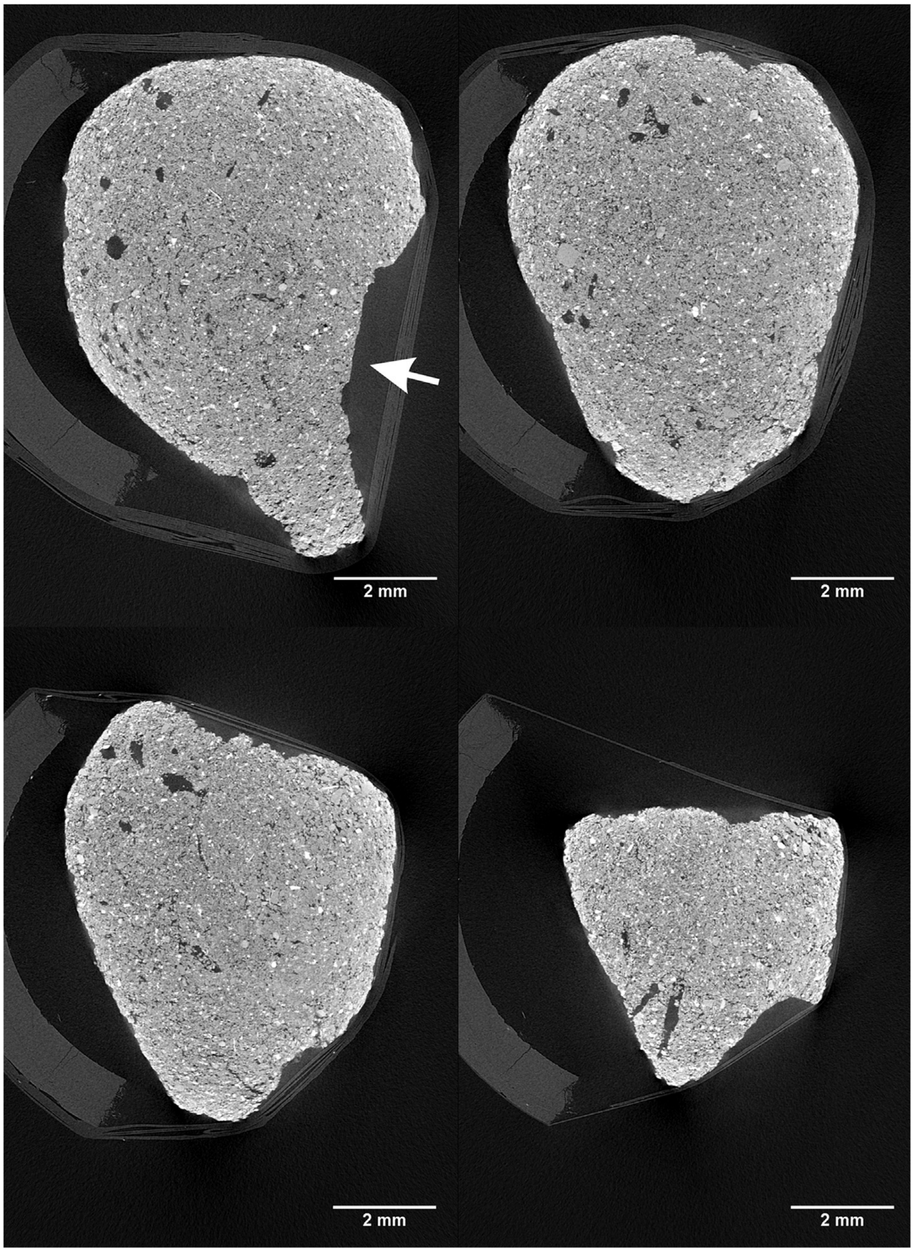

Fig. 11. Four selected μCT cross-sections through the largest clay pellet. Small cavities are visible within the inner mass of the pellet. The arrow indicates the concavity on its surface visualised in Fig. 10. Scale: 2 mm.

generally synchronous with the DV IIa sequence (materials actually analysed).

Another multi-phased hearth of middle Gravettian age has recently been examined at Krems-Wachtberg (Händel et al., 2013; Simon et al., 2014). Whereas the circumjacent layer averages only 2–3 cm in thickness, the hearth, obviously representing the same time-span, is ten times thicker. The excavators distinguished three stages separated by microlayers of burnt loess and stone plaques. This feature included a number of larger charcoal fragments suitable for showing climatic development and dendrochronology over several centuries (Cichocki et al., 2014), and thousands of animal bone fragments around, either from marrow and bone grease exploitation or from burning as fuel (Fladerer et al., 2014). It provided two dates separated by intervals of a few centuries around 27 ka uncal BP and two comparable dates from the living floor around (Simon et al., 2014, Table 1).

During the 1995 excavation at Petřkovice I in Silesia, one later Gravettian hearth (H8), about 30–40 cm thick, was uncovered in the centre of the site (Fig. 5; Svoboda, 2008). It was deposited in a shallow depression and deformed by slope movements similarly to DV IIa. Given the thickness of this hearth and its complexity, we interpret it as the central hearth within the whole occupation area. The 1995 section at this spot was preserved and used as a reference section for additional sampling in 2007 and 2008. Three accelerator dates from burnt bones were taken from superimposed positions separated by microlayers 15–20 cm thick. The results correspond well with this microstratigraphy. They are ordered within the time-span delimited by the previous dates, clustered around 22 ka uncal BP. After calibration (Fig. 13), the three new dates lie in

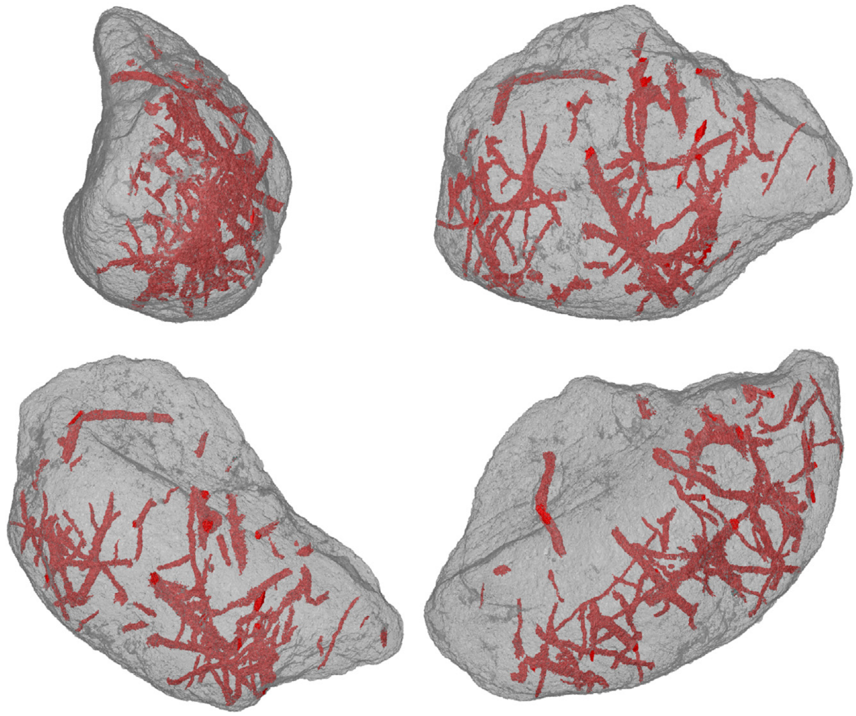

Fig. 12. Three-dimensional model of internal cavities (dark grey) in the largest clay pellet in four views. Created by the Amira software.

intervals of 400–500 years between 24 and 25 ka cal BC, whereas the whole occupation range falls between 23 and 26 ka cal BC. Results from hearth H8 are framed by two additional dates from nearby locations: a newly dated sample from 1953 produced the youngest age (22.9 cal BC) and a charcoal sample from 1994, from the relict of adjacent hearth H7, was the earliest one (26.2 cal BC).

In summary, whereas the DV-IIa charcoal accumulation provides a dated microstratigraphy related to the early Gravettian in Moravia, and the periphery of the same sub-site continues into the evolved Gravettian (Pavlovian), the Petřkovice H8 date sequence refers to the later Gravettian (Willendorf-Kostenkian). The importance of the DV-IIa microstratigraphy is strengthened by the fact that early Gravettian is a poorly understood time-period in Moravia.

13. Gravettian macrochronology and microchronology

The Gravettian chronological scheme (Pavlov and Willendorf-Konstenki stages) has been based on several sources such as the geological stratigraphy as at Willendorf II (Haesaerts et al., 2010), ^{14}C chronology (Jöris et al., 2010), tree ring analysis (Beresford-Jones et al., 2011; Cichocki et al., 2014), and archaeological microstratigraphies in the context of spatial analysis of the large settlements (Svoboda et al., 2000). Recently, Moreau (2012) rightfully questioned the validity of the early Gravettian stage at the south Moravian sites, given the rarity of evidence. Here we add new evidence of the early Gravettian and reconsider the evidence for early Gravettian from DV II–IIa in the light of the 2012 excavation records (and another series of early dates from the 2013 excavation at Pavlov I are being prepared for publication).

A series of early ^{14}C dates around 28/30 ka uncal BP has been published from the 1958–1959 excavation of the classic section in the former bricketerry at the foot of the DV II site (Klíma et al., 1962; Klíma, 1995). All originate from the first dataset from Moravia produced by the Groningen laboratory and relate to the research level of that time. In addition, at this stage of research it was not yet clear that a pararendzine or pseudogley, rich in charcoal but archaeologically sterile, dated around 28/30 ka, forms a typical substrate at several sites over the DV-Pavlov area. After a revision, it appears that some early dates from this series (GrN 2598, GrN 10525, GrN 11196) have no human association, while others are more recent and relate to small assemblages of lithics with typical pebble tools in the western wall of the bricketerry (Klíma et al., 1962).

However, one date (GrN 2092) from the eastern bricketerry wall, Section 4, excavation 1959, with the result of 28,300 ± 300 uncal BP, was associated with a small lithic assemblage composed of about 20 flakes, blades, and microblades, including four burins and one endscraper (Klíma et al., 1962; Klíma, 1995). In the actual collections, 16 of these artefacts are preserved; 14 are of flint and two of radiolarite. Following chronologically at DV II is the date GrN 13962 from the northern slope of the site, with a result of 27,660 ± 80 uncal BP, and a series of dates around 27 ka uncal BP from the western slope (Svoboda, 1991; Klíma, 1995).

14. Conclusion

The 2012 excavation at Dolní Věstonice unearthed a microstratigraphy which provided a sequence of AMS dates from the individual microlayers between 28.4 and 31.7 ka uncal BP (30–33 ka cal BC) and a peripheric zone with slightly more recent dates. In terms of micromorphology, these layers correspond to fossil soil sediments. The analyses of associated charcoal, pollen, faunal remains, and artefacts add to the understanding of the structure of this particular hearth and complete the picture of the MIS 3 landscape, chronology, and microchronology (Fig. 14). Generally, the climatic development through the six horizons was relatively stable. The charcoal analysis documents a picture of a cold and dry landscape with coniferous trees and the pollen analysis in horizon 3c confirms rather a parkland character of the

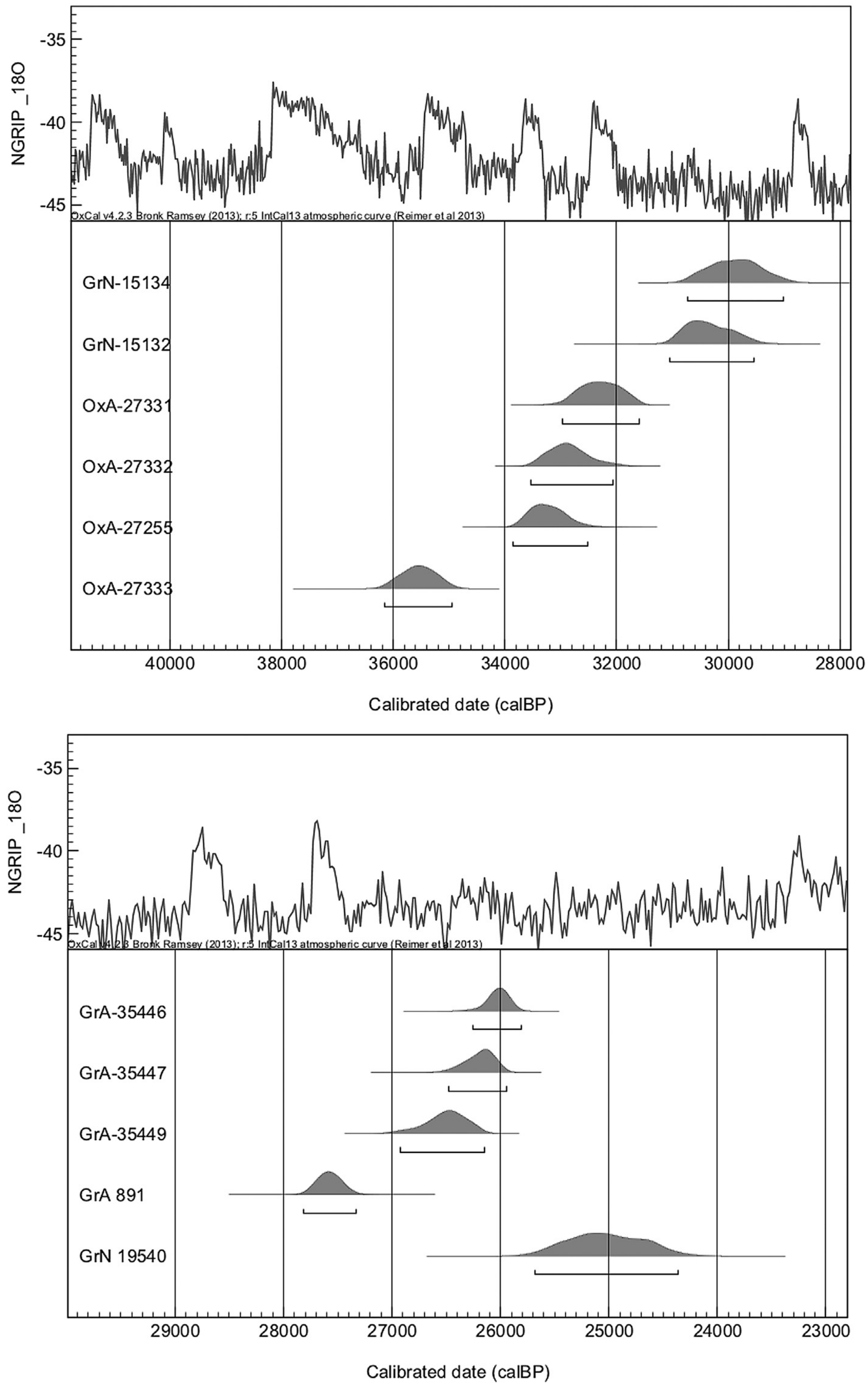

Fig. 13. Dolní Věstonice IIa and Petřkovice I: plots of cal C14 dates (BP) generated using the radiocarbon calibration program OxCal 4.2.3.

landscape with the scattered presence of some climatically demanding broadleaf trees. Nevertheless, the presence of certain snail and small mammal species, associated with fragments of red deer axis, documents an episode of restricted forest formation in horizon 3c around 28.4 ka uncal BP (30–31 ka cal BC).

The environmental development runs parallel with cultural changes starting from nondiagnostic Upper Palaeolithic industry at the base towards the early and evolved Gravettian (Pavlovian) lithic industries above. As such, the new evidence throws light on time periods predating the evolved Gravettian (Pavlovian) occupation.

Finally, an important contribution of the DV IIa excavation is the assemblage of non-figurative burnt clay pellets from one of these early horizons. As regards the inner structure of the pellet mass, the observed small cavities and their distribution may most likely be interpreted as natural features created by small roots of plants or by soil microorganisms. In any case, these items predate by about 2 ky all hitherto known finds of this kind and technology in Moravia and

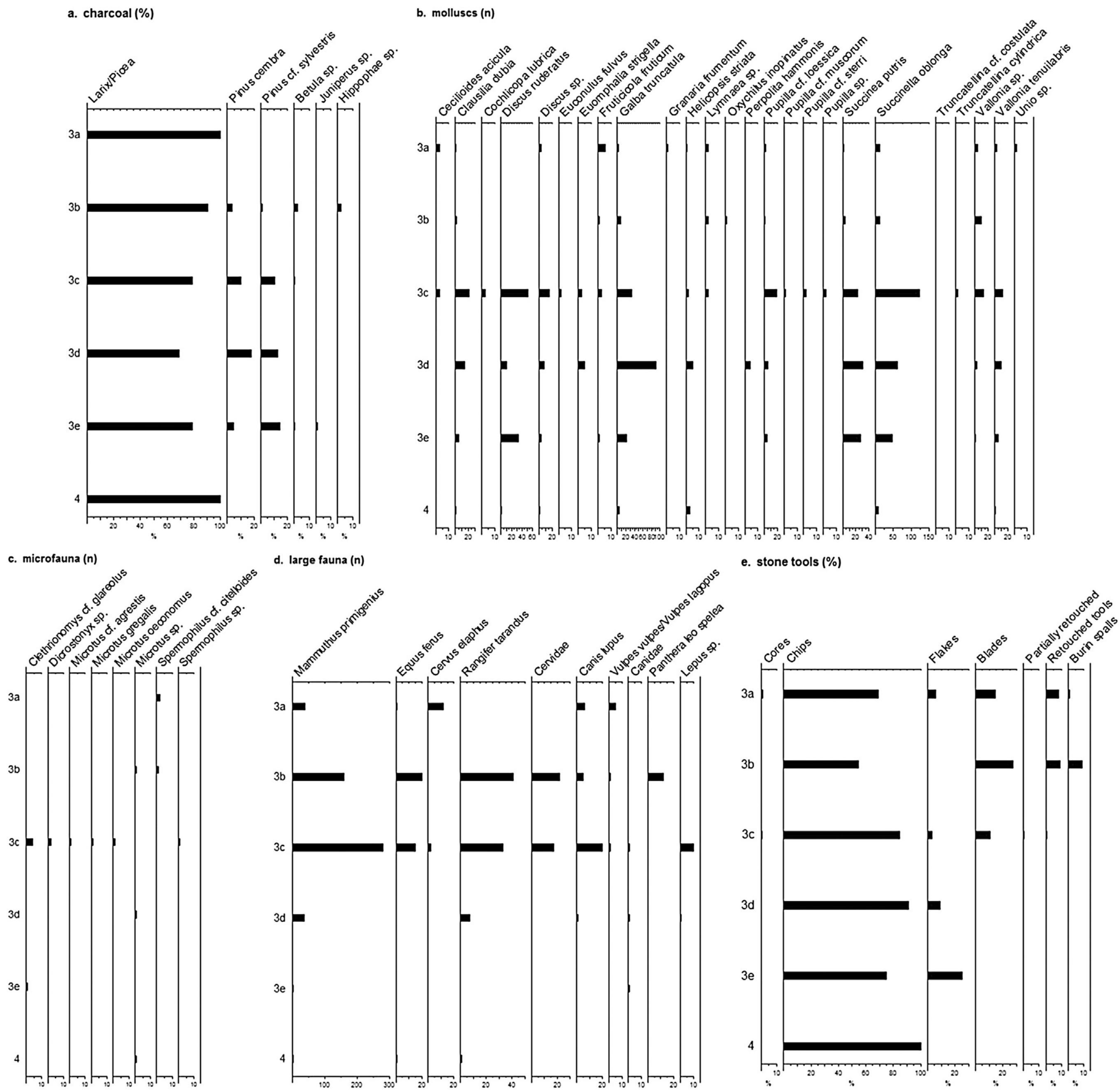

Fig. 14. Dolní Věstonice II, major developmental trends in the environmental and archaeological record.

Austria (dated to the evolved Gravettian (Pavlovian) stage, 27–25 ka uncal BP; Vandiver et al., 1989).

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3.5.3 The role of large canids: Preliminary variabilities forming the population structure in Moravia

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THE ROLE OF LARGE CANIDS:

PRELIMINARY VARIABILITIES FORMING THE POPULATION STRUCTURE IN MORAVIA

Angela Perri and Sandra Sázelová

Introduction

In general, large numbers of carnivores are characteristic of Central European Upper Paleolithic sites (Soffer 2000), including many Moravian sites (Musil 1997, 2001, 2005, 2014; Wojtal and Wiłczyński 2015). The extensive utilization of carnivores, including cut marks which suggest subsistence processing, has been proposed to reflect either seasonal food stress or ritual consumption (Musil 1994; Soffer and Kozlowski 2003; Wojtal *et al*. 2012; Germonpré *et al*. 2015), though fur production was probably the main reason for targeting most of the canid species (Musil 1958a; West 2001). Particular attention has been paid to the wolves from Gravettian sites in Moravia, although they do not appear to be treated any differently than other fur-bearing species, such as foxes or wolverines (e.g. Pokorný 1951; Fladerer 2001, 2010; Wojtal and Wiłczyński 2015). Interest in Moravian wolves recently increased due to the identification of purported domestic dogs from the site of Předmostí (c. 32,500-29,000 cal BP) in the Moravian Corridor, based on morphological and dietary isotopic variation (Germonpré et al. 2012, 2015; Bocherens *et al*. 2015). However, these identifications lead to a wider discussion with researchers who argue there is not enough information available to make a convincing identification of domesticated dog, or that the remains simply represent different wolf morphs within a broader population (Crockford and Kuzmin 2012; Morey 2014; Boudadi-Maligne and Escarguel 2014; Perri *et al*. 2015). Moreover, the possibility of initial domestication, or at least human-driven genetic isolation, had previously been discussed by various authors who explained morphological variation in the Předmostí canids as the result of natural variation (e.g. Pokorný 1951; Benecke 1994; Musil 2000) or sexual dimorphism (Musil 2000; Wojtal pers. comm.). For this purpose, we would like to discuss here first the historical context of this debate, which has been ongoing in the Czech literature for more than 100 years.

Historical approach to large canid variations in Moravia

During the excavations held by Karel Jaroslav Maška, at the end of the 19^{th} century, more than 100 individual wolves (NISP = 4143) were discovered at the Předmostí Ia site (estimations by Pokorný 1951, p. 34). The most important accumulation of wolf skeletons was found in the period from 17^{th} to 19^{th} May, 1894 in the northern zone of site. An extensive burnt area was discovered, containing separate accumulations of mammoth bones, such as tusks, limb bones, vertebrae and ribs, with little other human activity apparent. Maška describes that next to it within an area of 10 m^2 *"... seven wolf skeletons were laid, their individual parts were found mostly in a natural position. We have observed that the skulls were in some cases intentionally smashed in their frontal part, although the other remains were not damaged.*" (1894, p. 91; translated from Czech). Another note in his diaries concerns the find from 16^{th} August, 1894 within a distance of 13 meters northwest of the main human burial accumulation, when "… *a whole skeleton of a small wolf (or dog)*" was found (Maška 2008, 185; translated from Czech). The German transcription of his diary (Absolon and Klíma 1977, p.48) does not label this find as a dog, nor is there any other mention of a dog presented in his diaries from 1890-1893, published in the same book. Maška was aware of intrusive younger finds at the Předmostí I site, for example in 1893 (p. 112) when he describes two younger prehistoric pits intruding into the Pleistocene layers, containing several bones of a smaller dog (Maška 1893, p. 112), among other finds. Moreover, he must have been aware of variability in the Pleistocene wolf population at the Předmostí Ia site, as he identified three wolf groups according to their general size: *Canis lupus major*, *Canis lupus medius*, and *Canis lupus minor* (Pokorný 1951, p.36). Maška also documented in his field notes the stage of preservation and excavation damage to the wolf skulls.

Later, from 1946-1951, the large canid material from Předmostí Ia was studied by Miloslav Pokorný (1951), who made a complex description of the wolf population based on the osteometric analysis of skulls and mandibles, including notes on aging and pathology. He concluded then that Maška's *Canis lupus medius* might be classified as the smaller "type" of *Canis lupus*, but he also states that (1951, p. 47-48; translated from Czech): " *…it is possible to observe some variability, although the measuring of bone fragments does not always provide accurate values. In our case, the preserved material does not display enough characteristic markers necessary to decide safely about the difference of varieties. Most of the markers, possibly measurable, are under the influence of changes in their function and could not therefore be convincing in their distinguishing… Further study will be necessary to select fossil material, if possible, of the same geological age, because the closer study of fossil material from Předmostí shows that, on some skeletal remains belonging to Canis lupus L, the markers leading to older forms (Cuon) as well as to younger forms (Canis familiaris) are preserved."* Additionally, we should mention the work of Norbert Benecke (1987, 1994) who studied morphoscopically the crowding of premolars and molars in wolf mandibles from Předmostí Ia and stressed the higher occurrence of oligodontism (natural absence of teeth) or polydontism (redundant presence of teeth) in comparison to recent wild wolves. He suggested that this crowding might indicate a first genetic isolation of captured or semi-captured canids from the Pleistocene wolf population (Benecke 1995, 82-84).

Another accumulation of wolf skeletons was found in 1952 by Bohuslav Klíma at Pavlov I, southeast of the Pálava hills. The osteological material from this and excavations in 1953 was first studied by Rudolf Musil (1958a), where he reported that during the 1952 season the smallest wolf mandible (with a crowded "zig-zag" form of teeth) was found, in comparison to other known Gravettian canids from Dolní Věstonice I and Předmostí Ia. He did not observe any similar examples in the assemblage from 1953, but in his later work (1994) another example of a crowded zig-zag form mandible is described from the 1957 season of Pavlov I – northwest. Although he noted that tooth crowding is typically a domestication marker, he did not propose that the canids were dogs, only that future complex population analysis is needed (1997; 2005). Moreover, in 1955 he had suggested that, "*... Dimensions of our recent wolves and certainly of the diluvial ones are, beside other things, influenced by landscape, where they live. The mountain wolves are commonly stronger and robust if compared to swamp and lowlands wolves, which are gracile and weak. At Pavlov, mainly the smaller "type" of wolves occurs. It is possible that it is related to the position of Pavlov within the lowlands and flatlands of Southern Moravia. Contrary to Předmostí, where both types occurred in approximately the same proportion. Perhaps, their presence at this site might be affected by the neighboring location of Beskydy and Jeseníky Mountains, which are occupied by wolves with bigger and robust stature running down to lowlands in the winter* " (pp. 284-285; translated from Czech). Musil also later said of the two crowded "zig-zag" mandibles, "*In two cases the teeth were closely packed against each other. I'm sure that this was due to much variability in the size of the wolves rather than to attempts at domestication*" (2005, p. 197). Additionally, the most recent analysis of the wolf population of Pavlov I (southeastern part) estimated 57 individuals (NISP = 6190) with cut marks related to dismembering and filleting (Wojtal et al. 2012; Wojtal and Wiłczyński 2015).

Large canids at Dolní Věstonice II sites

Our preliminary analysis of *Canis* followed the previously mentioned importance of focusing on populations, not individuals, when examining the possibility of domesticated dogs from Gravettian sites. Here we present the canid material recovered at a complex of sites, Dolní Věstonice (DVII), repeatedly occupied by Gravettian hunter-gatherers between c. 36,000-29,000 cal. BP (Svoboda *et al*. 2014; see chapter in this volume). The canids originate from the 1958-2015 excavations or surface collections by Bohuslav Klíma and Jiří Svoboda at several parts of DVII sub-sites – northern slope, western slope, southern edge, site-top, and DVIIa (or closely indeterminate DVII). The faunal remains from individual parts have previously been discussed by Svoboda (1991), Seitl (1995), West (2001), Nývltová Fišáková (2001) and Wojtal and Wiłczyński (2015), see also Wojtal and Wiłczyński and Sázelová, this volume. The most highly represented carnivore species at Dolní Věstonice II sites are polar and red foxes (*Vulpes lagopus/V. vulpes*), occurring as 14.9-7.8% of all taxonomically identified material, followed by grey wolves (*Canis lupus*) with an interval between 12.1-5.3%. Other carnivore species are presented with an interval lower than 2%, such as wolverine (*Gulo gulo*) at 1.99-0.1%; cave lion (*Panthera leo spelaea*) at 0.07%; brown and cave bears (*Ursus arctos/U. spelaeus*) at 0.4-0.1%, lynx (*Lynx lynx*) at 0.03% and wild cat (*Felis sylvestris*) at 0.01%.

Material Description

The large canid skeletal remains deposited at the Centre for Research of Paleolithic and Paleoethnology in Dolní Věstonice (Institute of Archeology Brno, Academy of Sciences of the Czech Republic) were solely studied in this paper. Some additional canid material from the DVII sites is held at the Moravian Museum (Brno, Czech Republic) and was not included here. The wolf material was identified with assistance from virtual databases (ArchéoZoo or Virtual Zooarcheology of the Arctic Project), 3D models from the Max Planck Institute for Evolutionary Anthropology (Niven et al. 2009), and comparative atlases (Kolda 1951; Schmid 1972; Hillson 2005; France 2009). The frequencies of skeletal elements and number of individuals were studied in terms of number of identified specimens (NISP), minimum number of elements (MNE), and minimum number of individuals (MNI) when in some cases the side matching was possible (Klein and Cruz-Uribe 1984; Lyman 1994, 2008; Reitz and Wing 2008). However, the total number of remains estimated in this paper differs slightly from previously published papers (West 2001; Nývltová Fišáková 2001; Wojtal and Wilczyński 2015), because highly weathered or extremely fragmented material with a high probability of incorrect taxonomic determination were excluded, affecting namely the underestimation of vertebrae (for a comparison, see Wojtal and Wiłczyński, this volume).

Figure 1: Detail of large canid metapodia in anatomic position from the excavations in 1987, Dolní Věstonice II – Western Slope (courtesy of J. Svoboda).

Table 1: General distribution of wolf (*Canis lupus*) skeletal remains at Dolní Věstonice II sites. Abbreviations: NISP = number of identified specimens, MNE = minimum number of elements.

Skeletal element	NISP	NISP%	MNE	MNE%
cranium	2	0.26	2	0.28
maxilla	20	2.59	20	2.83
dentes superiores	41	5.31	28	3.96
mandibula	49	6.35	45	6.37
dentes inferiores	78	10.10	65	9.21
dentes indet.	77	9.97	57	8.07
vertebrae cervicales	37	4.79	31	4.39
vertebrae thoracicae	1	0.13	1	0.14
vertebrae lumbales	3	0.39	3	0.42
vertebrae caudales	6	0.78	6	0.85
vertebrae indet.	1	0.13	1	0.14
scapula	17	2.20	16	2.26
humerus	25	3.24	24	3.39
radius	25	3.24	22	3.12
ulna	24	3.11	24	3.39
carpals	9	1.16	9	1.27
metacarpals	84	10.88	82	11.61
pelvis	11	1.42	11	1.56
femur	10	1.29	10	1.42
patela	2	0.26	2	0.28
tibia	16	2.07	16	2.27
fibula	1	0.13	1	0.14
tarsals	48	6.22	48	6.79
metatarsals	48	6.22	45	6.37
metapodia indet.	36	4.66	36	5.09
phalanges	99	12.89	99	14.02
ossa sesamoidea	2	0.26	2	0.28
Total	**772**	**100.00**	**706**	**100.00**

Distribution of skeletal elements at the DV II complex of sites

In total, 772 skeletal fragments belonging to a minimum of 20 canid individuals were identified (Table 1), with most of the anatomical parts preserved (except hyoid bones documented, for example, at Pavlov I; Musil 1958a,b, 1994, or *sternebrae* and *baculum* as from Předmostí Ia by Pokorný 1951). The material was mainly post-depositionally fragmented within the index 1.09 (NISP/MNE), although various parts were found still in their anatomic position (Figure 1), such as a series of vertebrae or apical parts of limbs. Furthermore, neither Dolní Věstonice site (DVI and DVII) displays large wolf skeleton accumulations as seen at Pavlov I and Předmostí Ia. A side disproportion (prevalence of left side) was observed for the scapula, radius and carpals, and tibia and tarsals. Also, there was a prevalence of complete mandibles from the right side, although the total number from both sides, including fragments, was almost equal. However, similar side-patterns were not documented at Pavlov I or Předmostí Ia, so we suggest here accidental taphonomic selection at DVII sites, rather than intentional human activities. When considering the distribution of wolf skeletal elements from within the site area, perhaps the clearest observations can be made with the material from 1987 excavation. Within Klíma's section, the individual bones and teeth of canids were highly accumulated within features K1, K5 and K6, and within approximately 3 meters of K4 was a concentration of individual bones and teeth (3 x 5 m). Svoboda's 1987 area displays several concentrations – the first, with a diameter of 3 x 4 m, laid within 13 m from feature S1; the second laid in the western part of the hearth, and the third was accumulated above feature S1 with male burial DV16 (in its southeastern part). The distribution of wolf remains outside the dwelling is greater than inside the dwelling, so it seems that wolves do not play any special role within this burial context (as was previously suggested by Nývltová Fišáková and Sázelová 2008). The occurrence of wolf remains and gnawing marks is rare within the mammoth bone depository (see Wojtal and Wiłczyński, this volume). Additionally, the distribution of wolf skeletal elements originating from new excavations in 1991-2015 at DVII -recess and DVIIa are extremely random, thus we were not able to observe any spatial patterns.

Morphological and age structure of population

Most of the research concerning the morphological or morphometric descriptions of large prehistoric canid populations describes mainly the skulls and mandibles. Similarly, the DVII material will be analyzed as part of an ongoing dog domestication project, *Deciphering dog domestication through a combined aDNA and geometric morphometric approach*, led by Greger Larson (University of Oxford) and Keith Dobney (University of Aberdeen). For the purpose of this project, 2D measurements, 3D geometric morphometric photogrammetry, and ancient DNA sampling of the DVII material was involved. Because most of these analyses are still ongoing and metric descriptions of variability in DVII skulls and lower jaws will be discussed in a separate paper (Perri and Sázelová in prep.), we would like to demonstrate here only the preliminary variability of selected postcranial parts, namely the metapodials. Metapodials are generally one of the most variable elements in mammal skeletons, however they have two dimensions which are recommended for analysis according to von den Driesch (1976) – greatest length (GL) and greatest breadth of the distal end (Bd). As shown in Figures 2a-c, the variability within each metapodial group is high and in many cases exceeds the differences suggested as relevant for sexual dimorphism noted as a standard for recent wolf populations (Hillis and Mallory 1996; Morris and Brandt 2014).

Moreover, if we look at the age structure of the large canid population from DVII sites (Figure 3), it is clear that our 20+ individuals do not represent a data set with a uniform distribution. The population is imbalanced, with an absence of newborns and puppies up to 6 months and subadults aged between 1-1.5 years, which is important given previous suggestions that human groups at Moravian sites may have been breeding these canids (Germonpré *et al.* 2012). Taphonomic explanations for missing young canids can be excluded, as newborns or young animals from other species are present at DVII sites. On the other hand, this age imbalance is similar to the age structures of large canids documented at Předmostí Ia and Pavlov I sites (Pokorný, 1951; Musil 1955, 1958a, 1994), where both authors note that young individuals are present, but the prevalence of older animals is obvious. Additionally, it is possible that previous researchers mistook wolverine (*Gulo gulo*) bones, which can look similar, for wolf bones, especially when fragmented. For example, West (2001, p. 113) published a photographic example of an 'immature wolf' maxilla from the Western Slope at Dolní Věstonice, which is actually a wolverine.

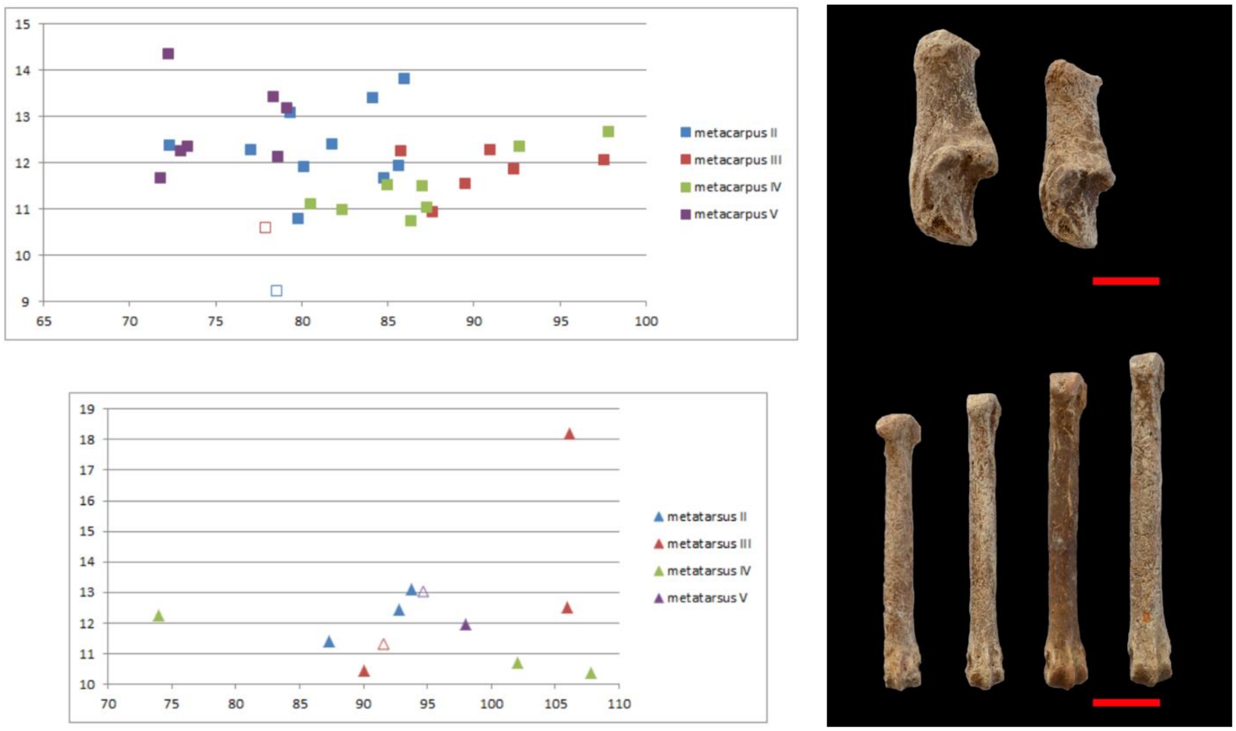

Figure 2a-c: Distribution of metric data on metapodials within the wolf population from Dolní Věstonice II sites. The greatest length (GL) is given on the X axis and the greatest breadth (Bd) of the distal end is given on the Y axis. (a) (upper): metacarpals; (b) (lower): metatarsals. The absence of color infilling indicates estimated measurement. The closest overlap of metapodial measurements signals the presence of the left and right side from the same individual; (c) Morphological variation in the left calcaneous and right 4th metacarpals of Dolní Věstonice II wolves (scale=2cm)

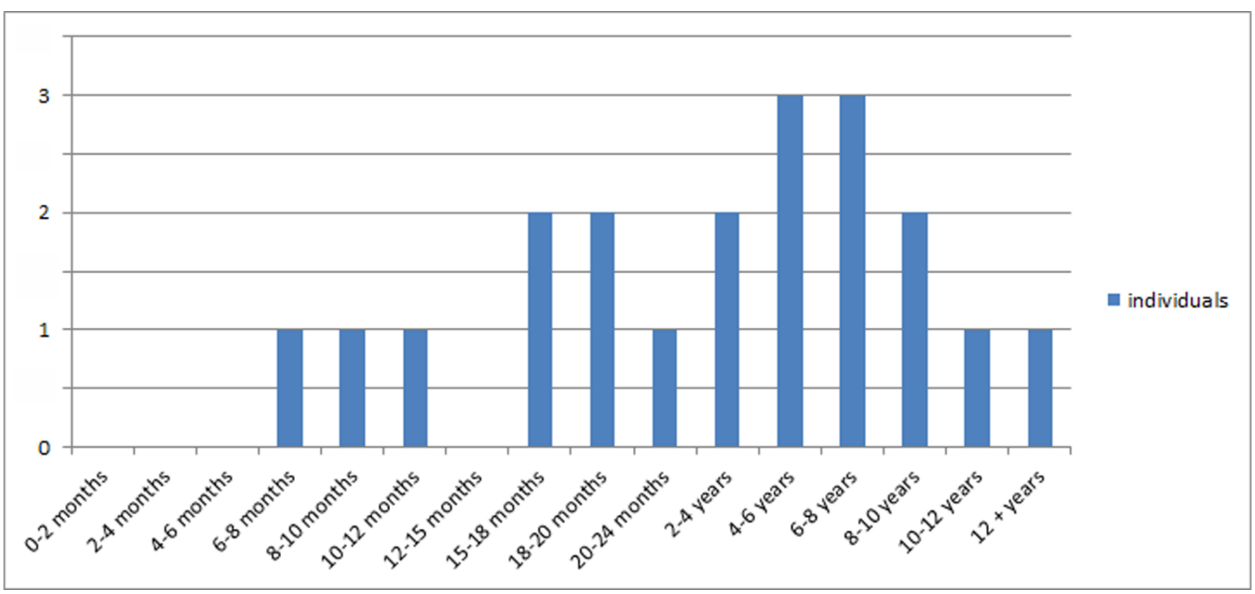

Figure 3: Number of individuals of each age from the large canid population from Dolní Věstonice II sites.

Figure 4a-c: Example of wolf left side mandible with traces of misalignment and *periodontitis* between P_3 and M_2 (a); detail of atypical abrasion on lingual side of canine (scale=5cm) (b); and detail on periodontitic lesions under M_1 causing pathological deformation in alveolar followed by baring of tooth neck and roots (c).

Pathologies and taphonomy

The pathologies observed on our large canid material only include degenerative types, affecting both cranial and postcranial parts of the skeleton. The first type is represented by malocclusions in six instances, causing the misalignment of teeth and atypical abrasions on the lower canines (mainly on the buccal side) or on the P^4-M_1 bite complex, which often preclude further individual age estimation. In four instances of individuals older than 9 years, periodontitis was observed affecting various types of lesions around alveolars (*alveoli dentales*) and expositions of the tooth neck (*collum dentis*) or upper part of roots (*radix dentis*) (Figure 4 a-c). After consultation with Dennis Lawler (DVM, Illinois State Museum), we reached the conclusion that the periodontitis might be caused by a wide variety of bacteria or fungi following the open tissue pathways after primary tooth trauma or gingival trauma with secondary infection. It can also be caused by a softer diet, producing less cleaning of gums and teeth, such as foraging on rotting carcasses, although other factors such as environment or genetics cannot be excluded. Further analyses will be needed in order to determine origin and development of this disease. The second type of postcranial degenerative processes affected mainly limbs, represented by arthritic osteophytes around the *cavitas glenoidalis scapulae*, *incisura trochlearis ulnae*, *caput radii* or on the calcaneus. In one instance, the surface scratches within the elbow (*articulatio cubiti*) suggest the cartilage was thinned enough that the ulnar and radial proximal epiphyses were in direct contact, causing traumatic abrasions.

From the taphonomic point of view, weathering was most frequently observed at I-II stage in 8.80% and III stage in 13.21% (following Behrensmayer 1978, 150-162) and root etching in 11.91%. In several instances both factors were combined together on opposite sides of a bone. For example, root etching on the lingual side and heavy weathering on the buccal side of a mandible. It seems that within its taphonomic history, the phases of exposure on the surface were alternated with bone deposition below the surface, with direct contact to plant roots, but also with an intermediate phase when the bone changed orientation within its layer (for example due to solifluction; chapter in this book). Traces of human activity, such as cut marks or burning, are well described in the chapter by Wojtal and Wiłczyński (this volume), but we would like to mention here a modified wolf upper canine with several traces after enamel removals (Figure 5) which was not previously detected (Sázelová *et al*. in prep.).

Discussion

The region and time period of Dolní Věstonice II sites suggests great variation should be expected in the fauna. Locally, human populations could take advantage of a range of topography, from hills to lowlands and climatic regions, from humid to arid. The chronological range of DVII also covers both a cold event and a warm interstadial, which introduced significant climatic and biotic changes in a short span of time (Musil 2011). This variation across time and space suggests dramatic variation in the wolf subpopulations present at DVII should not be surprising. Skeletal morphological variation, including in skull size and shape, is a known biological response to varying ecological conditions (Thorpe 1991; Eger 1990). For example, within modern North American grey wolves 24 subspecies have been recognized across varying geographical regions (Hall 1981). This suggests *Canis lupus* morphology is highly plastic, based on environmental and ecological conditions. A significant population bottleneck of European grey wolves since the Late Pleistocene suggests grey wolf subspecies may have been even more genetically, morphologically, and ecologically varied in the Gravettian than is known from modern populations (Pilot *et al*. 2014).

Figure 5: The modified wolf upper canine with several traces after enamel removals (scale=2cm)

The variation in Gravettian canids from Moravia (namely Předmostí) has been recently attributed to the identification of Paleolithic dogs (Germonpré *et al*. 2012, 2015), but these determinations rest on the premise that the region was populated by only one identifiable wolf subspecies, with static morphological and dietary parameters. Moreover, within the last century Germonpré is not the first author to suggest a closer social interaction between Gravettian hunters and wolf populations of wolves within the Moravian region (Maška 2008; Pokorný 1951; Benecke 1994; Musil 1955, 1958a, 1994, 1997, 2000), although most of the Czech authors conclude that further systematic analyses are needed. Carnivore gnawing is minimal from south Moravian sites (Wojtal and Wiłczyński 2015), suggesting live carnivores were probably not present alongside humans. Bones that did exhibit carnivore gnawing were primarily those of large mammals, such as mammoth, which would have been scavenged by predators after the sites was abandoned. This idea might be supported by periodontitis observed on several older individuals and if combined with other postcranial degenerative disorders, such individuals might have been disadvantaged in regards to hunting.

Additionally, Soffer (1990) suggested that the wolves from Dolní Věstonice were eaten as a starvation food or for ritual purposes. Others have suggested the eating of canids as a starvation food by Gravettian hunter-gatherers (West 1997; Prestrud and Nilssen 1992) and they have been ethnographically documented as starvation food in many locations (e.g. Lothrop 1928; Nelson 1969), although some recent populations have taboos about eating canids (Bogoras 1904-1909; Jochelson 1905-1908). When looking more closely at the role of wolves at Moravian sites, we should particularly note the large canid accumulations of several individuals at Předmostí Ia and Pavlov I – southeast, which is not mirrored at Dolní Věstonice I or II sites. Furthermore, large canid material within human burial contexts at Předmostí Ia or DVII does not play as important a role as previously suggested (Germonpré *et al*. 2012; Nývltová Fišáková and Sázelová 2008). According to our study of the literature (Maška 2008, Svoboda 2008, Klíma 1954, Musil 2005), we suggest that the smallest wolf remains deposited at Předmostí Ia and Pavlov I-southeast are closely associated with the larger wolf accumulations at both sites. This suggestion cannot be confirmed, as detailed mapping of the material from the original excavations is not available, but notes from Maška's excavation diary of Předmostí Ia (Maška 2008) and Klíma's excavation of Pavlov I-southeast (Klíma 1954), paired with maps of the excavation sites (Klíma 1954, Svoboda 2008), show a close association between the small wolf material and the wolf accumulations.

Thus, according to our preliminary observations, we conclude that human hunters at DVII probably had access to multiple wolf ecomorphs, both geographically and chronologically. The suggestion that similar variation at nearby sites represents early dog domestication events among Moravian hunter-gatherers cannot be supported by the DVII canid material. It is likely that such suggestions of earlier pre-LGM dog domestication are also, in fact, identifying multiple wolf ecomorphs from a single site, especially given our shallow knowledge of Pleistocene wolf populations (Perri, in review). Further analysis of canid material from Gravettian sites in Moravia will help to better characterize the interactions between human hunters and grey wolf subpopulations, assisted by advances in scientific techniques (e.g. stable isotopes, ancient DNA, geometric morphometrics). As our preliminary study here highlights, the analysis of canid populations, in contrast to individuals, is essential to understanding the complex interactions between wolves and humans in the prehistoric past.

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3.5.4 Pavlov I in time and space. Excavations 2013-2014

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Pavlov I: A large Gravettian site in space and time

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ABSTRACT

The formation of the large site clusters of the Gravettian (Pavlovian) represents one of the final effects of modern human adaptation in central Europe, but chronology of the site formation processes at such sites are still little understood. Here we present new evidence from Pavlov I, a site now prepared for the construction of a museum and subjected to a large-scale preparatory excavation. Understanding the spatial organisation, microstratigraphies, and the effects of cryogenic processes on the site formation is the basic presumption for lithic analysis at a large and complex site. Obviously, these extensive sites have a longer prehistory than was previously thought. The detection of the Early Upper Palaeolithic/Gravettian boundary was related to a radical change in the lithic raw material composition. The early and evolved Gravettian industries complete previously recorded the techno/typological spectrum by additional microlithic assemblages. With this new evidence, the paper also discusses the question of Gravettian origin.

1. Introduction

The formation of the extensive site clusters of the Gravettian (Pavlovian) represents one of the adaptive patterns in the culminating stages of early modern human expansion to central Europe. Their central place on the map of Upper Paleolithic Europe was recognized soon after the beginning of the excavation at Dolní Věstonice I in 1924. The discovery of important symbolic objects from this context was later followed by early modern human burials (especially at Dolní Věstonice II), the first evidence of ceramic technology (Dolní Věstonice I, Pavlov I), possible fibre and textile technologies (Pavlov I), and meat and plant consumption (Vandiver et al., 1989; Adovasio et al., 1996; Trinkaus and Svoboda, 2006; Revedin et al., 2010; Pryor et al., 2013). These sites also provide broader contextual evidence about optimal settlement strategies, long-distance lithic material transport, and specialized hunting strategies. However, the details of the site formation processes at these sites are little understood due to the complex archaeological record and excavation techniques in the past. Although the majority of the dates and evidence clearly refer to the evolved Gravettian (Pavlovian) period around 30 ka cal BP (*sensu* Svoboda, 1994), the time of origin of these sites remained undated. Understanding these contextual informations is the basic presumption for lithic analysis at a large and complex site.

Pavlov I is one of the largest campsites in the area below the Pavlov Hills (Fig. 1). Extensive parts of this site were excavated by Bohuslav Klíma between 1952 and 1972, and it was separated into two sectors – South-east and North-west (Klíma, 1954, 1959; Svoboda, 1994, 1997, 2005). Currently, Pavlov I is being prepared for the construction of a modern museum building with an *in-situ* exhibition, and our preparatory excavations between 2013 and 2015 aimed to reopen the surface and revise its spatial and stratigraphic context. In 2013 we excavated four trenches in the hitherto unexplored sector South-west. In 2014 we opened an area of approximately 80 × 20 m, part of which was excavated by Klíma and part of which was unexplored (Figs. 2 and 3). Additional excavation along the marginal parts of the planned building also continued in 2015. Sorting, analysing, and interpreting various types of evidence recovered during such large-scale excavation will be a long-term task. In contrast to Dolní Věstonice I, excavated by several generations of archaeologists, the advantage of Pavlov I is that it was excavated by two excavators and in two campaigns only, both with predetermined methodologies relevant to their times. Therefore, chances for creating a site model as a base for lithic analysis are better at Pavlov I than elsewhere.

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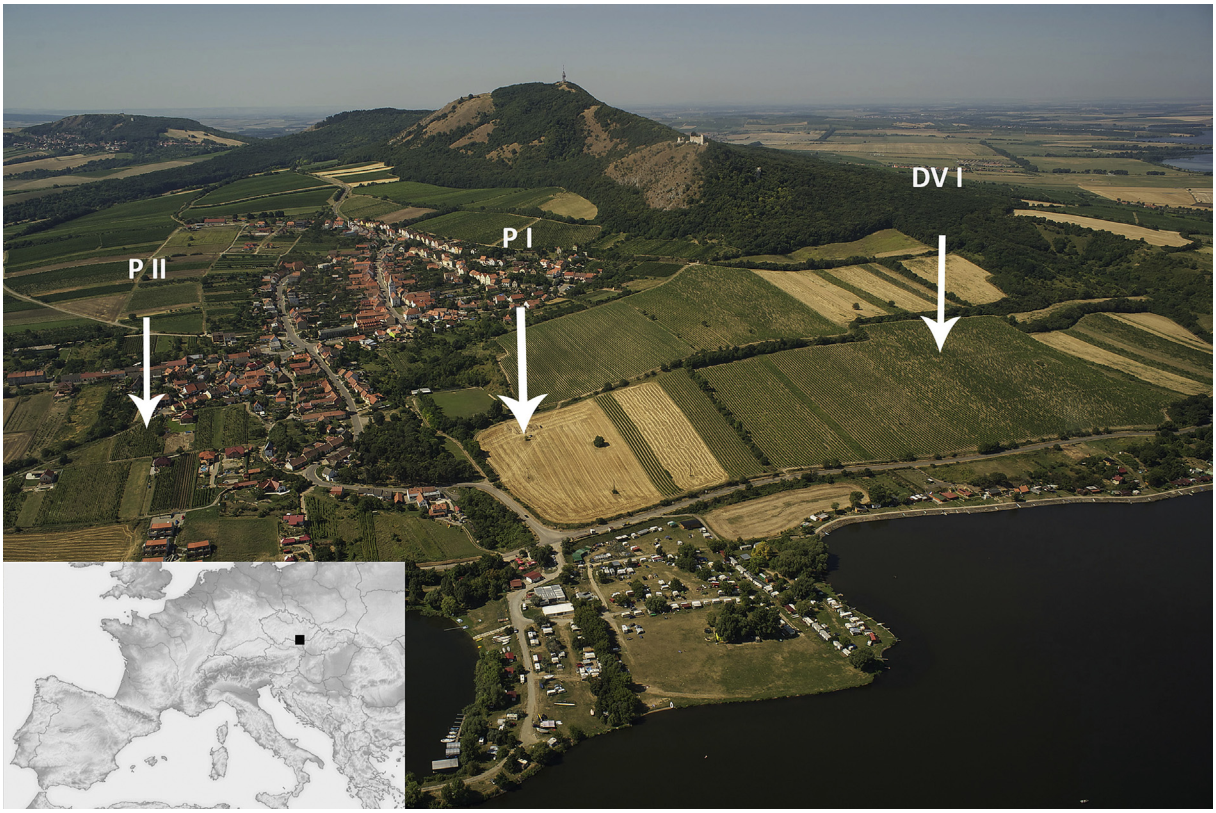

Fig. 1. Location of the sites Dolní Věstonice I, Pavlov I and II on the north-eastern slopes of the Pavlov Hills (550 m a.s.l.).

2. The evidence

2.1. Spatial organisation of a large campsite

The large sites are also centres of a variety of human activities. Their structure shows patterns of zonality, with central parts (a dense network of hearths, settlement features, and activity zones, including evidence of symbolic objects), and peripheries (with ashy areas, bone accumulations, and scarcer evidence of artefacts). Spatial analyses of these densely occupied areas were problematic in central parts of Pavlov I, where the settlement units are hard to delimit and several levels were mixed up (Verpoorte, 2000; Novák, 2005). Such situations pose questions about the very nature of the larger sites – whether it is best to deal with the addition of individual units over a given time period, or with one large settlement agglomeration, or with a combination of both. These issues are of key importance for evaluating social and demographic trends which stood behind the site formation processes, and for addressing the question of whether the size of a site directly correlates with with sedentism, human aggregation, and the level of hunter–gatherer's complexity.

While identifying his first 11 features, interpreted as dwellings, Klíma combined several viewpoints: "pits, a shallow depression, large bones along the edges, the spatial extent of the cultural layer, and artifact concentrations" (Klíma, 1959). Our approach while processing the excavation results was to analyse each of these components separately (Svoboda, 1994, 1997, 2005). Generally, the palimpsest area ranges over the South-east sector predominantly, with 11 features (K1-11), and partly in the North-west sector (K12-13).

After the removal of the LGM (Last Glacial Maximum) loess cover in 2014, it appeared that the Upper Palaeolithic surface differed significantly from the current field surface which slopes regularly from the hilltop in the south towards the current lake in the north. Our excavation unearthed a longitudinal, east–west oriented elevation and an adjacent gully separating it from the hilltop, now filled with loess. The elevation was formed by redeposited Cenozoic flysch (Hustopeče marls and sands), and angular Jurassic limestone debris from the above rising klippes of the Pavlov Hills. The location of the central occupation palimpsest on top of this elevation shows that prehistoric inhabitants preferred this kind of subsoil, which was drier than elsewhere. Silty deposits on the slopes were occupied less intensively, or used as peripheral bone deposits.

Our approach differed methodologically in areas excavated previously and in the hitherto unexplored zones. Even in the already explored areas, we recovered remains of the basal cultural layers and additional artefacts and bones. By fixing the margins of the old trenches we could more precisely locate them in the general site plan. Although rather marginal in location, the newly excavated areas provide archaeological deposits more easily understandable in terms of spatial organisation and microstratigraphies. Here we completed one of Klíma's settlement units (K1), excavated one more settlement unit with an adjacent pit and surrounding activity areas (S1 and S2), a mammoth bone deposit (as a typical feature at sites in the area), and several other features and concentrations of faunal remains and artefacts (Figs. 2–3):

South-east (SE014) – additional settlement area with feature S1, an adjacent pit S2, and an activity zone (Figs. 4–5). Feature S1 is reconstructed as a shallow circular depression about 5–6 m in diameter, filled with anthropogenic sediments maximally 15–20 cm thick in the centre, and showing two stages of filling.

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Fig. 2. Pavlov I, general plan showing the Klíma excavation (1952–1972) and the current excavation (2013–2014) and recorded find density (artefacts, bones) in the newly excavated parts SE014, NW014, and A-J 2013/2014.

Inside was an asymetrically-located hearth and a higher density of objects. The adjacent artificial pit, S2, rates among rare exceptions within the Dolní Věstonice-Pavlov-Milovice area, probably because hollowing out depressions was difficult due to permafrost in the subsoil (only one pit, K14, has so far been discovered at Pavlov I – centre; Klíma, 1977). They are mostly interpreted as storage pits (Soffer, 1989), although their actual refill may be secondary. Pit S2 is about 50 cm deep and the fill included a mammoth tusk at the base, bones, artefacts, and red ochre. One more hearth was located in the centre of an adjacent activity area further to the east. Dispersed within the SE part were fragments of molars, ribs, and long bone fragments of *Mammuthus primigenius*, fragments of axial skeleton or distal parts of limbs of *Rangifer tarandus*, and various species of carnivore. Adding feature S1 into the site plan (Fig. 3) completes the oval shaped agglomeration of features K1-11 into a spatially homogenous unit.

North-west (NW014) – area of mammoth bone deposition (Fig. 6). In contrast to all the other larger sites of the Dolní Věstonice-Pavlov-Milovice, we previously lacked the typical mammoth bone deposit at Pavlov I. The new discovery of an accumulation of parts of postcranial skeletons, such as ribs, pelvises, scapulae, long bones, molars and tusks, belonging to several individuals of *Mammuthus primigenius*, fills this gap. Representation amongst the remains of other animals, such as *Equus ferus*, *Rangifer tarandus*, and *Canis lupus* was occasional in this area, and lithic artefacts were sparsely distributed as well. Although the find density is smaller compared to Dolní Věstonice I or Milovice I (and the quantity of recovered bones seems low compared to the size and importance of Pavlov I), we now know that mammoth bones were deposited on the sloping terrain west of the site.

South-west A – another activity zone with one oval-shaped hearth. At a distance of 120 cm from the hearth, an almost complete skeleton of *Canis lupus* was recorded, which retained its anatomical position, especially in the thoracic part. The wolf skull found 40 cm away can most probably be associated with the same individual and an accumulation of *Dentalia* shells was located 80 cm from the wolf skeleton. Various other skeletal elements were dispersed around, namely of *Mammuthus primigenius* (ribs and long bone fragments) or *Rangifer tarandus* (antler and limb bone fragments).

South-west B-E – test trenches. Within these trenches, remains of hearths and depressions with fragments of molars and ribs of *Mammuthus primigenius* were recorded, followed by axial skeleton fragments or distal parts of limbs of various carnivores. In this part

Fig. 3. Pavlov I, general plan with inserted settlement units as defined by Klíma (K1-14) and Svoboda et al. (S1-3).

of the site, a horizon of Early Upper Paleolithic has been detected below the Gravettian complex.

Centre (F) – extensive charcoal deposits associated with four shallow pits, 20–30 cm in diameter and 5–10 cm deep. These features complete the last quadrant of Klíma's unit K1 excavated in 1952.

Centre (G) – a shallow oval-shaped feature, S3, 160 × 70 cm in size, included a large mammoth tusk, portions of at least one *Rangifer tarandus* skeleton (fragments of skull and antler, fragments of vertebrae, ribs, fore and hind limbs), and associated osteological material such as metapodials and phalanges of *Canis lupus*, a mandibular fragment of *Vulpes vulpes/Vulpes lagopus*, and a proximal part of a humerus belonging to *Equus ferus* (Fig. 7). Selected skeletal units retained their anatomical position, such as a wolf paw, parts of a reindeer thorax, and the line from first to third phalanges of this same animal.

Finally, the site-plan has been completed by several additional concentrations of bones and artefacts in the previously unexcavated areas H, I, and J.

2.2. Stratigraphy

At Upper Paleolithic sites within the Dolní Věstonice-Pavlov-Milovice area the cultural deposits are mostly located between the Last Glacial Maximum loess above and earlier loess or redeposited Cenozoic marls below (Antoine et al., 2013). Because Pavlov I has been considered as a palimpsest of intensive and overlapping occupations, our focus was on microstratigraphies of cultural deposits wherever these occurred (Figs. 8–9). In collaboration with Klement Rejšek (*pers. comm.*), the sections were sampled for granulometry, porosity, humus particles, carbonates, nitrogen, and other geochemical components; we also measured magnetic susceptibility (Fig. 8, right column). Generally, the stratigraphic framework at Pavlov I is as follows:

1. The LGM loess. In general, deposition of the LGM loess was rapid and massive, but the actual depth of the loess coverage varies due to irregular subsoil and erosive processes on the surface (Fig. 9). It disappears along the slope where cultural

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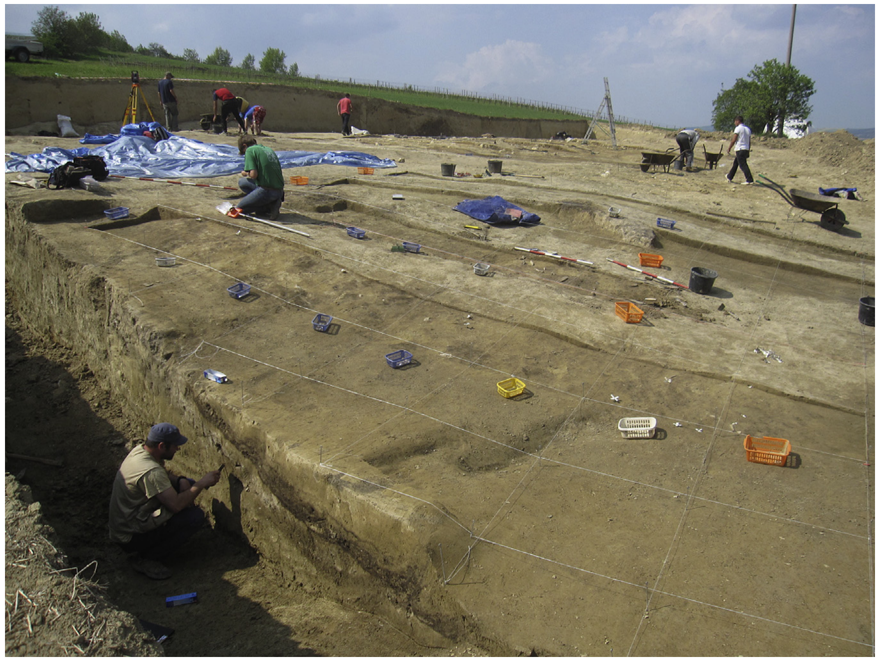

Fig. 4. Pavlov I South-east with section SE-OX1 in front and the area of feature S1 behind.

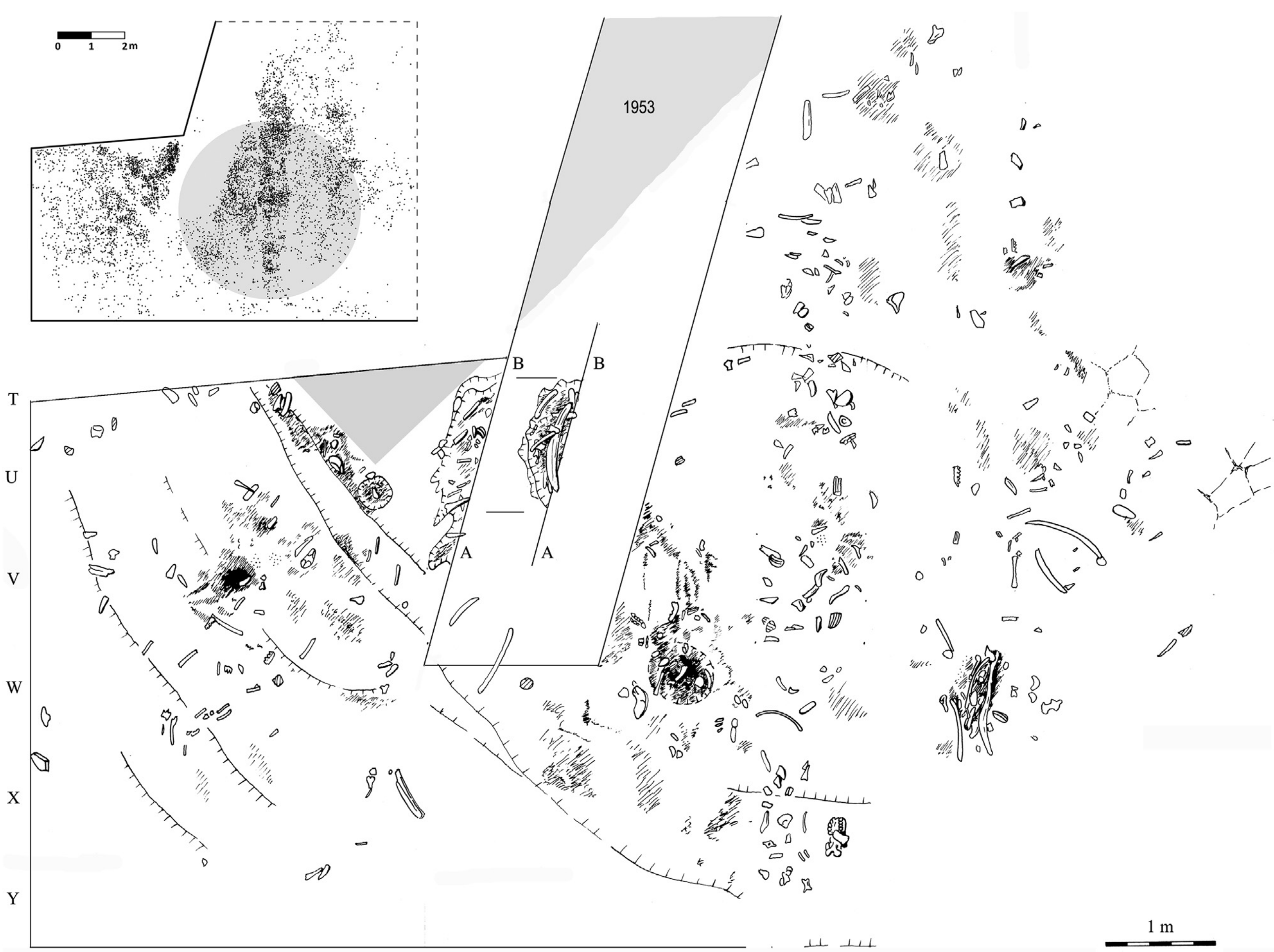

Fig. 5. Pavlov I South-east, plan of the features S1 (right), pit S2 (centre), and adjacent activity area (left). Distribution pattern of 3D-recorded finds (artefacts, bones) is shown above, left.

Fig. 6. Pavlov I North-west, a mammoth bone deposit.

layers occur on the surface but reaches depths of 3–5 m against the slope, and even 8 m in more distant boreholes. Its geochemical composition varies with the depth (calcareous concretions are dispersed in the upper part and several ferruginous horizons, partly deformed by cryogenic processes, lie in the lower part). Wherever fully developed, the loess deposit includes several horizons of initial pedogenesis. The lack of organic material renders radiocarbon dating impossible, but a sequence of OSL dates, all clustered around 22 ka BP, is available for comparable loess deposits at Dolní Věstonice II (Fuchs et al., 2013) and shows the loess deposition occurred quite rapidly. This loess has sealed the Upper Paleolithic evidence and includes no trace of human presence at any site of the area.

2. Cultural deposits. The lower part of the upper loess, only 50–70 cm loess in depth, is interstratified with several anthropogenic layers with bones and artefacts (Fig. 10). Obviously, deposition of these layers occurred in a time period of restricted but repeated loess deposition. The charcoal was sampled from the individual locations and dated by radiocarbon within the range of 29–33 ka cal BP, which accords with the middle and early Gravettian.

Fig. 7. Pavlov I G, a shallow oval-shaped pit S3 (120 × 70 cm) with a mammoth tusk and partial skeletons of reindeer, wolf and associated fauna.

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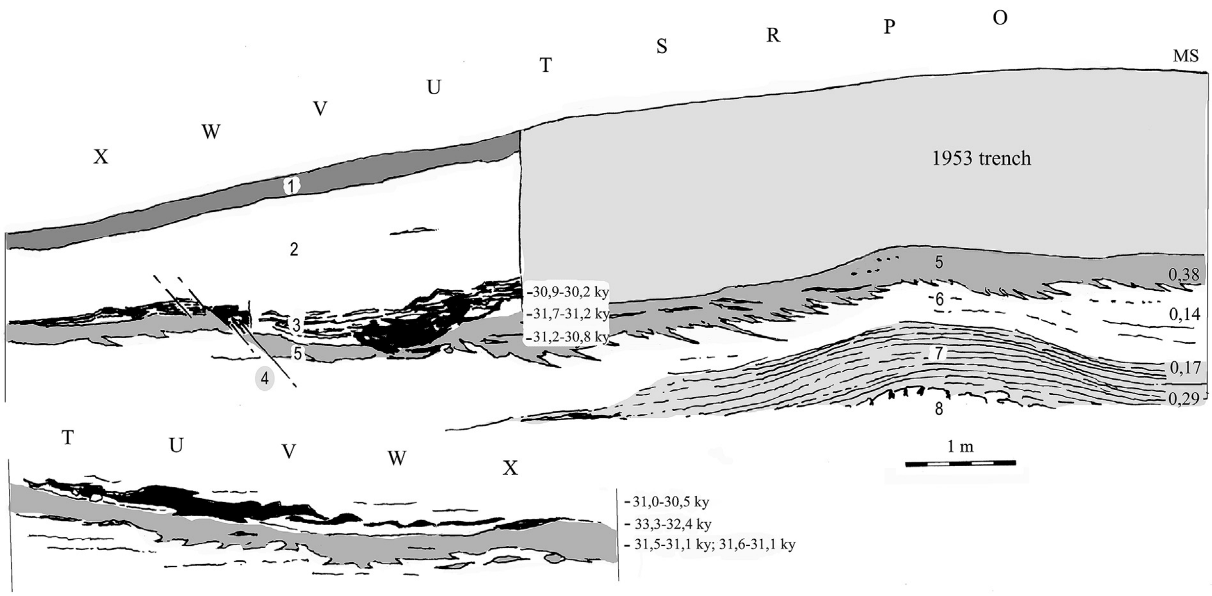

Fig. 8. Pavlov I South-east, section SE-OX1 through the features S1 and S2 showing the position of the ^{14}C samples (calibrated values after OxCal v.4.2, using IntCal13 calibration curve (Bronk Ramsey, 2009; Reimer et al., 2013)) and magnetic susceptibility (MS, right column). 1. Recent soil; 2. loess with post-cryogenic textures; 3. cultural layer; 4. cryotectonics; 5. palaeosol deposit with frost wedges; 6. loess; 7. laminated sheetwash and congelifluction deposits, redeposited Hustopeče marls, buckled; 8. coarse angular debris of Jurassic limestones (congelifractates).

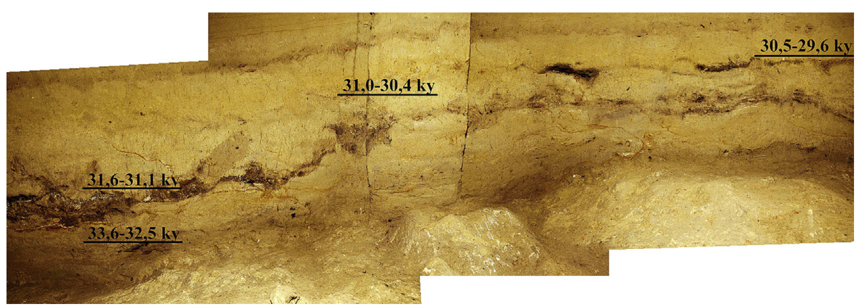

Fig. 9. Pavlov I South-west, section SW-A013, showing position of the ^{14}C samples (calibrated values after OxCal v.4.2, using IntCal13 calibration curve (Bronk Ramsey, 2009; Reimer et al., 2013)). Upper loess, with rusty ferruginous horizons at the base; light, brownish-grey gley horizon; loess interstratified with darkish anthropogenic horizons with charcoal (samples 1–3); dark brownish-grey paleosol with charcoal in the upper part (sample 4); limestone scree; yellowish-green marls. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.).

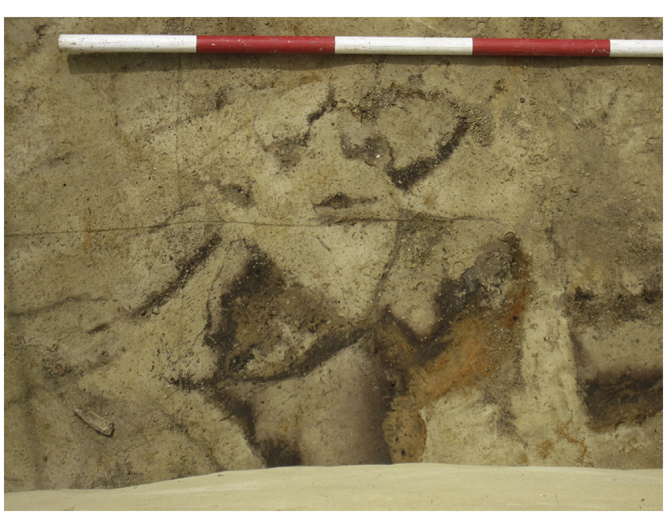

Fig. 10. Pavlov I North-west, ground plan of a hearth relict disturbance of the living-floor by frost wedge polygonal patterns.

3. The palaeosol. In some of the sections there were more or less continuous remains of a brownish-greyish palaeosol at the base of the cultural deposits, 15–40 cm thick, again with charcoal accumulations, dated by radiocarbon between 36 and 38 ka cal BP. Chronostratigraphically analogous palaeosols have been recorded in several nearby sections at Dolní Věstonice I–III, Pavlov II, and Milovice I, sometimes as the uppermost member of a complex of brown soils of MIS3 (Dolní Věstonice II). Depending on local developmental conditions, they have either the character of tundra gley or pararendzina (Smolíková, 1991; Smolíková in Svoboda et al., 2015; Smolíková in Oliva, 2009; Antoine et al., 2013). At Pavlov I, in a restricted part of sector South-west (trenches D, E), this palaeosol included the lowermost archaeological horizon of Early Upper Palaeolithic character. At the first sight, we observed a shift from imported lithic materials (flints and radiolarites) to the local ones (various Moravian cherts). At Milovice I, a stratigraphically comparable layer yielded a typically Aurignacian industry (and, hypothetically, similar layers could have existed at other earlier excavated sites; Oliva, 2009).

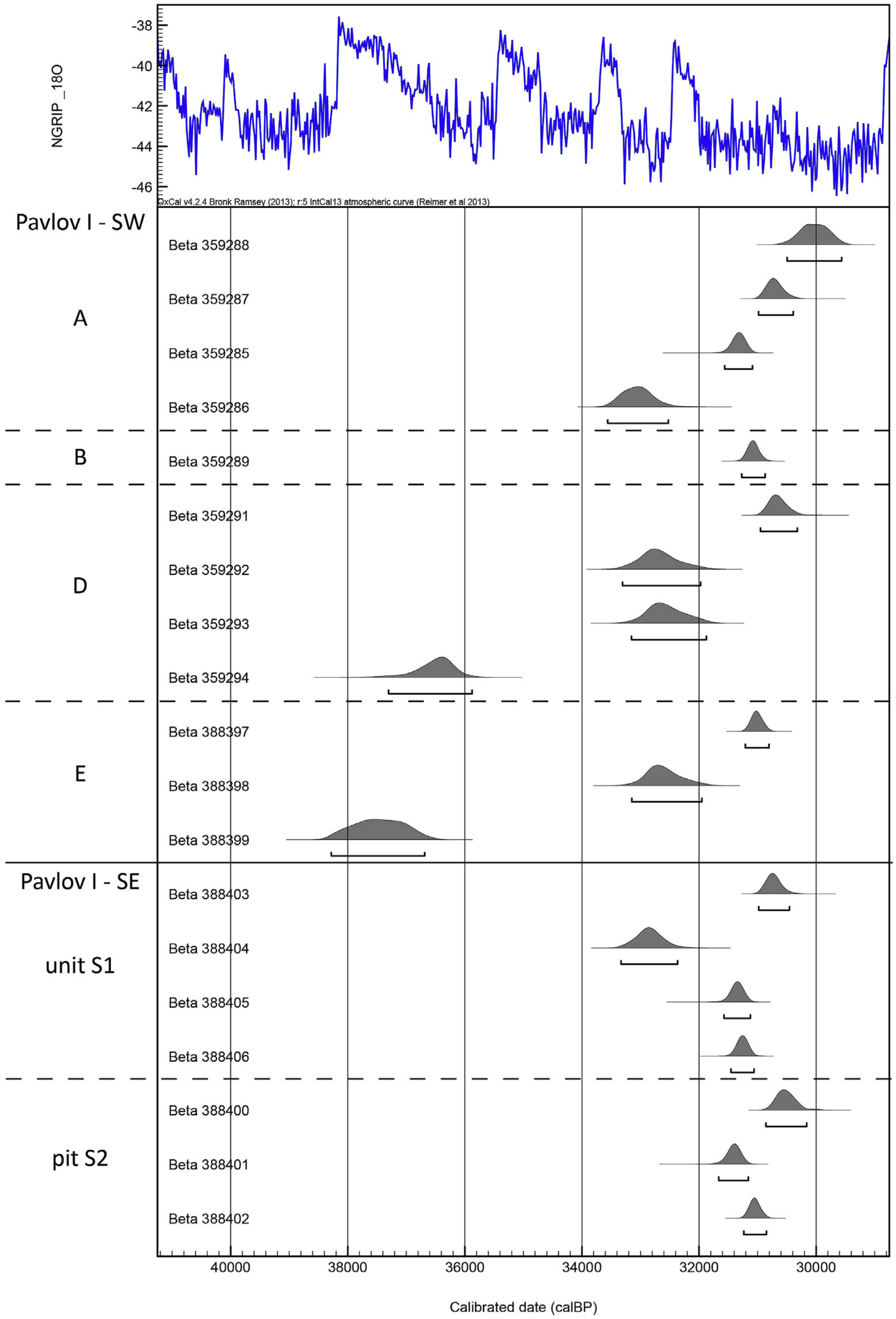

Fig. 11. Summary review of the new ^{14}C dates for Dolní Věstonice IIa and Pavlov I, 2012–2014 excavation (mostly charred wood, dates calibrated in OxCal v.4.2, using IntCal13 calibration curve (Bronk Ramsey, 2009; Reimer et al., 2013), Feb. 17, 2015).

4. The subsoil is formed by Jurassic limestone debris and by Cenozoic Hustopeče marls on top of the elevation, and surrounded by thicker sheetwash and congelifluction deposits on the slopes.

2.3. Cryogenic features

There is a running discussion about the presence and extent of permafrost during the Upper Paleolithic in Moravia. The stratigraphic position of cryogenic features within the new sections from Pavlov I suggests that permafrost existed at this site before, during and after the Gravettian, but we do not know how continuous it was. The character of the related features changes in the individual stratigraphic units (Fig. 8). At the base of the sections we observe coarse, angular congelifractates of local limestone with clayish loam, redeposited downslope by congelifluction. Above, still under a cold climate but with more moisture, lies a laminated layer of the Hustopeče marls of the Moravian flysch redeposited by

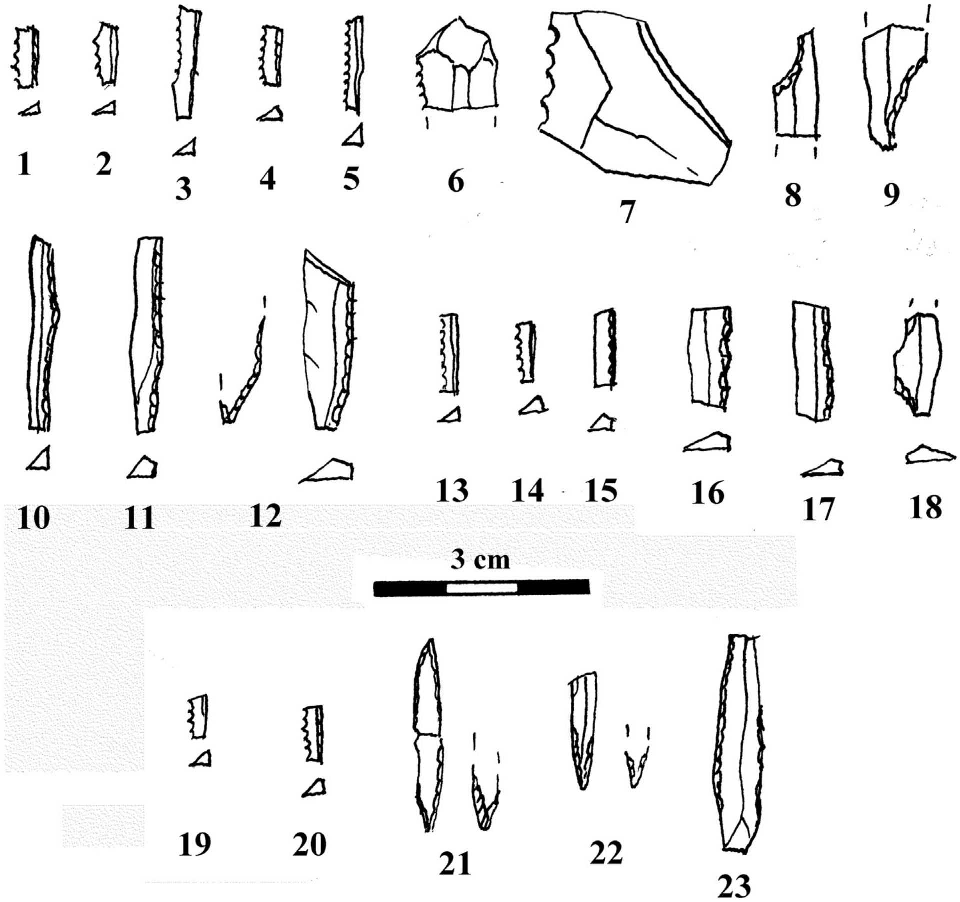

Fig. 12. Pavlov I, selection of microlithic industry according to trenches and depths. 1–18: Pavlov South-east, unit S1 (1–12: depth 140–160 cm; 13–16: depth 160–165 cm; 17–18: depth 175–180 cm). 19–23: Pavlov South-west, trench A (19–20: depth 303–313 cm; 21–23: depth 380–385 cm). 1–20 flint, 21–23 radiolarite.

sheetwash and congelifluction. Layers dipped downslope, were buckled, and have shown numerous frost features. Cryotectonic deformations suggest that the movements took place in the frozen state. At one place, features of frost heave and raising of the ground surface were found.

Cryogenic features are also visible in the Paleolithic living-floors. Frost wedges penetrate through base of the upper loess, cultural sediment and the palaeosol, where they were bent downslope. At places we observed patterns of frost wedge polygons through the living-floor (Fig. 10). Based on their size, the mean annual air temperature (MAAT) ranged between −1 °C and −2 °C. A rusty coating of these frost wedges suggests the presence of a segregation ground ice and cryosuction (migration of the ground water to the freezing front).

In the LGM loess, patterns of the cryogenic process change. There are parts with lenticular post-cryogenic structures, proving the presence of segregation ground ice and the obvious presence of permafrost.

2.4. Vegetation and fauna

Previous geoarchaeological, palaeobotanical and palaeontological evidence from the various Dolní Věstonice and Pavlov sites shows that the Gravettian settlement took place in the context of generally cold climates and in the unique steppic and forest-steppic environments, but was punctuated by rapid fluxes towards warmer periods (the Dansgaard–Oeschger cycles), and with seasonally diverse habitats varying across the landscape (Beresford-Jones et al., 2011; Pryor et al., 2013; Svoboda et al., 2015). The new excavations at Pavlov I offered an opportunity to collect samples for a variety of environmental analyses which could not have been done previously at this site. The sedimentary content of the cultural deposits was collected for wet-sieving and flotation, and a large volume of palaeobotanical, malacozoological, osteological, and archaeological material is currently in a long-term process of separation and sorting. Systematic wet-sieving also provides more representative samples of mollusc shales, bones and teeth of Rodentia, and bones of Aves compared to the limited samples from the previous excavations. The larger faunal assemblage mainly refers to the evolved Gravettian (Pavlovian) layers and it is composed of various skeletal parts of *Mammuthus primmigenius*, *Rangifer tarandus*, *Canis lupus*, and *Equus ferus*, followed by species such as *Vulpes vulpes/Vulpes lagopus*, *Lepus*, sp., *Gulo gulo*, and *Ursus*, sp. The effects of palaeopathology and cut marks are visible on some of the bones, namely on the wolf's extremity bones. In these layers, we document the typical structure of the Pavlovian hunting system, as in the previously excavated materials.

2.5. Radiocarbon chronology

Although a variety of dating techniques are used at the sites of the Dolní Věstonice-Pavlov area, radiocarbon chronology continues to be of major importance in constructing fine-grained chronologies of the cultural deposits (Haesaerts et al., 2010; Jöris et al., 2010; Fuchs et al., 2013). At Pavlov I, the radiocarbon dates hitherto obtained, either by Klíma directly or by the later dating of his

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materials, relate to the central parts of the site and to the middle Gravettian (or evolved Pavlovian) time period (Table 1). Therefore, the new sampling concentrated on microstratigraphic sequences which are developed on the slopes around the central areas (Table 2; Fig. 11). At Pavlov I – South-west, the sequence of twelve radiocarbon dates taken from sections in trenches A, B, D, and E demonstrates a continuity in the formation of the cultural deposits within the time span of 29–33 ka cal BP, which means from the middle to the early Gravettian, and in two cases reaching into the Early Upper Palaeolithic in the subsoil (36–38 ka cal BP). They run parallel with another new sequence of six radiocarbon dates from the 2012 excavation at Dolní Věstonice IIa (Svoboda et al., 2015) and with certain dates from the 1986–1989 excavation at Milovice I (Oliva, 2009).

Table 1
Pavlov I, summary review of ^{14}C dates from the 1952–1972 excavation (charred wood, dates calibrated in OxCal v.4.2, using IntCal13 calibration curve (Bronk Ramsey, 2009; Reimer et al., 2013), Feb. 17, 2015). SE – South-east, NW – North-west; precise location unknown.

Site/Section	Sample number	Result (BP)	Deviation	Calibration (cal BP)	Deviation
Pavlov I – SE	GrN-4812	26,730	250	31,235–30,535	95.4
	GrN-19539	26,650	230	31,178–30,490	95.4
	GrN-1272	26,620	230	31,163–30,452	95.4
	KN-1286	26,580	460	31,380–29,718	95.4
	GrN-22303	26,400	310	31,111–29,881	95.4
	GrN-22305	25,840	290	30,760–29,380	95.4
	GrA-192	25,530	110	30,101–29,295	95.4
	GrN-22304	25,160	170	29,618–28,785	95.4
	GrN-1325	25,020	150	29,453–28,709	95.4
Pavlov I–NW	GrN-20391	26,170	450	31,105–29,419	95.4
Pavlov I – centre	GIN-104	26,000	350	30,916–29,441	95.4

Table 2
Pavlov I, summary review of ^{14}C dates from the 2013–2014 excavation (charred wood, dates calibrated in OxCal v.4.2, using IntCal13 calibration curve (Bronk Ramsey, 2009; Reimer et al., 2013), Feb. 17, 2015). SE – South-east, SW – South-west; all other letters and numbers relate to numeration of the trenches and squares. The two dates in italics are problematic.

Site/Section	Sample number	Location/Depth (cm)	Result (BP)	Deviation	Calibration (cal BP)	Deviation
Pavlov I–SW/A	Beta 359288	A7/275	25810	130	30,495–29,564	95.4
	Beta 359287	A4d/335	26400	140	30,983–30,392	95.4
	Beta 359285	A3b/390	27520	150	31,563–31,088	95.4
	Beta 359286	A3b/397	28860	170	33,561–32,524	95.4
Pavlov I–SW/B	Beta 359289	B5a/388	27050	130	31,271–30,872	95.4
Pavlov I–SW/D	Beta 359291	D2c/330	26340	140	30,952–30,321	95.4
	Beta 359292	D7/270	28630	170	33,307–31,972	95.4
	Beta 359293	D7/290	28560	160	33,155–31,874	95.4
	Beta 359294	D7/310	32540	240	37,303–35,876	95.4
Pavlov I–SW/E	Beta 388397	E1/350	26920	130	31,210–30,805	95.4
	Beta 388398	E1/365	28580	140	33,148–31,952	95.4
	Beta 388399	E2/380	33230	220	38,282–36,686	95.4
Pavlov I – SE/unit S1	Beta 388403	OX1/145	26420	120	30,981–30,456	95.4
	Beta 388404	OX1/160	28710	120	33,334–32,367	95.4
	Beta 388405	*OX1/165*	*27570*	*130*	*31,574 – 31,122*	*95.4*
	Beta 388406	*OX1/170*	*27410*	*120*	*31,455 – 31,061*	*95.4*
Pavlov I – SE/pit S2	Beta 388400	U6/147	26180	110	30,858–30,162	95.4
	Beta 388401	U6/167	27660	130	31,664–31,159	95.4
	Beta 388402	U6/170	26990	120	31,236–30,848	95.4

An issue was raised by the section SE-OX1 at Pavlov I – South-east (Fig. 8) which provided a sequence of middle and early Gravettian dates in the upper part, but two more recent dates from the lower part (Beta 388405 and 388406). Suspiciously recent results are also recorded from the lower positions within the stratigraphies at Pavlov II (GrA-44291) and Pavlov VI (GrA-37629 and OxA-18321). Cryogenic studies show that groundwater concentrated on the permafrost table at the base of the active layer which lies at a certain depth below the exposed Upper Paleolithic living-floors. As noted by Darden Hood (Beta Analytic Lab, *pers. comm.*), radiocarbon dates in cores may give good results down to the water table and then become erratic due to a more recent water fluctuation or palaeo water fluctuation. This could be one of the explanations for the error.

Finally, in order to clear up the question of the filling of the artificial pits, three dates were also taken from various levels inside the pit S2 at Pavlov I – South-east (Fig. 8). As expected, the results of all three measurements confirm a rather rapid and chaotic refilling process during the main stage of occupation around 30.1–31.6 ka cal BP.

2.6. Lithic industries

The evidence from 2013 to 2015 excavation at Pavlov I confirms the main Gravettian (Pavlovian) layer as the major source of the accumulated archaeological, anthropological, and osteological material, but it also expands the interval of site-formation processes deeper into the past. Although the reconstruction of site formation processes and their social and demographic background is still on the level of hypotheses, we can address the lithic analysis with better planigraphic and microstratigraphic evidence.

In the southwest part of the site, an Early Upper Palaeolithic horizon represents a typologically poor flake industry with rare endscrapers which, nevertheless, differs markedly from the Gravettian by a dominance of the local Moravian cherts, mainly the spongolites. Evidence of the early Gravettian is restricted spatially and modest as well, but these industries are made of imported flint mainly. It is a blade and microblade industry with simple burins, comparable to the early Gravettian discovered recently at Dolní Věstonice IIa (Svoboda et al., 2015). Finally, the evolved Gravettian (Pavlovian) layers provide a typologically variable blade and microblade industry made of imported flint and radiolarite. Pavlov I was renomed for a variety of microlithic forms recovered in central parts of this site (Klíma, 1954) and the new assemblages from South-east (Fig. 12: 1–18) and South-west (Fig. 12: 19–23) complete this spectrum by additional specimens of backed microblades, microdenticulates, denticulates, and points. If we accept the above explanation of the C14 dates from South-east, than certain microdenticulates recovered from the lower locations indicate an earlier origin of this characteristic Pavlovian tool-type (Fig. 12:13–14).

3. Discussion and conclusion

Traditionally, the Gravettian was considered as a result of continual evolution in Europe (e.g. Bolus, 2010). Following our model, which interprets modern human immigration to continental Europe as a repeated process, the Gravettian represents a case for the last massive input of "fresh blood" from the Mediterranean, related to significant adaptive changes to the new environments. Although inhabiting periglacial Europe, the Gravettian humans conserved a more tropically-adapted body which supports the model of repeated gene flows from temperate regions (e.g. Svoboda, 2015). The question of Gravettian origins, including the formation of the related settlement clusters, seems to be a complex one, where both the external impulses and local developmental trends should be evaluated.

The new evidence of early Gravettian industries at Dolní Věstonice IIa and Pavlov I is still modest and requires further investigation. The present paper aims to demonstrate the complexity of spatio-temporal factors, as well as post-depositional (cryogenic) effects, that may influence the results of a lithic analysis at large and complex sites. At the present stage of knowledge, the occurrence of a blade and microblade industry in south Moravia before 33 ka cal BP becomes synchronous with analogical techno/typological changes in Lower Austria and the Swabian Jura (Nigst et al., 2008; Bolus, 2010; Moreau, 2012). In contrast to the Swabian sites, we observe in Moravia more radical changes in lithic raw material composition. Elsewhere in Moravia (Stránská skála IIa; Svoboda, 1991), we also observe persistence of the later Aurignacian in a similar stratigraphic position, so that the two entities were partly contemporaneous.

In terms of lithic technology and typology, the central European Gravettian seems invasive and may be related to a variety of earlier backed blade and microblade bladelet industries expanding along the Mediterranean and Black Sea coasts several millenia earlier. However, our model of Gravettian origin is more complex than simple introduction of lithic technology and typology from elsewhere. The Gravettian (Pavlovian) cultural complexity, characterized by extensive settlements, variable industries of organic materials, specialized hunting system, rituals and symbolism, reflects an optimal adaptation to climate of the northern latitudes, cold Eurasian steppes and parklands.

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3.5.5 Paleolithic hunting in a southern Moravia landscape: The case of Milovice IV, Czech Republic

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Paleolithic Hunting in a Southern Moravian Landscape: The Case of Milovice IV, Czech Republic

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The Dolní Věstonice–Pavlov–Milovice area (Czech Republic) on the slopes of the Pavlov Hills provides an opportunity for correlating the geomorphology of the Dyje River valley with Gravettian settlement patterns. Although the sites vary in size and complexity, they create a regular chain of strategic locations at elevations between 200 m and 240 m asl. In 2009, a road collapsed into deserted cellars inside the village of Milovice and revealed a complex of archaeological layers deep within loess, at an elevation of only 175 m asl. This paper presents an analysis of this atypical archaeological site location and compares the results with the other sites. We argue that this location allowed direct contact with mammoth herds concentrated on the floodplain, while the aquatic environment offered possibilities for gathering plants and fishing. This site represents a new aspect of organized settlement, hunting strategies, and short-distance human movements during the Gravettian within this area. © 2011 Wiley Periodicals, Inc.

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INTRODUCTION

During the past two decades, Paleolithic researchers working in the Moravian geomorphological corridor (Czech Republic) have investigated the relationship between a variety of landscape types, human settlement strategies, and social systems (Svoboda, Ložek, & Vlček, 1996:195–204; Škrdla & Lukáš, 2000; Verpoorte, 2001; Vasil'ev, Soffer, & Kozlowski, 2003; Oliva, 2007). Broadly, they found that Early Upper Paleolithic (EUP; Aurignacian) occupations are located on the margins of Moravian highlands with a good view over the landscape (250–400 m asl) and some distance from rivers, while the Middle Upper Paleolithic (MUP; Gravettian) settlements are found in mid-slope locations (200–300 m asl), although still high enough to control the adjacent river valleys. Late Upper Paleolithic (LUP; Magdalenian) sites, by contrast, are predominantly located in caves. It is expected that these settlement strategies are tied to the dominant resources exploited during the given time period: horse and reindeer herds during the EUP and LUP, versus mammoths supplemented by a variety of small game during the MUP.

On a microregional scale, the Dolní Věstonice–Pavlov–Milovice area, located on the slopes of the Pavlov Hills (maximum elevation 550 m asl) in the southeastern part of the Czech Republic (Figure 1), provides an ideal case study for investigating the relationship between the geomorphology of the Dyje River valley and MUP (Gravettian) settlement patterns. Although the individual archaeological sites vary in size and complexity, they create an almost regular chain at approximately the same elevation, 200–240 m asl and about 30–70 m above the floodplain (Figure 2). Almost all terrain investigated at these elevations has been found to show evidence of archaeological activity, so that new site locations may even be predicted based on the previous field surveys, as was the case in 2007 when Pavlov VI was discovered

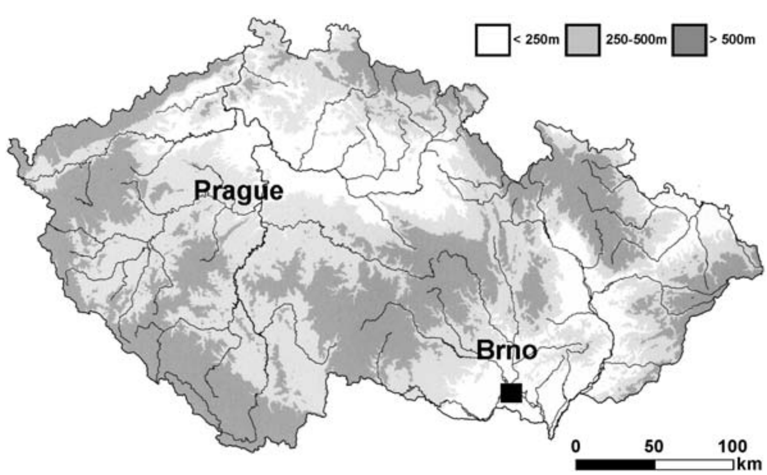

Figure 1. Map of the Czech Republic. The square indicates the location of the Dolní Věstonice–Pavlov–Milovice area.

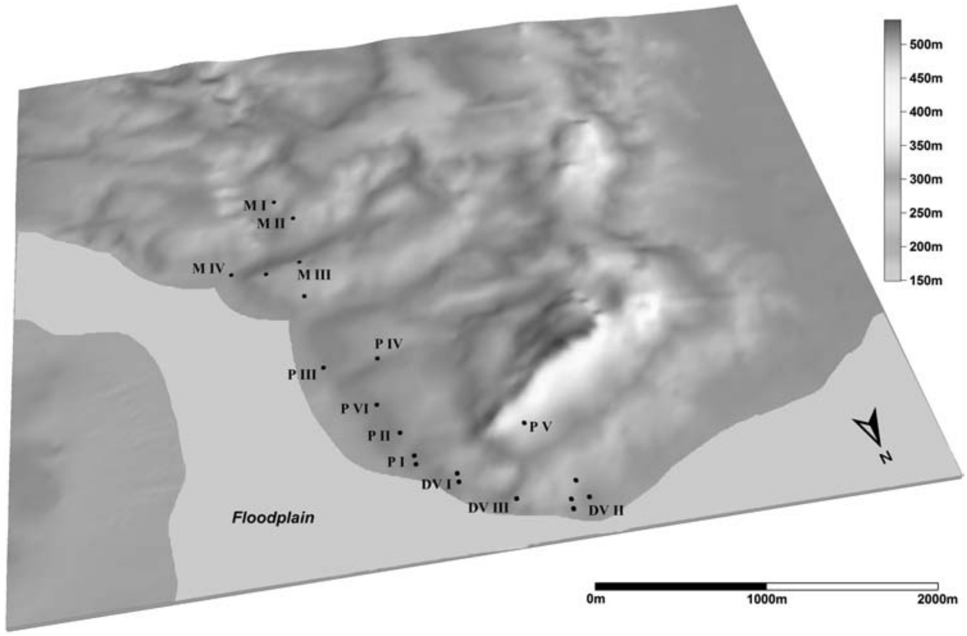

Figure 2. The Dolní Věstonice–Pavlov–Milovice area (marked by the square in Figure 1), showing the topography of the Pavlovské Hills, extension of the floodplain below, and position of individual Gravettian sites (DV = Dolní Věstonice, M = Milovice, P = Pavlov).

(Svoboda et al., 2009). Mid-slope locations adjacent to the river, from which the valley floodplain and lower slopes can be controlled, are interpreted as optimal locations for mammoth exploitation. These strategic locations allow aerial views of animal herds and easy access to side gullies and blind valleys which are interpreted as natural traps where selected individuals could be killed, as demonstrated by the frequent abundance of mammoth bones at such locations (e.g., Dolní Věstonice I and II). In the current discussions questioning the role of humans in mammoth bone accumulations (Soffer, 2003), this settlement pattern may be considered as one of the arguments for intentionality.

In 2009, Milovice IV, a new Gravettian site, was discovered in a very atypical location, situated almost on the valley floor at 175 m asl (Figure 3). In this paper we investigate the extent to which the different topographic location is reflected in other aspects of this site's climatic, environmental, and behavioral features. Although difficult to access and partly destroyed, the site was subjected to a series of paleobotanical, zooarchaeological, and archaeological analyses with the aim of reconstructing the environment and human activities. These data were correlated with the geographic and cultural contexts, and the implications of the observed patterns for different models of behavioral strategy were considered.

Figure 3. View from the Milovice valley over the village toward the Dyje River floodplain in the distance. The arrow indicates the position of Milovice IV. Photo by M. Frouz.

MILOVICE IV: LOCATION AND DATING

Background

Rare historical records repeatedly refer to a layer of bones of "Diluvial creatures" located several meters below the surface of Milovice village; however, the buildings and the depth of the bone material prevented access. In July 2009, a road collapsed into a system of abandoned cellars (Figures 4, 5). Both the location and the excavation methodology at this new site, named Milovice IV, were atypical. Collapse of the sediments enabled us to reach into depths otherwise inacessible, but also posed risks for further excavation and a bias in the record. The rescue excavation took place in 2009 and 2010, and both excavation seasons were linked with repair work on the village road. We stabilized the collapsed area of ca. 2.5 m × 4.0 m using wooden poles, provided facilities for entry of fresh air, cleaned and documented the side sections and the cellar ceiling, recorded three-dimensional provenience of the objects still in place, and excavated the ceiling in the reverse order of usual archaeological procedure: from below to above. Due to instability of the overlying sediments, it was risky to expand the archaeological excavation too far, so that the archaeological features could not be excavated in full and not all types of the material provided statistically sufficient quantities for separation according to the layers. The mass of collapsed sediments were transported and wet-sieved at the Institute of Archaeology in Dolní Věstonice; however, these materials lack precise provenience data within

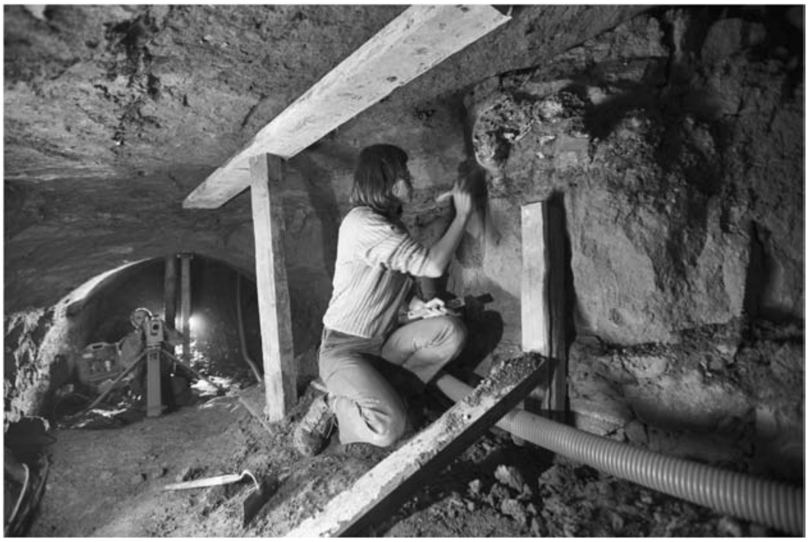

Figure 4. Fieldwork at Milovice IV within the collapsed cellar. Deposit of mammoth tusks is visible in the right wall (section 1). Photo by M. Frouz.

the archaeological layers. This bias especially concerns the faunal and microfaunal remains and the clay pellets.

Stratigraphy

A stratigraphic section through the collapsed depression revealed 2.8 m of darkish, redeposited sediments with medieval and recent pottery sherds, followed by several meters of yellowish-brownish loess, which covers the floor of the Milovice valley to a significant depth. The Upper Paleolithic archaeological evidence was recovered from the loess at the total depth of 5 m below the ground surface, where it formed the ceiling of one of the old cellars (the cellar floor was located 7 m below the ground surface). The loess below and above the archaeological complex was thick and homogeneous. In contrast to the nearby Gravettian sites of Dolní Věstonice and Pavlov, where the Upper Pleistocene stratigraphies display a series of chernozems and pseudogleys below the archaeological complex and a sequence of initial pseudogleys above it (Klíma et al., 1962; Svoboda, Ložek, & Vlček, 1996; Haesaerts et al., 2010; Beresford-Jones et al., 2011), no pedogenesis was recorded within the loess deposits at Milovice IV. This observation suggests that the mass of eolian sediments was blown into the Milovice valley relatively rapidly. As at other Gravettian sites, the human occupation took place during a short period of limited loess deposition and redeposition within Oxygen Isotope Stage 3 (OIS 3), shortly preceding the last loess accumulation, correlated with Oxygen Isotope Stage 2 (OIS 2).

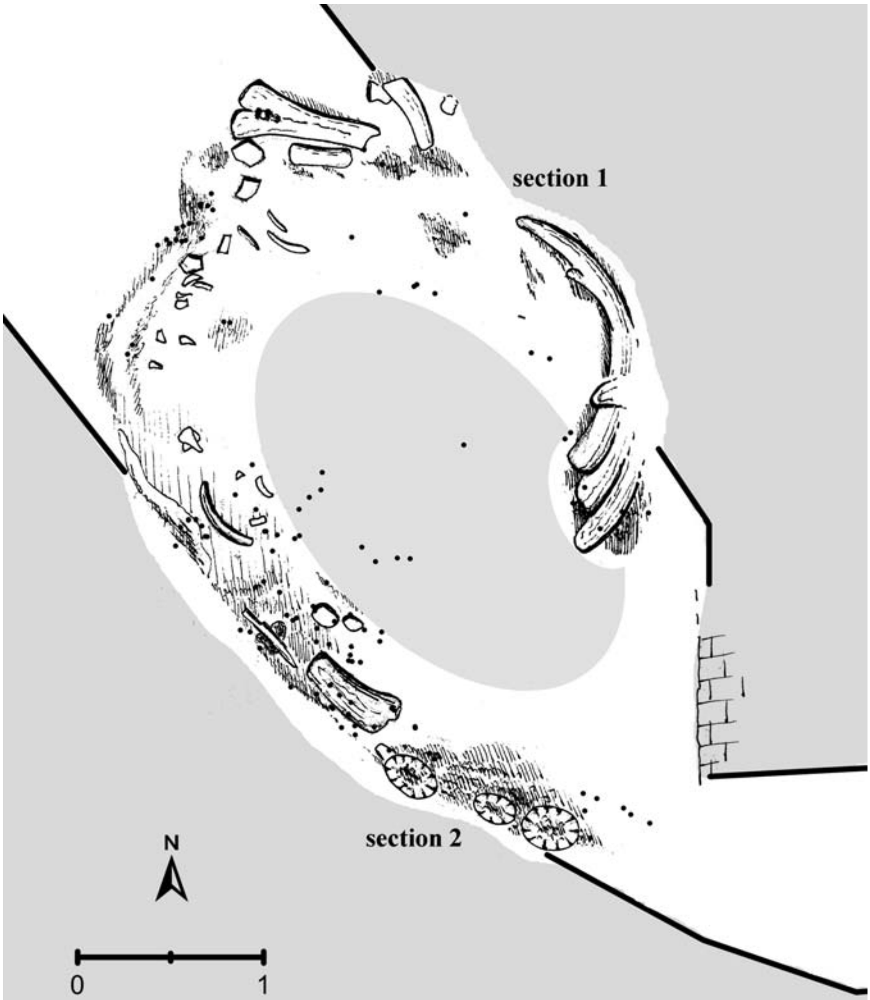

Figure 5. Planigraphy of Milovice IV (all layers): the cellar showing the collapsed oval-shaped area from the vault in the center, position of the larger bones, documented lithics (black dots), and location of the lateral sections 1 and 2. Scale one meter.

The archaeological complex was relatively thick (0.6–0.7 m) and composed of dark anthropogenic sediments with burnt and unburnt bones, charcoal, ochre, and artifacts (Figure 6). This complex was stratified into several sublayers. The base was extremely dark and rich in burnt bone and charcoal. Three regular kettle-shaped pits were hollowed into the basal loess below; although we could not excavate them completely, depressions of the same shape and size, found frequently at Dolní Věstonice, Pavlov, and other sites in the area, have generally been interpreted as boiling pits. Another important feature recorded at the base of the archaeological complex was

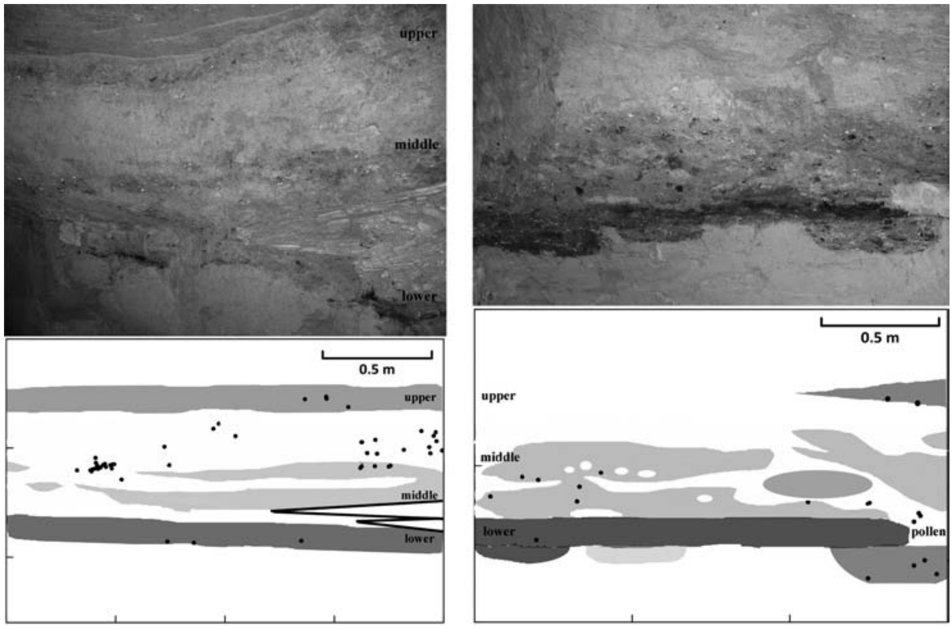

Figure 6. Stratigraphy of Milovice IV. Section 1 (left), showing the site's microstratigraphy in curvature of the cellar wall, with the deposit of several mammoth tusks at the base. Section 2 (right) with a complex hearth and small kettle-shaped pits at the bottom. Below are orthogonal projections of documented lithic artifacts (black dots) within the stratigraphic profiles.

a group of several mammoth tusks overlying each other, similar to tusk deposits excavated previously at the Gravettian site of Předmostí. Preservation of such regular features suggests that the basal archaeological layer had not been disturbed and lay in its original stratigraphic position. In contrast, the deposition pattern of the middle and upper layers shows the effects of redeposition.

Geography

The site of Milovce IV is located in the entrance of the Milovice blind valley. Approximately 2 km downslope within the valley lies another Gravettian site, Milovice I, associated with a large mammoth bone deposit and with a wide range of Pavlovian and later Gravettian ^{14}C ages (Oliva, 2009). The thickness of the cultural layers in the sections, combined with the earlier records of fossil bone finds scattered elsewhere in the village, leads us to suspect that Milovice IV represents one of the larger sites in terms of size, functional complexity, and intensity of occupation. The richness and diversity of the archaeological material recovered confirms this expectation.

Although it is difficult to demonstrate an absolute contemporaneity of Milovice IV and I, a site of this size would have blocked the passage of large animals deeper in the valley. A potential explanation for the unusual position of the site could be that the cultural layers were redeposited from the valley flanks into the valley bottom by slope processes, landsliding, or gelifluction (such cases were described from Dolní Věstonice I and are presumed at Pavlov III and elsewhere in the area). However, the *in situ* position of the basal layer at Milovice IV, including regular kettle-shaped pits and organized mammoth tusk deposits, argues against any movement of the sediments at this stage, and redeposition can only be postulated when dealing with the middle and upper layers.

^{14}C Chronology

The ^{14}C ages from the Dolní Věstonice–Pavlov–Milovice area suggest that the duration of the Gravettian occupation during OIS 3 was restricted in time. Figure 7 shows a probability distribution plot of the calibrated (95.4%) dates of samples from major Gravettian sites in the Dolní Věstonice–Pavlov–Milovice area using the program OxCal v. 4.1.7 (Bronk Ramsey, 2009). There is a cluster of Early Pavlovian dates, around 27 ka B.P. (32 ka cal. B.P.) detected at the sites of Dolní Věstonice II and Pavlov II, but the majority of dates from the largest site agglomerations such as Dolní Věstonice I and Pavlov I fall into the Evolved Pavlovian, dated 27–25 ka B.P. (31–30 ka cal. B.P.), and a few dates are even later. This time span coincides with the rapid oscillations of the Greenland ice core record, but a precise correlation, in the absence of more precisely dated microstratigraphies at the archaeological sites, is still a matter of research and debate (Jöris et al., 2010; Haesaerts et al., 2010; Musil, 2010; Beresford-Jones et al., 2011).

Certain sites or site sections in the area have provided microstratigraphies with sequences of ^{14}C ages, showing that the accumulation of these complex deposits took place within time intervals of millennia (Dolní Věstonice I) or centuries (Dolní Věstonice IIa, Pavlov II). It should be mentioned that samples for environmental analyses taken from such locations either failed to produce data or did not show much evidence for environmental change; yet analyzing Gravettian microstratigraphies in the Moravian region as a part of site formation processes and in more detail represents a promising research topic.

At Milovice IV, four charcoal samples were dated from superimposed positions within the microstratigraphy (Table I). Since the dates are not ordered in sequence in this case and sediments of the middle and upper layers show patterns of redeposition, we expect that the three upper dates relate to materials from higher locations. In general, however, the four dates confirm a relatively rapid formation of this settlement complex during the Evolved Pavlovian stage, with possible persistence into later Gravettian stages. In terms of the climatic record of OIS 3, the interval of occupation coincides with two Dansgaard–Oeschger colder intervals with an amelioration in between.

CLIMATIC AND ENVIRONMENTAL ASPECTS

Previous environmental reconstructions conducted at archaeological sites in the Dolní Věstonice–Pavlov–Milovice area focused on the immediate vicinities of these

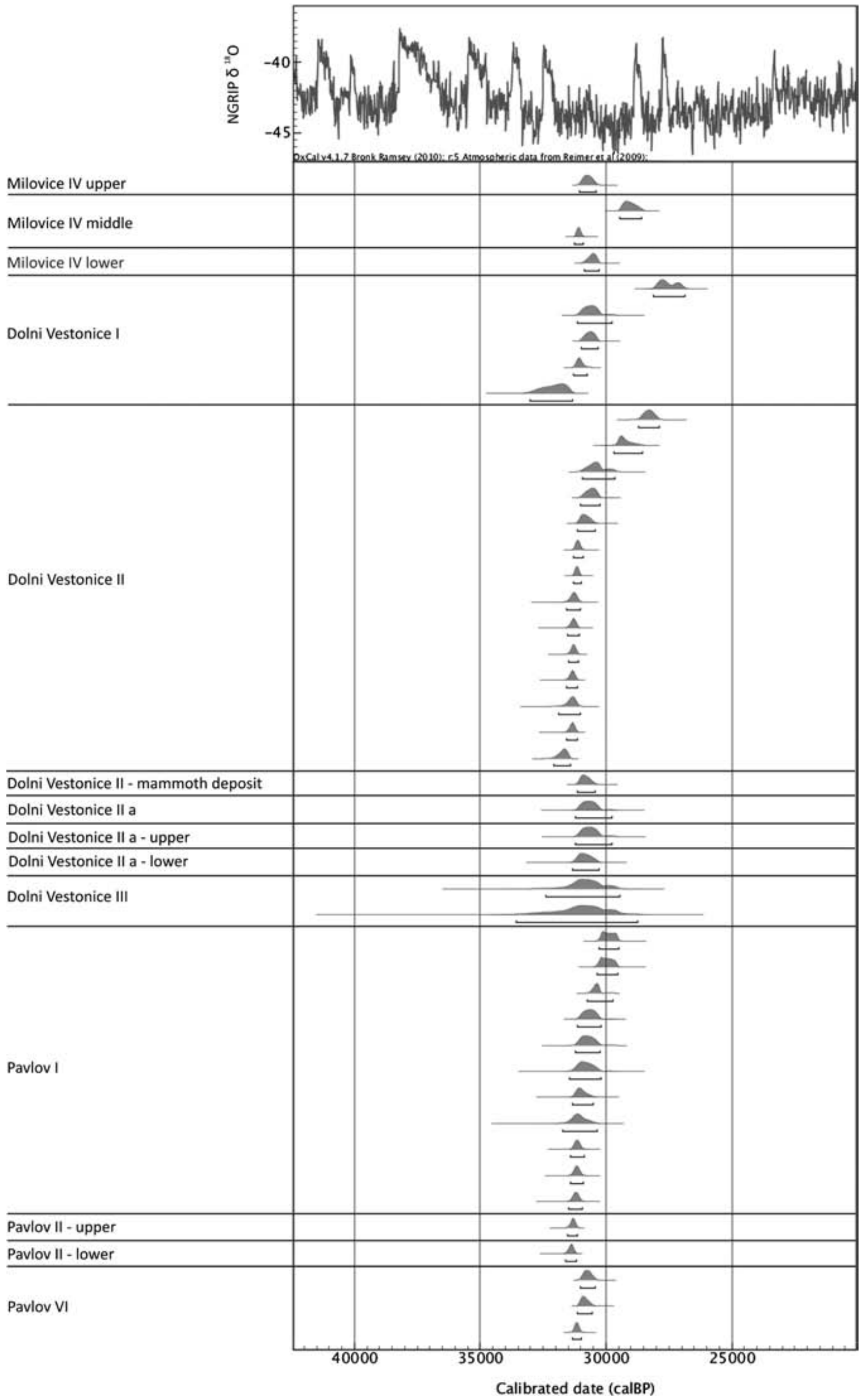

Figure 7. Plot of calibrated ^{14}C ages from major Gravettian sites in the Dolní Věstonice–Pavlov–Milovice area alongside the NGRIP ice core $\delta^{18}O$ record, generated using the ^{14}C calibration program OxCal v. 4.1.7.

Table I. The Milovice IV ^{14}C dates (all on conifer charcoal) and calibrations using the radiocarbon calibration program OxCal v. 4.1.7 (Bronk Ramsey, 2009).

Location in Microstratigraphy	Sample No.	Result (^{14}C yr B.P.)	Deviation	Calibrated Date (cal. yr B.P.)
Upper	GrA-45618	25,940	160	30,920–30,553 (68.2%)
				31,041–30,382 (95.4%)
Middle	GrA-44407	24,250	110	29,347–28,857 (68.2%)
				29,447–28,583 (95.4%)
Middle	GrA-48931	26,470	120	31,174–31,003 (68.2%)
				31,254–30,905 (95.4%)
Lower	GrA-44408	25,710	130	30,681–30,357 (68.2%)
				30,881–30,266 (95.4%)

elevated locations (Svobodová, 1991, Beresford-Jones et al., 2010), whereas the wetland vegetation on the plain below has been reconstructed on the basis of pollen analysis of marshes of the same ^{14}C age at the site of Bulhary, about 3 km eastward along the Dyje River (Rybníčková & Rybníček, 1992). In order to clarify the situation at Milovice IV, located in a marginal position between these two environments, we compiled the available data about vegetation (pollen and charcoal), fauna (mollusks, fishes, toads, small mammals), and isotopes.

Vegetation

Although samples for pollen analysis were taken from several positions within the Milovice IV microstratigraphy, only one location—a lens of pure loess interstratified between the lower archaeological layers—provided corroded pollen grains, containing a small number of palynomorphs. Pine was dominant among the trees with 11 grains recorded, accompanied by single grains of *Corylus* and *Betula*, and by the herbs Asteraceae, Poaceae, and Ranunculaceae. This phenomenon (i.e., pollen preservation in only one horizon of a complex microstratigraphy, and usually in lower position), has been repeatedly observed at other Moravian Gravettian sites (Pavlov, Dolní Věstonice, Petřkovice) and means it is not possible to reconstruct the vegetation sequences at most of these sites.

Concerning wood used as fuel, Milovice IV belongs to the group of larger Gravettian sites where burnt bone is dominant over wood (as at Předmostí; Beresford-Jones et al., 2010). Thus, charcoal fragments were rare compared to burnt bone, and all are small in dimension. Again, they were concentrated in the lower cultural layer, especially in basal parts of the hearths. Pine (*Pinus sylvestris* or *Pinus* cf. *sylvestris*) was dominant in most of the analyzed samples (total of 24 fragments), followed by spruce (*Picea abies*, 18 fragments) and/or larch (*Larix decidua*/*Picea abies*, 12 fragments). Additional trees are represented by individual occurrences only: fir (cf. *Abies alba*, 3 fragments) and willow (*Salix* sp., 2 fragments). An interesting find is a section of willow branch 2–3 years old and 15.5 mm in diameter. Although we could not detect vegetation change through time, the pollen and charcoal samples at Milovice IV are broadly in agreement and do not differ markedly from those recovered from other Gravettian sites in the area.

Fauna as Environmental Indicators

The malacofaunal and microvertebrate remains contribute important additional indications of the environment during human occupation of the site. The majority of finds were recovered during wet-sieving of the collapsed material, while samples taken directly from the sections were poor. Therefore, we cannot exclude some recent admixture in the Pleistocene faunal record, even if on a restricted scale.

Among the Pleistocene snails, relatively complete shells and fragments from various original contexts were numerous. Above all, a relatively large number of species typical for loess environments (Ložek, 2001) were observed, namely *Vallonia tenuilabris*, *Helicopsis striata*, *Succinella oblonga*, *Trochulus hispidus*, and so on, the genera *Pupilla* and *Vertigo* being less abundant. A conspicuously high percentage of species linked to various aquatic environments were also recovered, such as *Succinea putris*, *Anisus leucostoma*, *Galba truncatula*, and sporadic *Lithoglyphus naticoides*. After Ložek (2000), the terrestrial species are typical of open ground environments (*Vallonia tenuilabris*, *Helicopsis striata*, *Chondrula tridens*, *Granaria frumentum*) or woodland/open grounds (*Succinella oblonga*, *Cochlicopa lubrica*, *Clausilia* cf. *dubia*, *Trochulus hispidus*, *Perpolita hammonis*), the typical woodland elements being sporadic—*Alinda* cf. *biplicata*, *Arianta arbustorum*. The species *Xerolenta obvia* represents a Holocene admixture that occurs only in the historic period in this region (M. Horsák, pers. comm., 2010).

One piece of probable aquatic Crustacea and three fish vertebrae of indeterminable species provide evidence of adjacent fresh water environments. In addition, skeletal remains of a few toads (*Bufo viridis*) were recovered: one right frontoparietal (fused with prootic-exoccipital); five humeri (3 sin. + 2 dext.), five left ilia, four tibiofibulae (1 sin. + 2 dext.), two right femora, two presacral vertebrae, and one urostyle (Figure 8; Table II). Although the oldest known Central European *Bufo viridis* probably occurs as early as the Early Miocene (Böhme, 2003), this species is common in many Quaternary localities in Germany, Poland, Austria, and the Czech Republic. *Bufo viridis* is one of the most polytopic amphibian species of the Palearctic, recently inhabiting Europe with the exception of Great Britain, western parts of France, Belgium, and Iberia. It is a thermophilous species usually preferring open areas and edges of forest ponds. During the larval stage of ontogenetic development, this species occurs in wet environments with stagnant water reservoirs; however, adult specimens are resistant against increased aridity and even increased salinity. Therefore, it can also inhabit dry environments in steppes, semideserts, and karstic areas (Baruš et al., 1992; Gasc et al., 1997).

Small ground mammals are represented by dental and skeletal fragments of the following taxa (MNI): *Spermophilus* cf. *citellus* (3), *Myodes* cf. *glareolus* (1), *Arvicola terrestris* (1), *Microtus gregalis* (1), *Microtus arvalis* (2), Arvicolidae indet. (3), *Apodemus* cf. *flavicollis* (2), and *Mus* sp. (1). With the exception of the last two taxa (which most probably do not belong to the studied community, as indicated by their

Figure 8. Green toad (*Bufo viridis*) remains. A, B: right frontoparietal (fused with prootic-exoccipital); C, D: right humerus; E: left ilium; F: left tibiofibula; G: right femur; H, I: presacral vertebra; J, K: urostyle. A, D, F, H, K: dorsal, C, G, I: ventral, E: lateral, J: cranial, B: caudal views. Scale equals 2 mm.

taphonomic characteristics: nearly complete mandibles in a nonstratified sample), all the taxa are known to represent glacial communities (Table II). *M. gregalis* is an indicator species of glacial steppe environments, and *Microtus arvalis* and *Spermophilus*, which dominate the sample, indicate milder climates and steppe

Table II. Milovice IV. NISP (number of identified specimens) and MNI (minimum number of individuals) of the animals groups.

Taxon	NISP	MNI
Piscae indet.	3	
Bufo viridis	20	5
Anura indet.	1	
Lagopus lagopus	7	1
cf. *Lagopus* sp.	3	
Tetrao tetrix	1	1
Aves indet. (size *Tetrao tetrix*/*Lagopus* sp.)	5	
Spermophilus cf. *citellus*	4	2
Spermophilus sp.	1	1
Apodemus cf. *flavicollis*	2	1
Arvicola terrestris	1	1
Arvicolidae indet (size *Dicrostonyx*/*Microtus*)	3	
Arvicolidae indet.	1	1
Myodes cf. *glareolus*	1	1
Microtus gregalis	1	1
Microtus arvalis	2	2
Lepus sp.	63	2
Alopex lagopus/*Vulpes vulpes*	18	1
Canis lupus	62	2
Ursus sp.	2	1
Carnivora	11	
Equus sp.	31	2
Mammuthus primigenius	130	2
Coelodonta antiquitatis	1	1
Rangifer tarandus	96	3
Cervidae	13	
Total	**483**	**31**

environments with high primary production. *Arvicola* is a semi-aquatic form, while *Myodes glareolus* is an indicator species of woodland and/or arboreal habitats in general. A picture of a rich steppe habitat with riparian tree vegetation along a water body would be in perfect correspondence with the respective fossil record.

Isotopic Analysis as a Climatic Indicator

As part of the climatic investigations at Milovice IV, an analysis of oxygen and carbon isotopes ($\delta^{18}O$ and $\delta^{13}C$) was conducted on five horse teeth from the site. $\delta^{18}O$ in terrestrial herbivores is known to precipitate in isotopic equilibrium with body water $\delta^{18}O$, which in turn is linked to local precipitation $\delta^{18}O$ (Luz, Kolodny, & Horowitz, 1984; Luz & Kolodny, 1985; Longinelli, 1984). The $\delta^{18}O$ of an animal's tooth enamel thus reflects the $\delta^{18}O$ composition of local precipitation during the period of tooth formation. Precipitation $\delta^{18}O$ relates to near-surface air temperature across mid-high latitude and

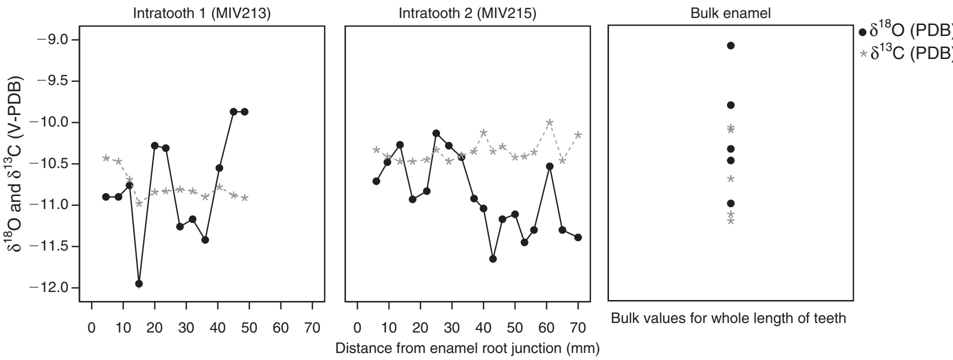

Figure 9. $\delta^{18}O$ and $\delta^{13}C$ results from five bulk samples and two horse teeth sampled for intra-tooth analysis.

continental environments (e.g., Rozanski, Araguás-Araguás, & Gonfiantini, 1992), and tooth enamel $\delta^{18}O$ values can therefore be used in paleoclimatic research to provide information about past temperatures. $\delta^{13}C$ in terrestrial herbivore teeth reflects the carbon isotope composition of the animal's whole diet (Ambrose & Norr, 1993), which in turn can be influenced by the local climate conditions (Heaton, 1999).

Teeth grow and mineralize progressively from the crown tip toward the root, recording seasonal variations in $\delta^{18}O$ and $\delta^{13}C$ during the time the tooth is growing, approximately two to three years for horses (Hoppe et al., 2004). Teeth were sampled using two approaches, first by bulk sampling the enamel across the full remaining crown height to give an average of the longest period of time possible, and second by sampling two of the teeth serially down the length of each tooth to investigate seasonal variability. All samples were pretreated for carbonate analysis according to Balasse et al. (2002) and measured by reacting them with 100% orthophosphoric acid at 90°C to release CO_2 for analysis with a PRISM isotope ratio mass spectrometer (located in the Department of Earth Sciences, University of Cambridge).

The results from the bulk samples gave a mean $\delta^{18}O$ of $-10.1‰$ ($\sigma = 0.7‰$) and a mean $\delta^{13}C$ of $-10.6‰$ ($\sigma = 0.5‰$) relative to the PDB isotopic standard (Figure 9). These $\delta^{18}O$ data were converted to drinking water $\delta^{18}O$ on the SMOW isotopic scale using existing conversion formulas (Coplen, Kendall, & Hopple, 1983; Iacumin et al., 1996; Delgado Huertas et al., 1995), and used to calculate an estimate of mean annual temperature following Rozanski, Araguás-Araguás, and Gonfiantini (1992) of $-3.1°C$ ($\pm 2.3°C$). This reflects the cold glacial climatic conditions inhabited by the horse individuals found at Milovice IV. The intra-tooth $\delta^{18}O$ values suggest seasonal temperature variations of at least 6°C. There is limited variation in the intra-tooth $\delta^{13}C$ values, indicating that the horses consumed a similar range of C3 flora throughout the year.

Further isotopic work on other Moravian Gravettian sites is continuing, and will help to place the Milovice IV values into the broader environmental context of the Pavlovian chronological period.

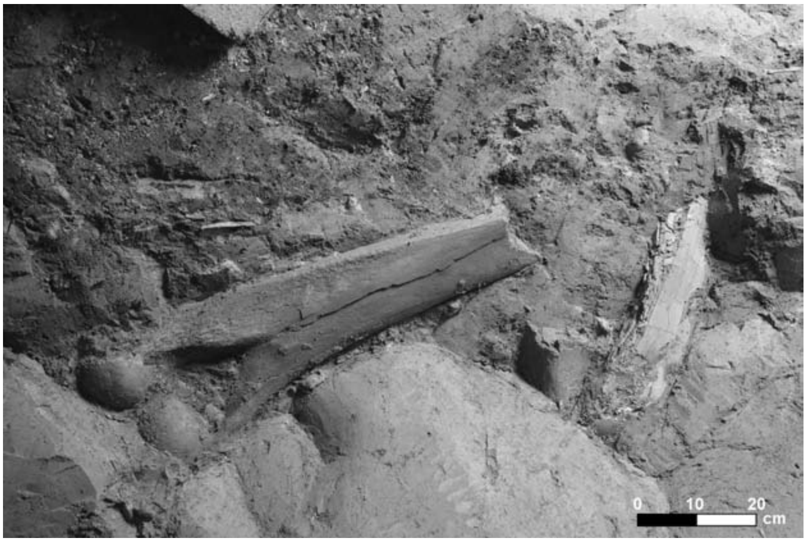

Figure 10. Group of mammoth bones in the cellar's vault (seen from below). Photo by M. Frouz.

BEHAVIORAL ASPECTS

The second major question addressed in this paper aims to clarify whether human activities performed at Milovice IV differed in some aspects from situations analyzed previously at larger sites from the Milovice area (e.g., Milovice I). The size of our own excavations was limited in space, taking place underground and in the center of the modern village, and given the depth of the overlying sediments only a small portion of a potentially large site could be processed and analyzed. Yet several lines of evidence, namely faunal remains representing food waste, lithic debitage, bone artifacts, personal ornaments, and fired clay pellets, are integrated here to reconstruct human behavioral patterns at this locality.

Fauna as Hunter's Prey

The collapse of sediments and risk of further collapse due to excavation limited the number of faunal remains that could be plotted three-dimensionally. In total, more than 20,000 bones and fragments were recovered, but only 390 fragments have three-dimensional provenience recorded and only 35 of them could be determined in terms of type of bone and species. Therefore, we consider the faunal record as a whole (Table II).

The majority of animal bones and teeth were unidentifiable fragments smaller than 20 mm, and species and element identifications were possible for only 483 bones and teeth.

The identified faunal remains are dominated by fragments of bones and teeth of woolly mammoth (*Mammuthus primigenius*; NISP = 130), representing at least two individuals, probably killed close to the site (Figure 10). Other taxa (reindeer, wolf, hare, horse, and fox) are each represented by a few dozen bones and teeth, which belong to between one and three individuals in each case. In addition, 16 bird bones were recovered, the majority of them (NISP = 10) belonging to a minimum of two individuals of ptarmigan; one bone is of a female black grouse. In fact, various parts of the animal's skeleton are represented (Table III).

Despite the small number of finds at Milovice IV, signs of human activity on the bones were visible in the form of cut marks and from evidence of burning. Cut marks from lithic tools were found on several reindeer bones, including marks on a tibia (Binford code number Tp-1; Figure 11), astragalus (Binford code number TA-1 and TA-2), and navicular cuboid, which clearly originate from dismembering the carcass. Meanwhile, traces on a reindeer calcaneus (Binford code number TC-3) were made by inserting a rope or gambrel, possibly for hanging the carcass. Cut marks were also observed on a wolf's vertebra (Figure 12), possibly from dismembering or filleting the carcass.

The high fragmentation of bones into fragments smaller than 20 mm was a very common feature at Milovice IV, but this was not caused exclusively by post-depositional processes, such as the pressure of sediments or collapse of the cellar's ceiling. The majority of breakages instead result from various human activities such as marrow and grease extraction or preparation of broth. According to ethnoarchaeological observations among the Nunamiuts of Alaska, the length of bone fragments resulting from these activities is smaller than 50 mm (Delpech & Rigaud, 1977).

The most characteristic feature at this site, however, is a large number of burned bone fragments, possibly indicating that bone was used as a fuel in the hearths. Certainly, the bones were exposed to a variety of temperatures and burned for different durations of time (following Lyman, 1994). Some bones display dark brown patches on the surface, possibly as a result of heating or roasting meat attached to them. However, the same type of modification was recorded on bones with no meaty content such as a reindeer astragalus or a wolf mandible (Figure 13), and a black grouse bone also displays these brown patches. Buikstra and Swegle (1989) noted that when fleshed bones were heated/roasted in an open fire, they could become carbonized in the area where there is no meat to cover the bone. Accordingly, we suggest these marks at Milovice IV likely result from bones coming into direct contact with flames or hot coals.

The amount of burnt bone fragments at Milovice IV, which comprises about 15,000 of the total of 20,000, has no parallel at other sites in south Moravia, such as Dolní Věstonice I and II, Pavlov I, or Milovice I (Brugère, Fontana, & Oliva, 2009); rather, it compares better with the large Gravettian sites of central and northern Moravia, namely Předmostí I and Petřkovice (Beresford-Jones et al., 2010; Nývltová Fišáková, 2008).

The faunal composition at Milovice IV also differs from the nearest large site Milovice I, dating to an equivalent period, where woolly mammoth dominates the entire assemblage, while small mammals (hares and foxes) are almost absent (Brugère, Fontana, & Oliva, 2009). Rather, the composition at Milovice IV recalls sites like Pavlov I and Pavlov VI, with a more balanced representation of small (hare–fox sized), medium (wolf–reindeer sized), large (horse–bear sized), and very

Table III. Milovice IV. NISP (number of identified specimens) and MNE (minimum number of elements) of the most numerous mammalian taxa. Several mammoth tusks, because of their size and fragility, were left in place and not incorporated in this analysis.

	Lepus sp.		Alopex/Vulpes		Canis lupus		Equus sp.		Mammuthus primigenius		Rangifer tarandus	
Skeletal Part	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE
Tusk												
Maxilla and cranium			2	1					12	2		
Antler												
Mandible	1	1			5	4					1	1
Tooth	21	21	10	10	11	9	19	16	7	2	18	18
Fragments of tooth											4	
Atlas					1	1						
Axis					1	1						
Vertebra					7	6			1	1	1	1
Ribs	3	1							6	1		
Scapula					1	1	1	1	1	1	1	1
Humerus	1	1			1	1					3	2
Radius	3	2			1	1					9	4
Ulna			1	1	1	1			6	2	3	2
Carpals	1	1			1	1	2	2	1	1	5	5
Metacarpal	1	1			3	3	2	2			1	1
Reduced metacarpal							2	2			1	1
Pelvis	2	2			2	1	1	1			3	3
Femur					2	1	1	1	1	1	6	5
Patella									1	1	4	4
Tibia					2	2	1	1	2	1	10	8
Astragalus											3	3
Calcaneus	3	3			1	1			2	2	4	3
Tarsal	2	2			1	1					2	2
Metatarsal	4	4	1	1							2	1
Metapodial	13		1		1	1			2		8	
Phalange	8	8	3	3	14	14			1	1	3	3
Sesamoid					6	6	2	2	3	3	4	4
Fragment of long bone									32			
Bone fragment									52			
Total NISP	**63**	**47**	**18**	**16**	**62**	**56**	**31**	**28**	**130**	**19**	**96**	**72**

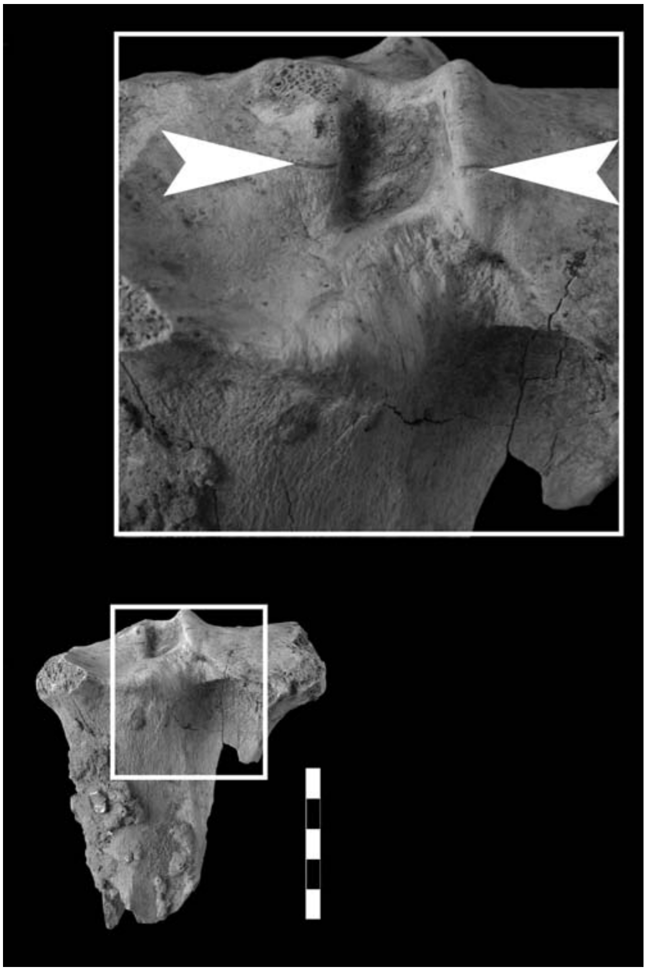

Figure 11. Reindeer (*Rangifer tarandus*). Proximal part of a right tibia with cutmarks created during dismembering. Caudal view. Scale 50 mm.

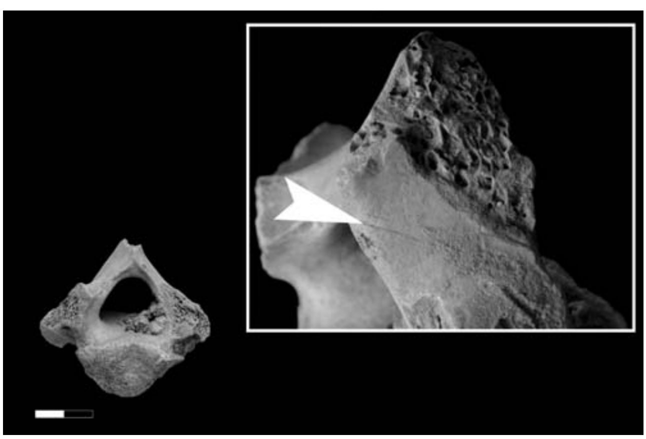

Figure 12. Wolf (*Canis lupus*). Thoracic vertebra with cutmarks created during dismembering. Scale 20 mm.

Figure 13. Wolf (*Canis lupus*). Mandible fragment with characteristic red-brown patches. Scale 20 mm.

large mammals (woolly mammoths). The presence of bird remains at Milovice IV, Pavlov I, and Dolní Věstonice II also provides good evidence that these animals represented an important contribution to the diet during the Gravettian period (Bocheński et al., 2009)

In sum, despite the limitation of the excavated and sampled area, the faunal record at Milovice IV demonstrates similarities to some of the larger sites of the Pavlov Hills area, namely in terms of the species diversity and presence of various signs of human activity on the bones.

Lithic Artifacts

The excavation revealed a sample of 5083 lithic artifacts. Given a better visibility of the lithics in the walls and ceiling of the collapsed cellar, part of the collection could be related to the upper, middle, and lower layers (Table IV). Again, the majority of artifacts were found in collapsed sediments without stratigraphic provenience, and these were analyzed together.

As at other sites of the area, lithic artifacts are predominantly made of flint originating from fluvioglacial sediments (46%), but the proportion of radiolarite (41%; mostly greenish to brownish hues) is relatively high. These dominant raw materials are also supplemented by various types of cherts, spongolite, quartzites, and rock crystal (altogether, 13%).

Technological analysis has shown a complete chain of lithic reduction is represented at the site, from core preparation to final tool production, additional rejuvenation, and reutilization. There were only 25 cores recorded in the assemblage, mostly in an advanced stage of reduction and predominantly of single-platform types (15 pieces). The cores were largely intended for blade or blade-microblade production. Typologically important are five micro-cores made on rough flakes, morphologically similar to massive burins.

The blanks for tool production are represented by 159 flakes and 467 nonretouched blades (including 30% of microblades, less than 8 mm wide). They are predominantly

Table IV. General composition and percentages of lithic industry according the major technological group. The category of flake fragments and small chips representing the fine waste from core processing or tool retouching excluded (3264 pieces, nearly 83% of all artifacts).

Major Technological Groups	Upper Layer		Middle Layer		Lower Layer		Nonlocalized		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Cores	0	0.0	4	3.9	0	0.0	21	2.8	25	2.8
Flakes	1	7.7	15	14.6	0	0.0	143	19.0	159	18.1
Blades	8	61.5	63	61.2	8	66.7	388	51.7	467	53.1
Partially retouched	0	0.0	3	2.9	0	0.0	25	3.3	28	3.2
Retouched tools	3	23.1	11	10.7	0	0.0	102	13.6	116	13.2
Burin spalls	1	7.7	7	6.8	4	33.3	72	9.6	84	9.6
Total	13	100	103	100	12	100	751	100	879	100

Table V. Milovice IV. General composition and percentages of retouched tools.

	Upper Layer		Middle Layer		Lower Layer		Nonlocalized		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Burins	3	100.0	2	18.2	0	0	33	32.4	38	32.8
Endscrapers	0	0.0	2	18.2	0	0	15	14.7	17	14.7
Backed artifacts	0	0.0	1	9.1	0	0	21	20.6	22	19.0
Points and pointed blades	0	0.0	2	18.2	0	0	3	2.9	5	4.3
Retouched blades	0	0.0	1	9.1	0	0	18	17.6	19	16.4
Combined tools	0	0.0	2	18.2	0	0	6	5.9	8	6.9
Other tools	0	0.0	1	9.1	0	0	6	5.9	7	6.0
Total	3	100	11	100	0	0	102	100	116	100

noncortical and originate from advanced stages of core reduction. From the morphological point of view, the majority of blades have parallel or convergent lateral edges, but only about 20% of the blades are complete. The average length of complete pieces ranges 40 to 60 mm, with the longest blades up to 85 mm. The width of most pieces varies from 14 to 20 mm (microblades excluded).

Typologically, the assemblage of retouched tools is of Gravettian character, although some Aurignacoid features are visible in the endscrapers group. Other characteristic features are the predominance of burins over endscrapers and a high proportion of backed artifacts (Table V). Points and pointed blades occur only rarely. No technological and typological differences are visible between the individual stratigraphic layers.

The most numerous burins are on breaks (14 pieces), made by a simple single blow on fragmented coarse and massive blades. The next most numerous are burins on truncations (8 pieces), also made in multiple forms (Figure 14: 16), followed by simple, single-blow burins made on proximal blade ends (four pieces), which could also represent fragments of other tools with a negative scar caused by hafting. Other

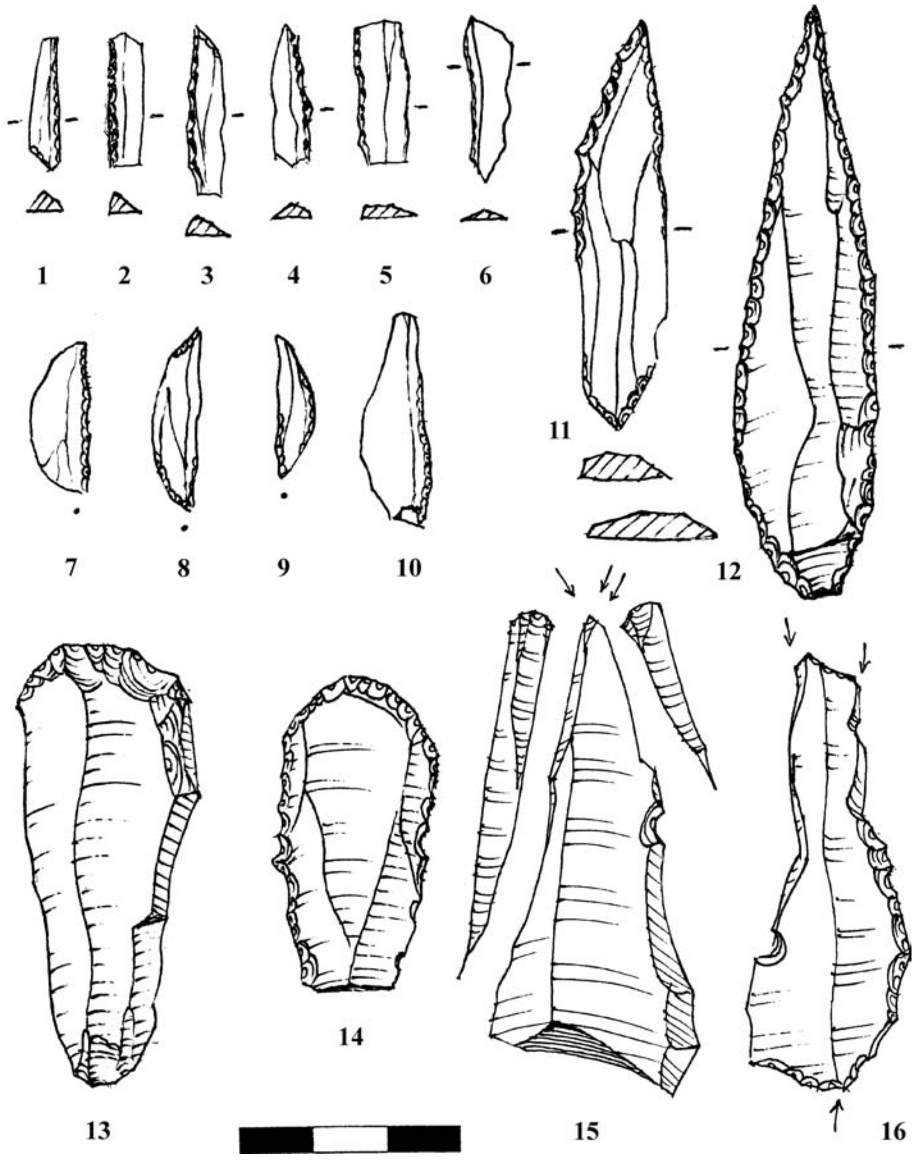

Figure 14. Selection of the lithic industry (dominated by green-grayish radiolarite): microliths (1–10); partially backed points (11–12); endscrapers (13–14); burins (15–16).

types are transverse burins on flakes (three pieces), massive single-blow burins on coarse flakes (three pieces), a single symmetrical dihedral burin (Figure 14: 15), and a multifaceted burin made on the ventral surface of a distal blade end. Several multifaceted burins (but not as massive as the cores) were made on fragments of coarse flakes. By-products of burin manufacturing are represented by 84 burin spalls.

Endscrapers are made predominantly on wider and coarser blades (Figure 14: 13, 14), usually without lateral retouch. The typologically most significant pieces constitute several carinated forms made on flakes in an Aurignacian style.

Nearly all of the backed implements are microliths, maximally 0.7 cm wide, including predominantly broken fragments of backed microblades, supplemented by a few crescents and one atypical triangle (Figure 14: 1–10). The larger blade form is represented by two partially backed points (Figure 14: 11, 12). Retouched blades are mostly unilateral and truncations are rare.

Partially retouched artifacts are predominantly represented by blades (21 pieces), usually with short areas of retouch caused by the artifact situated on lateral edges. The collection of lithics is completed by a coarse and heavy-duty industry, plaques with traces of ochre grinding, and fragments of mineral dyes.

Animal Tissue Artifacts

Ivory was an important raw material at all Gravettian-period sites of the area, and was used at Milovice IV to produce a variety of polished points, projectiles, and fine "needles" (circular and oval-shaped in section), all preserved as fragments. These include a large and blunt tusk tip, measuring 28 mm in diameter at the widest point and decorated by short parallel incisions; 13 fragments of ivory projectiles, oval-shaped or circular in cross-section and 5–15 mm in diameter or on the longer axis (Figure 15); and two fragments of a fine "needle," 2–3 mm in diameter. In addition there are six irregular fragments of mammoth tusk decorated by short incisions, some of which create X-shaped forms (Figure 16).

Two fox teeth constitute personal ornaments, including one lower canine partly prepared for perforation and a perforated (but damaged) third upper incisor. This compares well with the type of decorative objects previously found at other sites in the area.

Tertiary molluscs (Scaphopoda, Bivalvia, Gastropoda) of Badenian, Sarmatian, and Pannonian ages found at Milovice IV originate from the Carpathian Foredeep or Vienna Basin, indicating a similar composition and origin to the mollusk assemblages found at other Gravettian sites in the Dolní Věstonice–Pavlov–Milovice area (Hladilová, 1994, 1997, 1998, 2005; Svoboda et al., 2009). The Milovice IV sample included more or less complete shells of *Dentalium badense*, *Pirenella picta picta*, *Pirenella picta mitralis*, *Pirenella nodosoplicata nodosoplicata*, *Astraea meynardi*, *Conus vindobonensis*, *Melanopsis vindobonensis vindobonensis*, *Zonaria* sp., *Alaba costellata anomala*, *Glycymeris pilosa deshayesi*, *Cardites partschi* sp., and some undeterminable fragments. As at the other sites of the area, the shells were typically weathered, indicating collection at outcrops; some of the shells were perforated, or display traces of red ochre or a black coal mass on the surface. In contrast to the other sites, this assemblage appears deliberately heterogeneous: Besides the dominating scaphopods, most other species are represented by only a single specimen.

Figure 15. Fragments of ivory points. Photo by M. Frouz.

Clay Pellets

As at the other important sites of the Dolní Věstonice–Pavlov–Milovice area (Klíma, 1952; Vandiver et al., 1989), the wet-sieved sediments at Milovice IV provided a collection of typical clay pellets (76 and 523 specimens recovered in 2009 and 2010,

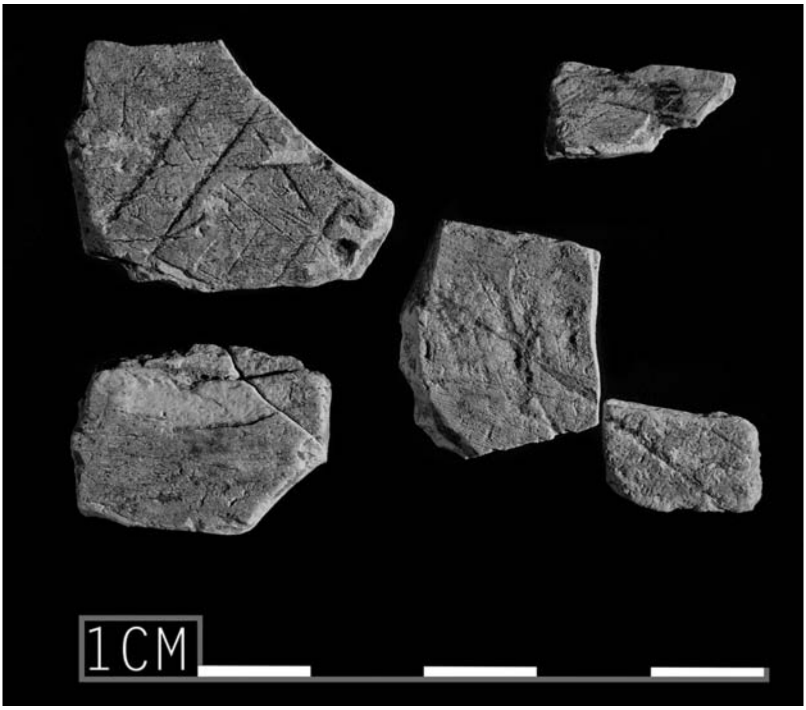

Figure 16. Fragments of ivory with incisions. Photo by M. Frouz.

respectively). The dimensions range from 1 mm to 50 mm, but the majority fall in an interval between 5 mm and 15 mm. Their color ranges from grayish white, pale ocher, to brown and black gray, and a few of them are reddish. The shape is predominantly rounded (caused partly by wet-sieving), with a few of unusual irregular, elongated, or flattened shapes. One conical specimen recalls the animal "legs" of Pavlov I, and other pieces imply some intentional shaping, but no identifiable traces of modeling into zoomorphic or anthropomorhic shapes were recorded.

Study of use-wear traces was not possible in most of the cases because the original surface was corroded and also altered during wet-sieving. No fingerprints or other unequivocal imprints of the human body are preserved. Some of the pellets show small cavities and linear holes probably representing natural macropores. The origin of these structures will be subjected to further analysis, given the similarity of some of the traces to the traces of animal hair, found previously on two objects from the site of Pavlov VI (Králík et al., 2008).

Since the pellet collection is variable in terms of size, shape, color, hardness, and macroscopic internal structures (and, hence, in its origin), four samples were selected for micropetrographic analysis to identify their mineralogical and petrographic composition (following Gregerová et al., 2010). In one case only, the minerals bear signs of temperature alterations pointing to firing temperatures of ca. 400–450°C. Two more samples represent an important group of irregular grayish-white pellets, composed of calcareous clay with an admixture of dust particles and sand grains. The fourth sample, a rounded dark gray pellet, was identified as siltite with an admixture of sand and clay. It is worth noting that the dark color of the fourth sample is due to organic matter content, but not the carbon/charred remains from a fire. Rather, this comprises the remains of decaying organic matter in a moist environment (e.g., mud). The minerals do not show evidence of thermal alterations in any of the last three samples. All four analyzed pellets originate from the same material, which was not the local loess, but rather a clay-silt brought to the site from elsewhere.

The micropetrographic analysis shows that at least some of the pellets are probably relics of clay modified/consolidated by heat from a hearth. Others, namely the dark-colored pellets, could be just a product of organic relics that decayed in humid environments, without firing.

DISCUSSION

The chronology of settlement in the Dolní Věstonice–Pavlov–Milovice area allows a separation into the Early Pavlovian, Evolved Pavlovian, and later Gravettian substages (Figure 7; Svoboda, Ložek, & Vlček, 1996:138 –143), but the majority of these sites and dates, including the new site of Milovice IV, belong to the Evolved Pavlovian horizon, dated 27–25 ka B.P. or 32–30 ka cal. B.P. (Figure 7). During this short period of time, the area functioned as a system of interrelated sites, differing in size, duration of occupation, and seasonality, but located at the same elevation and in similar geomorphological positions on the slopes of the Pavlov Hills. All of these sites may be seen from the hilltop of the remarkable Děvičky Hill (now crowned by a medieval castle). Milovice IV, by contrast, a site with identical dating and the same cultural inventory (and also visible from Děvičky), is located at a lower altitude at the bottom of a side valley (175 m asl). Instead of overlooking the access point into the Milovice side valley, Milovice IV blocks its entrance for animal herds. Given the regular features preserved at the base of the archaeological layers at Milovice IV, namely the three kettle-shaped pits and the deposit of several mammoth tusks, we reject the hypothesis that the basal sediments are redeposited downslope from higher locations by slope processes, landsliding, or gelifluction. However, redeposition by slope processes may be expected in the case of the middle and upper layers. This implies the excavated part of Milovice IV site was found in its original position, and represents a genuinely different placement on the landscape than other Gravettian sites of similar date in this region.

In terms of the climatic scheme, the time span of the Evolved Pavlovian correlates with rapid global changes in temperature and moisture abundance (Dansgaard–Oeschger events), but it is unclear from the present state of research how far this rhythm of change is reflected in the local environmental conditions, since we have never noted dramatic changes in the composition of vegetation and fauna among the individual sites and layers in the Moravian region. This is also true for the local microregional environments on the slopes of the Pavlov Hills, a remarkable elevation rising ca. 400m above the floodplain, which should equally reflect any patterns of changing altitudinal zonality connected with these climatic fluctuations. Even the evidence of elevated moisture, whether recorded in vegetation, mollusks, or vertebrate microfauna, may either reflect the short-term climatic fluctuations or result from site location. For example, numerous springs on the mountain slopes created basins with swampy ground and small lakes, especially in the side gullies, and influenced the environmental record at the archaeological sites of Dolní Věstonice I and II (Svoboda, 1991), whereas extensive wetlands formed along the Dyje River, on the basal floodplain (e.g., paleobotanical site of Bulhary; Rybníčková & Rybníček, 1992). How the human occupations at Milovice IV and other Gravettian sites around the Pavlov Hills relate to the broader climatic oscillations that took place during late OIS 3 therefore remains unclear at this time.

CONCLUSION

In contrast to previously proposed views of the Gravettian environment which have reconstructed a cold, dry, and treeless landscape, recent research has emphasized a higher proportion of arboreal and thermophile elements, represented in both floral and faunal records (Rybníčková & Rybníček, 1992; Svobodová, 1991; Beresford-Jones et al., 2010; Musil, 2010). The environmental record at Milovice IV, located directly at the margins of the floodplain, does not contradict this standard picture, observed repeatedly at the Gravettian sites located at higher elevations around the Pavlov Hills, but some evidence for a localized increase in moisture abundance was nevertheless recorded. This is not so much apparent in the vegetation, but rather in the malacofauna record, which includes mollusk species indicating aquatic environments, namely *Succinea putris*, *Anisus leucostoma*, *Galba truncatula*, and sporadically *Lithoglyphus naticoides*. A fragment of aquatic Crustacea shell, the occurrence of fishes, green toads (*Bufo viridis*), and the semi-aquatic mammal *Arvicola* contribute to the general reconstruction of a basically steppic habitat accompanied by riparian tree vegetation along the meandering Dyje River.

Despite restrictions in excavating the site, the archaeological analysis shows that most of the household activities documented at the other Gravettian sites in south Moravia also took place at Milovice IV: intensive use and deposition of faunal remains, making hearths and cooking meat, production and use of stone and bone tools, collection and perforation of animal teeth and use of Tertiary shells for decorative purposes, grinding ochre, and firing small pieces of clay. The mammal and bird taxa represented at Milovice IV is similar to Pavlov I, Pavlov VI, or Dolní Věstonice II, but the tendency to burn animal bones and fragment into small pieces is reminiscent of the practices documented at sites of central and northern Moravia (Předmostí, Petřkovice). In another words, elevation alone is not a decisive criterion dictating the character of a Pavlovian camp site.

Complexity of the site's microstratigraphy suggests that human activities at the same locality occurred repeatedly, sometimes with a high intensity, but not permanently. Periodically, the location of the site would have allowed close contact with mammoth herds concentrated in the floodplain, and the aquatic environment offered possibilities for gathering plants, fishing, and a variety of additional activities.

Following the recent discovery of starch grains at Pavlov VI, *Typha* roots could also have been collected in such areas, ground, and used for food (Revedin et al., 2010). The range of these activities, however, had little or no impact on artifact typology recorded at Milovice IV. The atypical location of this site suggests that the settlement strategy of Pavlovian hunter-gatherers was more flexible than previously thought.

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3.5.6 Předmostí III: un site pavlovien de la Porte de Moravie (République tchèque, Europe centrale)

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Předmostí III : un site pavlovien de la Porte de Moravie (République tchèque, Europe centrale)

Předmostí III: Pavlovian site in Moravian gate (Czech Republic, Central Europe)

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Résumé

Le complexe des gisements de Předmostí est parmi les plus connus du centre de l'Europe centrale. Le site Předmostí III a fait l'objet de plusieurs campagnes de fouilles. Le présent article se focalise sur les découvertes mises au jour en 1982 et 1983. L'industrie lithique est produite in situ sur les galets de rivière en radiolarite. L'association d'un couteau de Kostenki à un microlithe géométrique permet d'attribuer l'ensemble au Pavlovien et plus particulièrement à l'une de ces composantes « le groupe à microlithes géométriques ». Les lames et les lamelles sont majoritairement débitées au percuteur tendre organique. Cette technique identifiée est en concordance avec la découverte d'un objet en ivoire de mammouth portant des traces d'impacts, interprété comme un percuteur. Une partie de la faune étudiée pour le moment montre la forte prédominance du mammouth. Malgré la quantité restreinte du matériel, le site contribue à une meilleure compréhension des industries pavloviennes.

Mots clés : Gravettien ; Pavlovien ; Předmostí ; Microlithes géométriques ; Couteau de Kostienki ; Possible percuteur en ivoire

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Abstract

The complex of sites of Předmostí is one of the most famous in the Central Europe. The site Předmostí III has been excavated several times during the last thirty years. This article focuses on the materials discovered in 1982 and 1983. The lithic industry has been knapped in situ on radiolarite river pebbles. The association of a Kostenki' knife with geometric microlith indicates a cultural attribution to the Pavlovian and more particularly to the kind described as the "group with geometric microliths". Blades and bladelets are mainly produced with an organic hammer. This fact could fit with the discover of a piece of mammoth tusk with percussion marks on its the distal end that could have been used as a hammer. In spite of the small number of artefacts preserved, the reassessment of that collection contributes to a better understanding of the Pavlovian industries.

Keywords: Gravettian; Pavlovian; Předmostí; Geometric microliths; Kostienki' knife; Likely ivory hammer

1. Introduction

Le complexe des sites de Předmostí compte parmi les gisements paléolithiques les plus importants du centre de l'Europe centrale (Fig. 1). Le site Předmostí III se situe à 300 m de l'ensemble des locus de Předmostí I. La localité étudiée a fait l'objet de plusieurs fouilles de sauvetage en vue de travaux d'urbanisation. Les découvertes et les restes fauniques proviennent essentiellement des alentours du bloc 2 de la zone d'habitation (Fig. 1).

Le présent article participe d'une volonté de synthétiser les informations relatives aux différents ensembles pavloviens du complexe des sites de Předmostí. Ce travail de synthèse a été initié par la récente étude réalisée sur le site de Předmostí Ib (fouille 2006) (Svoboda, 2013a,b, éd.). L'étude se focalise sur le matériel mis au jour lors de la fouille de B. Klíma en 1982–83 (attribué au Pavlovien[1]). Le matériel recueilli est composé d'industrie lithique, de faune, d'un objet qui s'apparente à un percuteur tendre organique en ivoire et d'un galet (décrit anciennement comme une enclume). Ces observations ne permettent pas de tirer de conclusions significatives concernant les sociétés gravettiennes, néanmoins elles donnent des informations complémentaires sur certains aspects de l'industrie lithique, et sur les liens entre celle-ci et l'objet en matière dure animale.

2. Contexte de la recherche

Le site a été fouillé à plusieurs reprises, a livré essentiellement de la faune et serait daté de 16,800 ± 90 BP non calibré. Cette datation, faite sur un fragment d'os, est contestée (Svoboda et al., 2007) car l'échantillon daté provient des anciennes fouilles de B. Klíma et nous ne disposons d'aucune information concernant sa provenance.

2.1. Historiques de fouilles

2.1.1. Fouilles de B. Klíma de 1982–83

Lors des travaux de construction du complexe d'habitations de Přerov, entre 1982 et 1983, plusieurs accumulations d'ossements de faune ont été mises au jour dans l'arrondissement Předmostí[2] (Klíma, 1983, 1984, 1985). B. Klíma, accompagné de J. Svoboda et d'autres

[1] Le terme Pavlovien et son contenu sont actuellement en révision typo-technologique. Pour le moment, nous réservons ce terme aux industries du groupe à microlithes géométriques et du groupe à microscies d'Europe centrale.

[2] Předmostí (« endroit devant le pont » en tchèque) est actuellement l'un des arrondissement de la ville de Přerov.

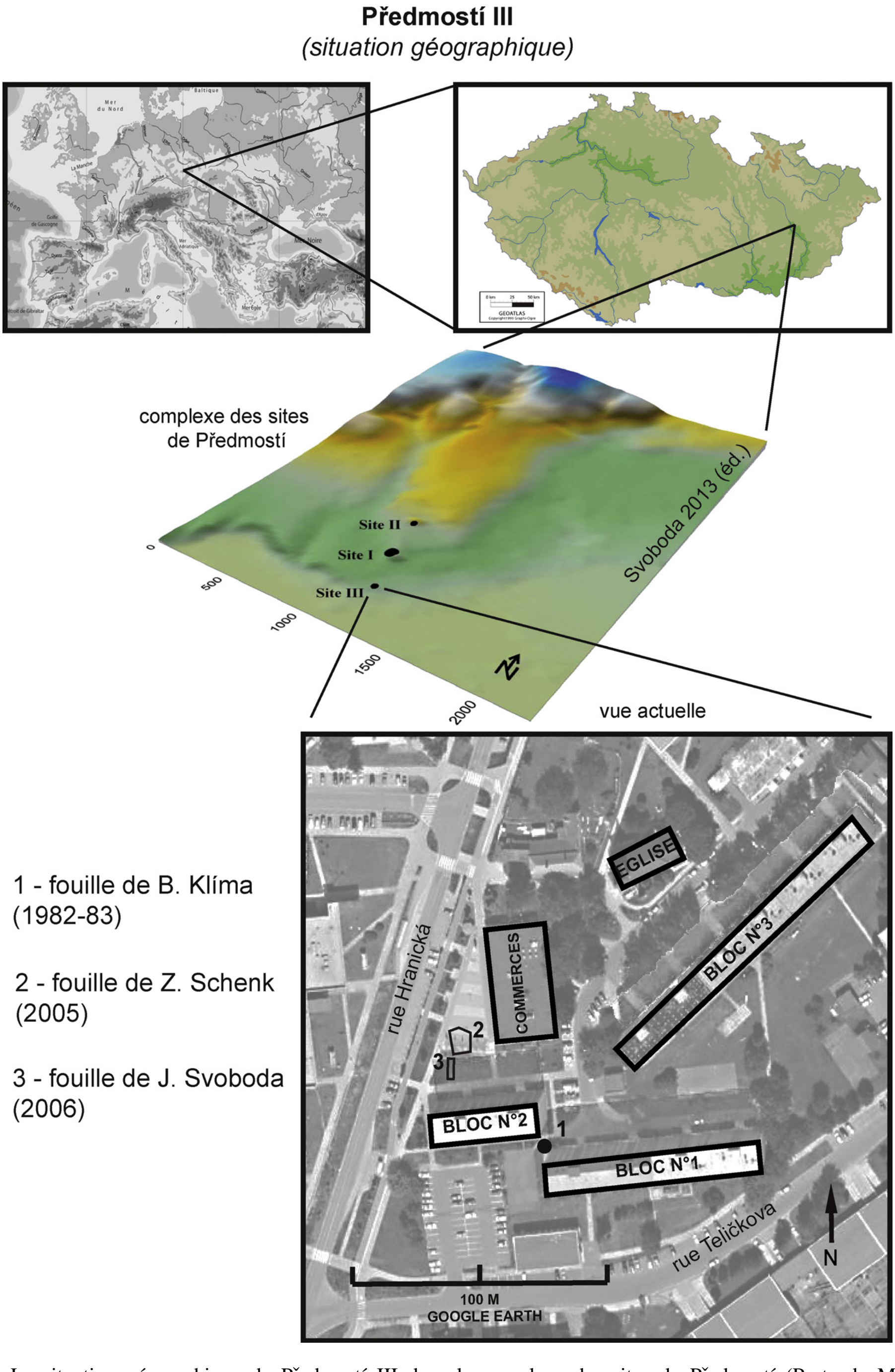

Fig. 1. La situation géographique de Předmostí III dans le complexe des sites de Předmostí (Porte de Moravie, République Tchèque ; DAO M. Polanská).

Geographical situation at Předmostí III in the complex of other sites at Předmostí (Moravian Gate, Czech Republic; CAD by M. Polanská).

fouilleurs de l'Institut d'archéologie AÚ AV ČR de Brno ont ponctuellement surveillé les travaux d'aménagement. La première découverte d'amas de restes fauniques, en position secondaire à cause de la solifluction, date du printemps 1982. Ensuite, pendant l'été 1982, un autre amas a été découvert, composé d'ossements de faune et cette fois de pièces lithiques et a fait l'objet d'une fouille de sauvetage. La couche archéologique en position secondaire (solifluction) a été perturbée par une occupation médiévale (fosses, sépulture [Fig. 2]). Les découvertes faites dans

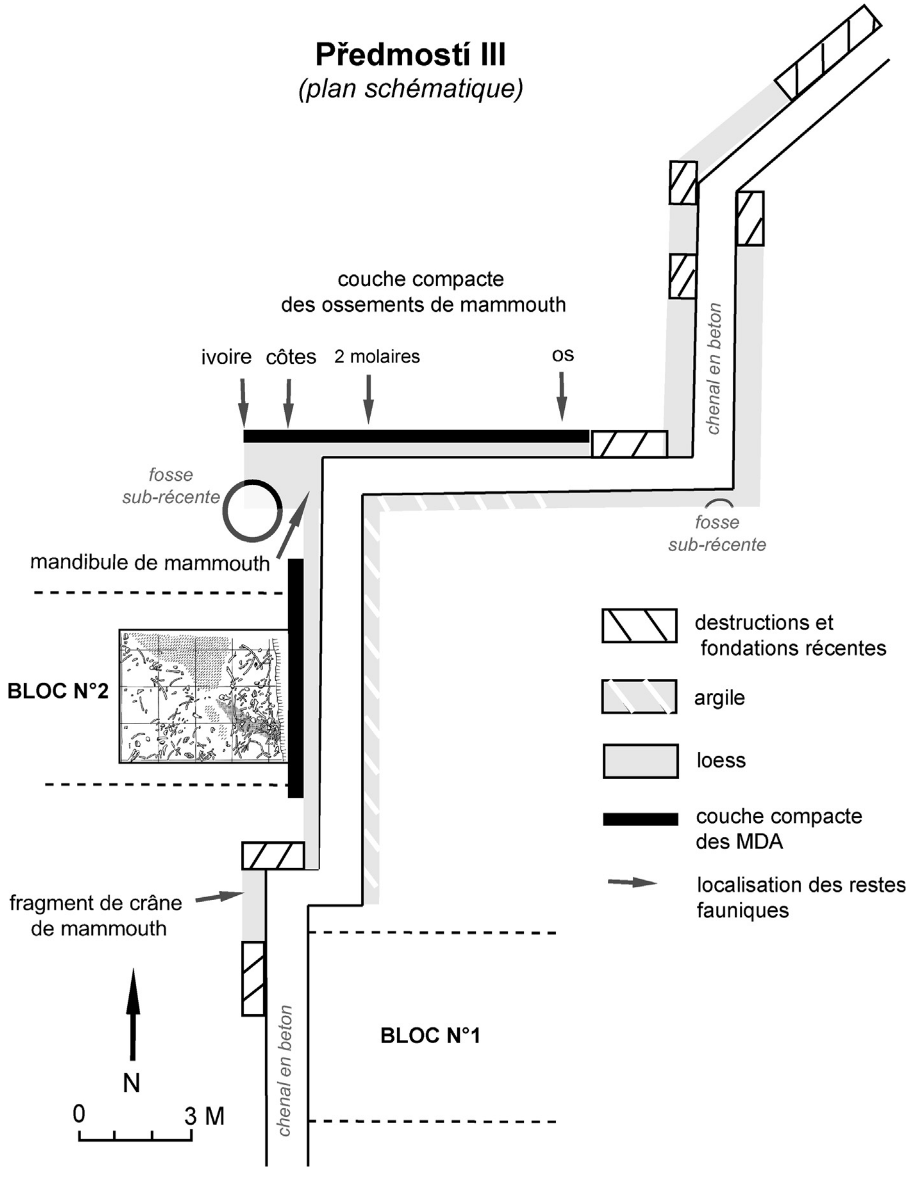

Fig. 2. Le plan de la fouille lors de la construction du bloc 1 et 2 avec l'emplacement schématique des découvertes de la faune et des vestiges sub-récents (modifié selon B. Klíma, 1983 par M. Polanská).

The scheme of excavations during the building of bloc 1 and 2 with the positions of animal remains and sub-recent findings (modified after B. Klíma, 1983 by M. Polanská).

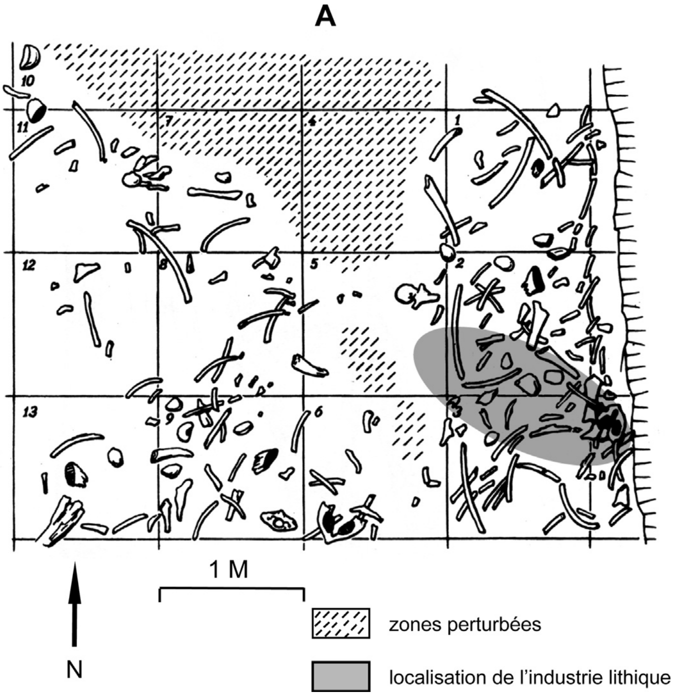

Fig. 3. Le plan de décapage avec l'emplacement de l'industrie lithique (modifié d'après B. Klíma, 1985 par M. Polanská).
The scheme of excavations with designed position of lithic industries (modified after B. Klíma, 1985 by M. Polanská).

la partie centrale de l'une des coupes ont justifié l'ouverture d'un décapage horizontal sur 4 m^2 (Fig. 3). La couche fouillée a livré en plus des artefacts mentionnés, quelques charbons de bois et de l'ocre rouge. Pour résumer, le matériel recueilli en 1982 provient de plusieurs zones situées à proximité les unes des autres, mais nous ne connaissons pas l'extension exacte de la surface fouillée (sans doute plus de 4 m^2 [Fig. 2]).

Le matériel recueilli en 1983 provient également de plusieurs endroits. En janvier, le décapage de l'accumulation de restes fauniques a continué sur une surface de 7 m^2 (matériel en position secondaire) et n'a livré qu'une industrie lithique peu abondante (Fig. 3). Parmi les artefacts les plus intéressants, soulignons la présence d'un objet en ivoire de mammouth souvent interprété comme un percuteur ou un retouchoir. Pendant l'automne 1983, des travaux d'aménagement menés sur la conduite d'eau chaude et autour de l'église ont été suivis par les archéologues. Ainsi, le long du conduit ont pu être mis en évidence les restes de la faune, répartis sur une distance de 25 m de long.

2.1.2. Fouilles de Z. Schenk de 2005

En août et en septembre 2005, lors du réaménagement d'une canalisation, de 3 m de long, dans la partie nord de la rue Hranická à Přerov-Předmostí, une accumulation a été mise au jour et a livré exclusivement des restes fauniques (Nývltová-Fišáková et Schenk, 2006; Schenk et Mikulík, 2013).

2.1.3. Fouilles de J. Svoboda de 2006 (Svoboda et al., 2007; Svoboda, 2013a,b)

En 2006, un sondage couvrant une surface de 2 × 2 m, sur une profondeur de 3,3 m a été réalisé dans la rue Teličkova à Přerov–Předmostí (à proximité des commerces actuellement situés sous le parking, à quelques mètres des sondages de 1982–83 de B. Klíma, et en connexion avec les fouilles de 2005 de Z. Schenk [Fig. 1]). Le mobilier recueilli est composé de faune et de malacofaune.

2.2. *Données stratigraphiques*

Une corrélation des deux coupes stratigraphiques, une située dans la partie centrale du site (fouilles B. Klíma) et une autre située sur la périphérie de Předmostí III (fouilles de Z. Schenk et de J. Svoboda) permet de réaliser une synthèse (Fig. 4).

2.2.1. *Partie centrale du site*

Dans la partie centrale du site, B. Klíma (B. Klíma, 1983, 1984 ; rapport 343/83) a décrit la séquence stratigraphique suivante (Fig. 4) :

- sol récent ou argiles redéposées (40–45 cm d'épaisseur) ;
- lœss supérieur avec fragments calcaires (80 cm d'épaisseur) ;
- couche culturelle formée par des argiles finement stratifiées, redéposées dans un milieu humide, avec des dépôts d'ossements et des artefacts (jusqu'à 30 cm d'épaisseur) ;
- argiles lœssiques avec des horizons limoneux jaunes, gélifiés (50–60 cm épaisseur) ;
- substrat formé par des graviers et du sable.

La couche culturelle (couche 3) est composée de plusieurs microcouches et est structurée en lentilles irrégulières de coloration variable. Elle est formée par des argiles qui atteignent parfois 30 cm d'épaisseur. Étant donné la faible profondeur d'enfouissement, la couche culturelle a été perturbée par différentes activités d'aménagement et des constructions plus récentes et subrécentes.

2.2.2. *Périphéries du site*

La séquence stratigraphique mise au jour sur les périphéries du site en 2005 (Nývltová-Fišáková et Schenk, 2006) et en 2006 (3,2 m de profondeur ; Svoboda et al., 2007, 2013) paraît plus complexe (Fig. 4). La couche culturelle, peu développée par rapport à celle de la partie centrale et contenant des ossements, a été protégée par d'épaisses redépositions d´âge sub-actuel et récent (couches 1–9). Une mince couche du lœss supérieur (couche 10) repose directement sur les limons jaunâtres de la base (couche 11). Les phénomènes de structuration en microcouches suivie par leur redéposition sont analogues à ceux observés dans la partie centrale au même niveau. Il s'agit d'après J. Demek d'une congelifluction sous conditions humides (Svoboda et al., 2007) :

- argiles marron clair (humus) (15–20 cm d'épaisseur) ;
- argiles brunes foncées (2–3 cm) avec des débris (10 cm d'épaisseur) ;
- limons lœssiques redéposés formant des lentilles (5 cm d'épaisseur) ;
- argiles brunes foncées avec des débris (max. 10–15 cm), des fragments de briques, du fer, et d'autres objets d'âge sub-actuels et interstratifiés avec des lentilles lœssiques (80–100 cm d'épaisseur) ;
- gravier (5–10 cm d'épaisseur) ;
- limons lœssiques, redéposés (10–20 cm d'épaisseur) ;
- argiles brunes foncées avec des fragments de briques et des charbons de bois (10–20 cm d'épaisseur) ;

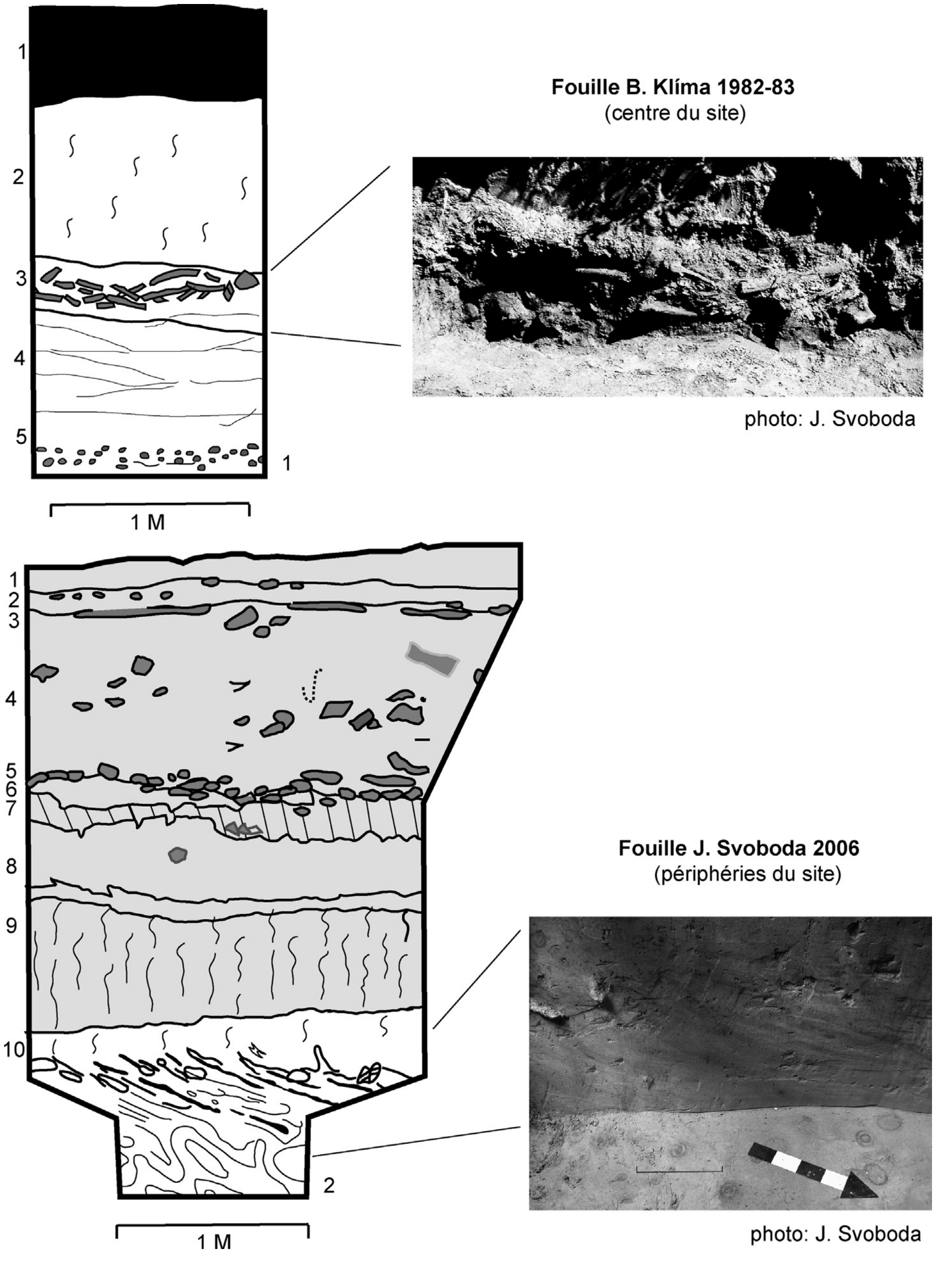

Fig. 4. Les profils stratigraphiques mis au jour lors des fouilles de 1982 à 1983 et 2006 (n° 1 modifié d'après B. Klíma, 1983 par M. Polanská et J. Svoboda).
The stratigraphic profiles founded during the excavations in 1982–83 and 2006. (No.1 modified after B. Klíma, 1983 by M. Polanská and. J. Svoboda).

- argiles marron clair avec de rares fragments de briques et de charbons de bois (30–40 cm d'épaisseur) ;
- limons lœssiques ocreux avec des débris (max. 3 cm) et du gravier (50–60 cm d'épaisseur) ;
- lœss clair, avec des Mn-concrétions et des textures post-cryogéniques probablement causés selon J. Demek par le permafrost (15–20 cm d'épaisseur) ;
- limons argileux et poussiéreux, finement stratifiés par des mouvements plastiques suivant la pente (congélifluction) dans un milieu humide, et continuant plus profondément dans le sous-sol.

Les analyses des pollens réalisées par V. Jankovská sont sans résultats. Les restes des vertébrés ont été localisés entre ces limons et le lœss supérieur (couches 10/11) ainsi que les mollusques dominants *Succinella oblonga* DRAP et *S. O. elongata* SNDB, le fragment d´un helicidé *Trichia* sp. ou *Helicopsis striata* (MÜLL.), et *Vallonia tenuilabris* (BR.) (Kovanda in Svoboda et al., 2007). La composition de la faune confirme à la fois un climat froid et humide.

3. La faune

Les restes fauniques ont été mis au jour pendant les campagnes de fouille de sauvetage. Les plus importantes découvertes ont été faites pendant les fouilles de B. Klíma. Malheureusement, jusqu'à maintenant, nous n'avons pu localiser et étudier uniquement qu'une partie des restes fauniques.

3.1. Centre du site

La faune actuellement disponible à l'étude provenant des années de fouille de 1982–83 de B. Klíma comprend 179 fragments de restes de mammifères (Fig. 5, Tableau 1). Incontestablement, l'espèce la plus représentée est le mammouth (*Mammuthus primigenius ; NMI = 140*), au moins représenté par 2 individus de catégorie *juvenilis* et 2 de catégorie *subadultus/adultus*. L'importante fragmentation ne permet plus la subdivision de cette dernière. Les restes fauniques sont dominés par des fragments de côtes, des fragments crâniens, des mâchoires inférieures, des molaires, des vertèbres (surtout des atlas), puis d'autres os des membres, en particulier leurs parties distales, comme les os du carpe (*os magnum*, dx.), du

Fig. 5. Exemples de la faune de Předmostí III : 1 molaire provisoire de mammouth, 2 incisives de renard avec cassure post-dépositionelle (dessin : B. Klíma, photo S. Sázelová).
Selected examples of animal remains at Předmostí III: 1 deciduous molar of mammoth, 2 fox incisor with post-depositional breakage (drawing by B. Klíma, photo by S. Sázelová).

Tableau 1
Classement des restes fauniques selon les espèces (fouilles 1982–83), pour le moment accessibles à l'Institut d'Anthropos (Musée Morave) de Brno et de l'Institut d'archéologie AV ČR de Brno.
Animal remains assigned to species (excavations in 1982–1983), which are partly accessible at Institute of Anthropos (Moravian museum) in Brno and at Institute of archaeology at academy of Sciences of Czech Republic in Brno.

	Mammuthus primigenius		*Canis lupus*	*Equus ferus*	*Vulpes vulpes/ V. lagopus*
	J	S/A			
Crâne et dents supérieures	2	6			
Mandibule et dents inférieures	2	3			1
Dents indéterminées et fragments de lamelles d'ivoire		13			
Fragments d'ivoire		1			
Vertèbres	1	7			
Côtes		49			
Humérus	1				
Radius	1		1		
Ulna	1				
Carpes/tarses	1	7		1	
Métacarpes		1			
Pelvis	1	2			
Patela		2	1		
Fibula		1			
Phalanges		1			
Fragments d'os longs		2			
Fragment d'os		40			
Total	10	135	2	1	1

métacarpe (*metacarpus III*, dx.), du tarse (*astragalus*, sin., deux *os naviculare*, sin.) et les phalanges (*phalanx III*). Les os des autres espèces restent sporadiques, notamment ceux du loup (*Canis lupus*), du cheval (*Equus ferus ;* dont *os lunatum)*, ainsi qu'une canine inférieure d'un renard (*Vulpes vulpes/V. lagopus*). Ensuite, l'ensemble est composé de 22 fragments de côtes et d'os longs attribués à la catégorie des grands, voire extra grands mammifères et un fragment de côte d'un mammifère de taille moyenne, 8 fragments des restes fauniques sont non diagnostiqués (Lavocat, 1966; Ziegler, 2001).

D'un point de vue taphonomique, la position stratigraphique de la faune (en microcouches ou en forme de lentilles) était perturbée par la solifluction. Certains os ont été mis au jour verticalement, en position perturbée (Klíma, 1983, 1984, 1985). Peu de restes fauniques présentent des dégradations liées au processus de *weathering*, ce qui pourrait indiquer l'enfouissement assez rapide sous la terre et le contact minime des racines. Quelques fragments d'ivoire présentent de possibles traces d'impacts ce qui reste à vérifier ultérieurement. B. Klíma (Klíma, 1985) signale la présence d'os brûlés dans les alentours du bloc 2. Malheureusement, cette faune n'a pas été retrouvée pour le moment.

3.2. Périphéries du site

En 2005, lors des fouilles de sauvetage de Z. Schenk sur la périphérie du site, le matériel paléontologique a été mis au jour à une profondeur de 2,40 m (le sédiment était fortement perturbé par la gélifluxion). La faune comprenait quelques dizaines d'os, ainsi que des dents.

M. Nývltova Fišákova a suggéré l'attribution des restes fauniques à au moins un individu mammifère : soit le mammouth (*Mammuthus primigenius*), soit le cheval (*Equus ferus*), soit le loup (*Canis lupus*). Les restes indéterminés sont répartis entre les catégories des mammifères de taille moyenne et des grands mammifères. La présence du mammouth est attestée grâce à des fragments (mâchoire inférieure, des dents, des vertèbres cervicales), des parties apicales des membres (os d'autopodium) et d'autres os indéterminés. Le cheval est représenté par des fragments crâniens, des côtes, des os du bassin et du carpe, puis quelques restes d'os longs (Nývltová-Fišáková et Schenk, 2006). Cet ensemble provenant de la périphérie du site a été enrichi en 2006 par la découverte de fragments d'os de mammouth et d'autres os indéterminés (Svoboda et al., 2007).

3.3. Interprétations

Étant donné le caractère fragmentaire de l'étude, le manque d'informations spatiales, le non-tamisage du sédiment pendant les fouilles, ainsi que la présence de restes fauniques riches et pauvres en viande, nous supposons la réalisation des activités complexes sans pouvoir donner plus d'interprétations.

4. Corpus lithique (fouilles B. Klíma de 1982–1983)

L'industrie lithique de Předmostí III provient des fouilles de sauvetage de 1982 et 1983 réalisées pendant l'aménagement du canal de l'eau chaude entre les blocs 1 et 2 d'habitation.

Le mobilier lithique étudié issu de ces fouilles est numériquement limité, mais fournit des informations sur l'attribution culturelle du site.

4.1. L'interprétation de B. Klíma (Klíma, 1983, 1984, 1985)

Selon B. Klíma il s'agit « *...d'une collection typologiquement intéressante et homogène...qui contient des types intéressants et montrent des marques technologiques de débitage caractéristiques pour l'évolution du Tardiglaciaire* ». Néanmoins, comme la collection lithique provient d'un contexte de PKI, cela exclut son rattachement aux occupations du Magdalénien, du Tardiglaciaire ou du Mésolithique.

Les trois artefacts brûlés en roche siliceuse témoigneraient de l'utilisation du feu, identifiable également par des traces visibles sur plusieurs ossements et la présence de taches charbonneuses soliflués. Les artefacts lithiques présentent une inclinaison verticale et ont été retrouvés, soit parmi les ossements de mammouths, soit dans la partie basse de l'horizon archéologique et notamment dans le sillon formé par l'érosion (Fig. 3). B. Klíma interprète l'ensemble comme un atelier spécialisé.

4.2. Étude

Selon les notes de B. Klíma, 270 artefacts lithiques taillés proviennent des fouilles de 1982 (Fig. 6), et quelques-uns seulement de celles de l'année 1983[3] (Fig. 7 ; Klíma, 1984, 1985). Du fait d'un inventaire partiel du matériel lithique, nous sommes aujourd'hui dans l'incapacité de

[3] B. Klíma ne mentionne pas le nombre exact d'artefacts lithiques provenant de la fouille de 1983.

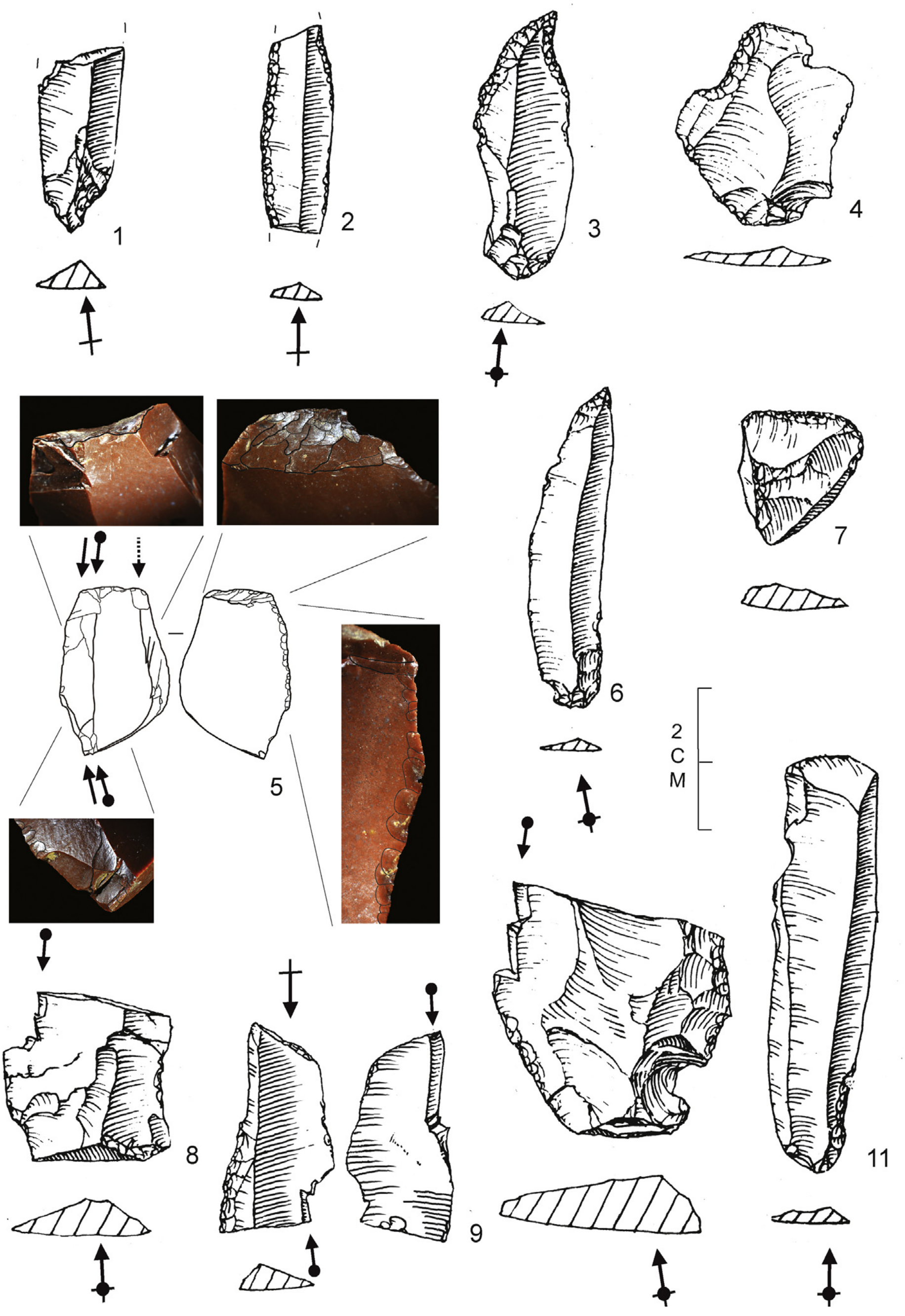

Fig. 6. Divers outils découverts lors des fouilles de 1982 (dessins : 1–4, 6–11 B. Klíma, 5 M. Polanská).
Selected lithic tools founded in 1982 (drawings 1–4, 6–11 B. Klíma, 5 M. Polanská).

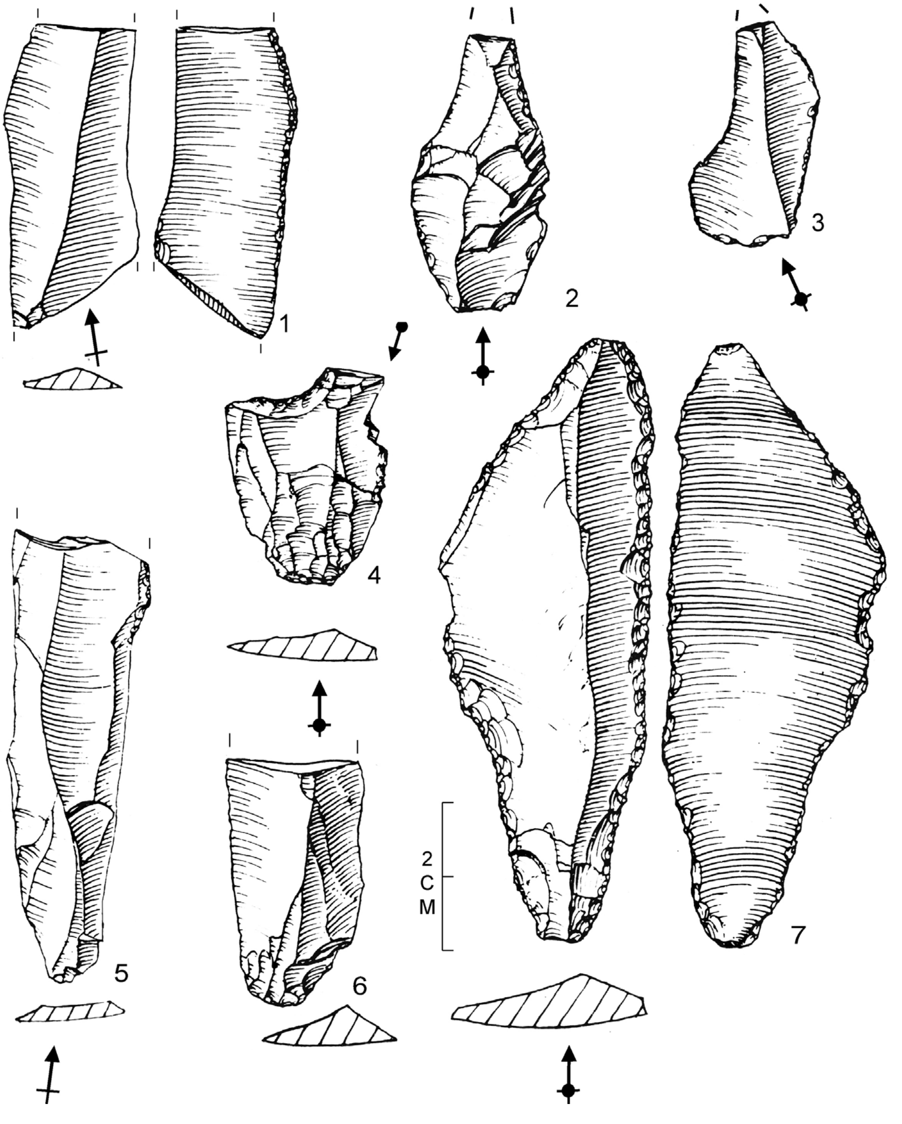

Fig. 7. Divers outils découverts lors des fouilles de 1983 (dessins : 1–4, 6–11 B. Klíma, 5 M. Polanská).
Selected lithic tools founded in 1982 (drawings: 1–4, 6–11 B. Klíma, 5 M. Polanská).

déterminer l'année de découverte exacte pour une partie du matériel : 133 artefacts lithiques taillés proviennent de 1982, 10 de 1983 et 170 n'ont pas de numéros d'inventaire (Tableau 2). Le matériel recueilli en 1982 et en 1983 provient probablement de zones plus ou moins en connexion, mais pour lesquelles, en l'absence de remontages, nous ne disposons pas d'informations permettant d'étayer l'hypothèse de leur contemporanéité. Aussi, nous les avons traitées comme deux ensembles différents (ensemble 1–fouille de 1982, ensemble 2–fouille de 1983).

Tableau 2
Předmostí III. Classement technologique de l'industrie lithique provenant des fouilles de 1982–83 (numéros inventoriés) et des artefacts non inventoriés pouvant provenir des deux années de fouilles.
Předmostí III. Technological classification of lithics excavated in 1982–1983 (with inventory numbers) and artefacts without inventory numbers, which were excavated in same period.

	Fouille 1982	Fouille 1983	Artefacts sans numéro d'inventaire	Total
Brut	115	3	170	288
Outils *stricto-sensu*	14	3		17
Outils possibles	4	4		8
Total	133	10	170	313

4.2.1. *Matières premières*

La majorité des artefacts lithiques taillés est débitée dans de la radiolarite grise foncée et dans de la radiolarite verte-jaunâtre (Tableaux 3 et 4). Dans les deux cas, la matière première est introduite sur le site sous forme de petits galets, dont la provenance reste pour le moment en question. Les gisements primaires de cette matière première se situent en Slovaquie occidentale et centrale (Vršatecké Podhradie, Podbranč, Brodno), à Mauer près de Wien en Autriche ou secondairement dans les graviers du Danube (Přichystal, 2009). Toutefois, la radiolarite est également disponible en Moravie, notamment sous forme de petits galets (5 à 6 cm) dans les graviers à Karpatská předhlubeň (Vallée de Haute et Basse Moravie, Bassin d'Ostrava). Leur localisation sous cette forme de petits nodules est signalée à Stará Ves près de Přerov (Přichystal, 2009). L'étude de la provenance de ces galets, fortement roulés doit être approfondie par une analyse pétrographique. Mais, leur importation à Předmostí III sous cette forme soulève la question des différences dans les stratégies d'approvisionnement par cette matière première (par exemple sous forme de galets roulés des positions secondaires situés peut être en Moravie ou sous forme de plaquettes tectoniques des gisements primaires des Carpates Blancs).

Tableau 3
Předmostí III (fouille 1982). Classement technologique de l'industrie lithique inventoriée (ensemble 1).
Předmostí III (excavation in 1982). Technological classification of inventorized lithics (assembledge 1).

	Radiolarite	Silicite indéterminée	Silicite erratique	Total
Brut	109	5	1	115
Outils *stricto-sensu*	10	4		14
Outils possibles	3	1		4
Total	122	10	1	133

Tableau 4
Předmostí III (fouille 1983). Classement technologique de l'industrie lithique inventoriée (ensemble 2).
Předmostí III (excavation in 1983). Technological classification of inventorized lithics (assembledge 2).

	Radiolarite	Silicite indéterminée	Silicite erratique	Total
Brut	2	1		3
Outils *stricto-sensu*	2	1		3
Outils possibles	2	1	1	4
Total	6	3	1	10

La radiolarite rouge typique est peu représentée sur le site, et il est impossible de préciser son mode d'importation : a-t-elle été ramassée dans la rivière, taillée sur place ou importée individuellement ? Les autres silicites, y compris la silicite erratique (apportée des moraines), sont représentées sur le site et elles ont probablement été importées. La spongolite et le grès silicifié à glauconite ne sont présents chacun que par une seule pièce.

Les résultats présentés sont biaisés, car le site n'a fait l'objet que d'une surveillance ponctuelle. En conséquence, une partie de la couche culturelle a sûrement été emportée lors de la construction des bâtiments et des différents travaux d'aménagements.

4.2.2. L'approche technologique

La collection de Předmostí III livre donc 3 séries (ensemble 1 et 2, série des pièces sans numéros d'inventaires), certes limitées d'un point de vue quantitatif, mais cohérentes d'un point de vue culturel et des matières premières. L'ensemble 1 se compose de 133 artefacts lithiques taillés, dont 115 bruts, 14 outils *stricto-sensu*, et 4 outils possibles (à retouche d'utilisation). L'ensemble 2 est représenté par 10 artefacts, dont 3 bruts, 3 outils *stricto-sensu* et 4 outils possibles (à retouche d'utilisation ; Tableau 4). Il nous est impossible de développer une approche approfondie visant l'étude des systèmes techniques, mais néanmoins nous pouvons effectuer quelques observations typologiques et technologiques.

4.2.2.1. Outils stricto-sensu *et outils possibles.* Toute la collection fournit de maigres indices typologiques. Les outils *stricto-sensu*, majoritairement des burins (2 burins d'angle et 2 burins sur cassure), sont peu représentés dans l'ensemble 1 (Tableau 5).

Les autres outils (à l'exception des microlithes) sont représentés par un seul exemplaire. Le microlithe géométrique (Fig. 8 : 9) et le couteau de Kostienki double (Fig. 6 : 5) sont sans aucun doute les outils les plus diagnostics. Pour ce dernier, les coups de raffûtage sont donnés sur une troncature inverse située à l'une des extrémités. L'un d'eux est outrepassé et a emporté une partie de l'autre extrémité. Cette surface a ensuite servi de plan de frappe pour les autres coups débordants sur la face supérieure du support. Ces coups servent à raffûter le bord qui porte des retouches d'utilisation sur la face inférieure (Fig. 6 : 5 ; pour voir la définition précise voir Lev et al., 2009).

Les microlithes et les armatures sont représentés par 5 pièces (Fig. 8). Le microlithe géométrique est taillé dans de la silicite indéterminée à patine blanche (Fig. 8 : 9). Cet artefact est un exemplaire typique, récemment décrit à Předmostí Ib et à Pavlov I (Polanská, thèse en cours ;

Tableau 5
Předmostí III (fouille 1982). Classement de l'outillage *stricto-sensu* (ensemble 1).
Předmostí III (excavation in 1982). Classification of retouched tools stricto-sensu (assembledge 1).

	Radiolarite	Silicite indéterminée	Total
Burin	4		4
Lame retouchée/1 bord		1	1
Lamelle retouchée/1 bord	2	1	3
Lamelle retouchée/2 bords		1	1
Microlithe géométrique		1	1
Couteau de Kostenki	1		1
Outil indéterminé	2		2
Lame appointée ou bec ?	1		1
Total	10	4	14

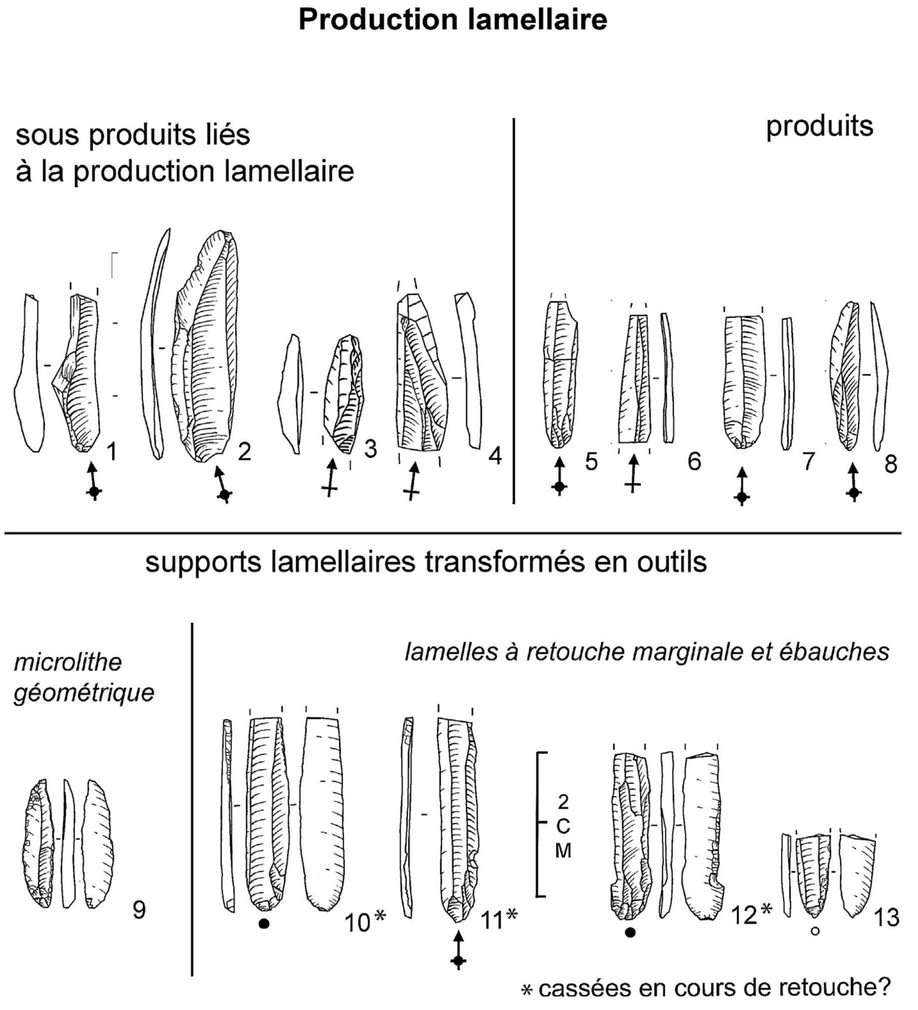

Fig. 8. Divers artefacts liés à l'industrie lamellaire (dessins : M. Polanská).
Selected artifacts' in the context of bladelet industry (drawings by M. Polanská).

Polanská, 2013). Dans le cas présent, il s'agit d'un exemplaire polarisé. Sa base asymétrique est définie à la fois par un bord à bord abattu (droit, à retouche marginale directe) et par une troncature directe oblique. Son extrémité appointée est affûtée par une retouche directe marginale partielle.

Les deux autres lamelles retouchées sont en radiolarite : l'une porte une retouche directe marginale partielle et l'autre est aménagée par une retouche inverse courte partielle. Il est possible que les deux aient été abandonnées en cours de retouche (Fig. 8 : 10,12).

L'assemblage a également livré deux autres lamelles : un fragment d'une lamelle à retouche directe marginale et une à retouche directe marginale bilatérale. Notons enfin la présence d'un petit bec ou une petite lame appointée.

Au final, parmi les outils découverts dans l'ensemble 1, 12 sont sur lame ou lamelle et 2 sur éclat.

Tableau 6
Předmostí III (fouille 1982). Classement de l'outillage possible (ensemble 1).
Předmostí III (excavation in 1982). Classification of possible tools (assembledge 1).

	Radiolarite	Silicite indéterminée	Total
Lamelle à retouche d'utilisation probable/1 bord	1	1	2
Éclat laminaire à retouche d'utilisation probable/1 bord	1		1
Éclat à retouche d'utilisation probable/1 bord	1		1
Total	3	1	4

Tableau 7
Předmostí III (fouille 1983). Classement de l'outillage *stricto-sensu* (ensemble 2).
Předmostí III (excavation in 1983). Classification of retouched tools stricto-sensu (assembledge 2).

	Radiolarite	Silicite indéterminée	Total
Burin	1		1
Lame retouchée/2 bords		1	1
Outil indéterminé	1		1
Total	2	1	3

Les possibles outils de l'ensemble 1 sont au nombre de 4 : 1 éclat, 1 éclat laminaire et 2 lamelles (Tableau 6).

L'ensemble 2 est composé de 3 outils *stricto-sensu*, deux en radiolarite (burin cassé sur lame, un outil indéterminé ; Tableau 7) et puis une lame irrégulière, légèrement arquée, à retouche bilatérale (c'est l'outil le plus long de Předmostí III). La retouche est directe, continue, longue par endroit. L'extrémité distale est tronquée par une retouche inverse très courte, de ce fait elle est classée parmi des lames retouchées et non pas parmi des troncatures (Fig. 7 : 7).

Les outils possibles sont représentés dans l'ensemble 2 par 3 exemplaires probables à retouche d'utilisation. Deux ont été aménagés sur lame et un sur un sur éclat laminaire (Tableaux 8 et 9).

4.2.2.2. Production lamino-lamellaire. L'ensemble 1 de la collection de Předmostí III a livré 115 pièces brutes (Tableau 9), l'ensemble 2 a livré 3 artefacts et l'industrie (Tableau 10) sans numéros d'inventaire a livré 170 pièces (Tableau 11). Au total, 37 pièces ont une taille inférieure à un centimètre.

Il semblerait que l'un des objectifs du débitage soit la production des lamelles en radiolarite in situ (Fig. 8). En pratique, il nous est possible de différencier les artefacts liés à cette production lamellaire (reconnue dans l'ensemble 1 et dans l'ensemble sans numéros d'inventaire), puisqu'ils sont faits en radiolarite, dont la couleur varie de jaunâtre à vert. Il s'agit de la production unipolaire de lamelles axiales, minces, aux bords parallèles et réguliers (Fig. 8 : 5, 7, 10–13). Les

Tableau 8
Předmostí III (fouille 1983). Classement de l'outillage possible (ensemble 2).
Předmostí III (excavation in 1983). Classification of possible tools (assembledge 2).

	Radiolarite	Silicite indéterminée	Silicite erratique	Total
Lame à retouche d'utilisation/1 bord		1	1	2
Éclat laminaire à retouche d'utilisation probable/1 bord	1			1
Total	1	1	1	3

Tableau 9
Předmostí III. Classement technologique de l'industrie lithique brute provenant de la fouille de 1982 (ensemble 1).
Předmostí III. Technological classification of non-retouched lithics excavated in 1982 (assembledge 1).

	Radiolarite	Silicite indéterminée	Silicite erratique	Total
Lame/plein débitage	1	2		3
Lame/indéterminée	2			2
Lame/mise en forme	1			1
Lamelle/plein débitage	14	2		16
Lamelle/indéterminée	4			4
Lamelle de bord	2		1	3
Lamelle de bord/pan cortical	1			1
Lamelle à crête	1			1
Lamelle sous-crête	1			1
Lamelle néo-crête	1			1
Lamelle de burin/pan revers	1			1
Éclat/allongé	6			6
Éclat/indéterminé > 1 cm	16			16
Éclat < 50 % cortex	8			8
Éclat > 50 % cortex	3			3
Éclat/dégrossissage	8			8
Éclat à crête	6			6
Éclat/néo-crête	1			1
Éclat/sous néo-crête	1			1
Éclat/aménagement crête	7			7
Éclat/mise en forme	17			17
Éclat/ouverture de plan de frappe	1			1
Casson > 1 cm	3			3
Tablette	1			1
Chute de burin	3			3
Total	110	4	1	115

Tableau 10
Předmostí III. Classement technologique de l'industrie lithique brute provenant de la fouille de 1983 (ensemble 2).
Předmostí III. Technological classification of non-retouched lithics excavated in 1983 (assembledge 2).

	Radiolarite	Silicite indéterminé	Chert du type KL ?	Total
Lame/cortex			1	1
Lame/sous crête	1			1
Éclat/aménagement de crête		1		
Total	1	1	1	1

4 lamelles sélectionnées comme les supports de microlithes suggèrent le débitage dans l'axe central de la table lamellaire, le long de deux (d'où sections quadrangulaires, Fig. 8 : 5, 10–13) ou d'une nervure parallèle (Fig. 8 : 6, 7 exemplaires brutes). Le remontage de tablette de ravivage axiale (percutée à partir de la surface de débitage, Fig. 9 : 1) illustre l'installation et la progression du débitage frontal sur petit galet, à table lamellaire cintrée et au plan de frappe lisse et incliné (Fig. 10). Quelques produits liés à la production lamellaire témoignent des opérations de cintrage réalisées à partir de l'un des flancs (enlèvements de cintrage proximal ou distal (Fig. 8 : 4, 8) ou d'autres moyens d'entretien comme des néo-crêtes (Fig. 8 : 3). Les données morphométriques des microlithes montrent la recherche de support allant de 4 à 6 mm de largeur pour 2 à 3 mm

Tableau 11
Předmostí III. Classement technologique de l'industrie lithique brute (artefacts sans numéros d'inventaire).
Předmostí III. Classement technologique de l'industrie lithique brute (artefacts sans numéros d'inventaire). Předmostí III. Technological classification of non-retouched lithics (without inventory numbers).

	Radiolarite	Silicite indéterminée	Grès silicifié avec glauconite	Total
Éclat indéterminé < 1 cm	34	1		35
Casson < 1 cm	20			20
Éclat indéterminé > 1 cm	58		1	59
Casson > 1 cm	29			29
Éclat < 50 % cortex	2			2
Éclat > 50 % cortex	12			12
Éclat/dégrossissage	2			2
Éclat à crête	3			3
Éclat/aménagement de crête	4			4
Éclat de mise en forme	2			2
Éclat de retouche		2		2
Total	166	3	1	170

d'épaisseur (Fig. 11 et 12). Toutefois, il semblerait que le seuil entre la production lamellaire et la production laminaire se situe vers 10 mm de largeur et l'épaisseur à partir de 3 mm pour les lames (Fig. 11). Rien n'indique l'existence d'autres schémas de production des lamelles sur le site, notamment concernant la production des supports des microlithes géométriques[4]. Le seul microlithe géométrique de la collection est fait dans une silicite indéterminée à patine blanche (Fig. 8 : 9), ainsi que quelques artefacts bruts ou aménagés, qui présentent parfois les cassures dues au débitage (importés ou produits sur le site ?).

Le croisement des données dimensionnelles de l'ensemble 1 et de l'ensemble sans numéros d'inventaire confirment les observations effectuées sur la composition des matières premières des deux ensembles. Une majorité des produits lamino-lamellaires sans numéros d'inventaire provient à l'origine de l'année de fouille de 1982, comme le suggère à première vue le débitage sur la radiolarite jaunâtre (Fig. 13). Il semblerait que les dimensions plus importantes des artefacts de l'ensemble 2 sont probablement dues aux modes d'acquisition[5]. Il n'y pas de différences dimensionnelles saisissables selon les artefacts débités dans différentes matières premières, à part la présence d'un fragment mésial d'une lame massive en silicite indéterminée (Fig. 14–16).

Concernant le débitage laminaire, nous en sommes réduits à quelques observations. Il semble que l'unipolarité (sauf Fig. 7 : 5) soit la règle avec une préférence pour les volumes étroits ou relativement cintrés, les produits sont légèrement courbes. L'observation des talons (en majorité lisses, bien abrasés, voir émoussés) suggère des plans de frappe plutôt lisses et obliques.

La production lamellaire est caractérisée, pour la majorité des pièces, par une longueur variant entre 15 et 40 mm, avec un pic situé entre 25 et 30 mm (ensemble 1 et ensemble sans numéro

[4] La question des productions distinctes des lamelles pour aménager des armatures axiales et la production des supports caractéristiques des microlithes géométriques est actuellement en cours à Pavlov I (Polanská, thèse en cours).

[5] Il est possible que la série de l'ensemble 1 et celle sans numéro d'inventaire qui semblent assez fine, proviennent pour la plupart de la même année de fouille. Les artefacts jugés « intéressants » c'est-à-dire essentiellement des outils ou « les pièces techniques » plus diagnostiques ont été numérotés. Le reste du débitage n'a pas fait l'objet d'inventaire. Par contre les artefacts recueillis lors des fouilles de 1983 sont de plus grandes dimensions, essentiellement représentés par des outils. Ceci peut être probablement expliqué soit par rapport au mode d'acquisition moins fin, soit par une sélection d'objets.

Fig. 9. Remontages en radiolarite vert-jaunâtre de l'ensemble 1 et de la série sans numéro d'inventaire (photos M. Polanská).

Remontages from green-yellowish radiolarite from the assemblage 1 and without inventory numbers (photos by M. Polanská).

d'inventaire [Fig. 17 et 18]). Les outils provenant de l'année de fouille 1983 sont de plus grandes dimensions, avec une mesure maximale de 84,7 mm (Fig. 19).

4.2.2.3. Techniques de débitage. La détermination des techniques de détachement des supports lamino-lamellaires n'est pas systématique pour les industries d'Europe centrale. Néanmoins,

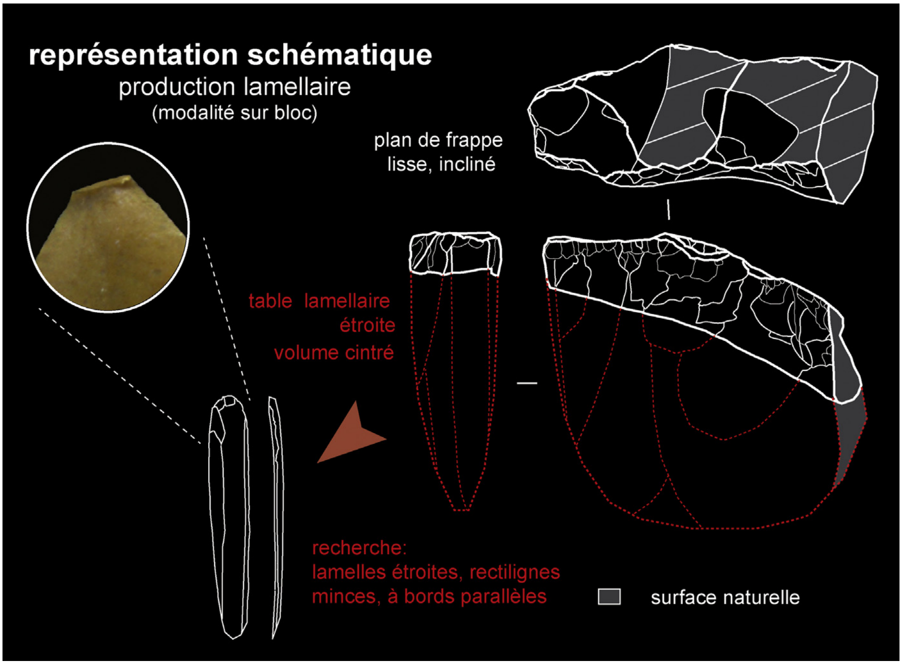

Fig. 10. Représentation schématique de la production lamellaire sur bloc à Předmostí III (DAO M. Polanská).
Schematic representation of bladelet production from the bloc from Předmostí III (CAD by M. Polanská).

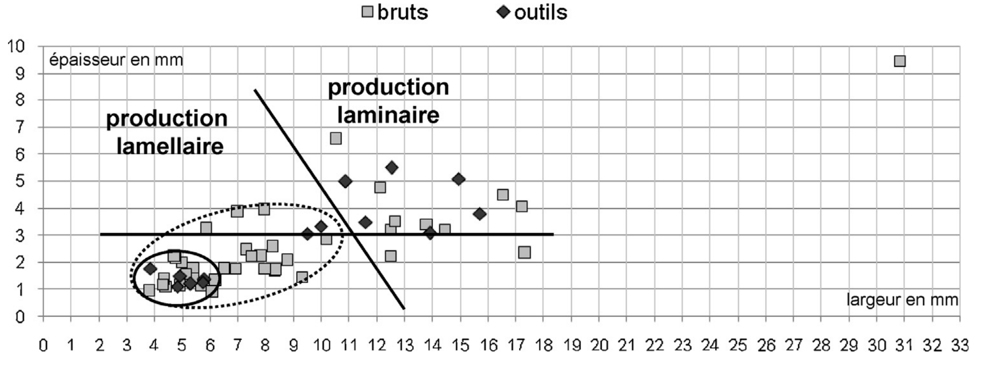

Fig. 11. Rapport entre largeur et épaisseur de l'industrie lithique provenant des fouilles de l'année 1982 (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics excavated in 1982 (blade-bladelet blanks).

pour le moment nous disposons de quelques exemples. La percussion directe au percuteur tendre organique est la technique majoritairement reconnue dans les ensembles gravettiens datés de 30/29,000 à 22,000 BP non calibré (entre autres reconnue à Pavlov I, Pavlov II, Pavlov VI, Dolní Věstonice II–Western Slope, Dolní Věstonice I, Milovice I, Milovice IV, Kašov I–Spálenisko, Banka–Horné farské role, Předmostí Ia, Ib ; Willendorf–couche 5 ; Moreau, 2009, 2012 ; Polanská, 2008, 2009, 2011, 2013).

Quelques cas de percussion tendre minérale sont toujours parallèlement identifiés parmi les produits de plein débitage ou des sous produits de production lamino-lamellaire. Étant donné le

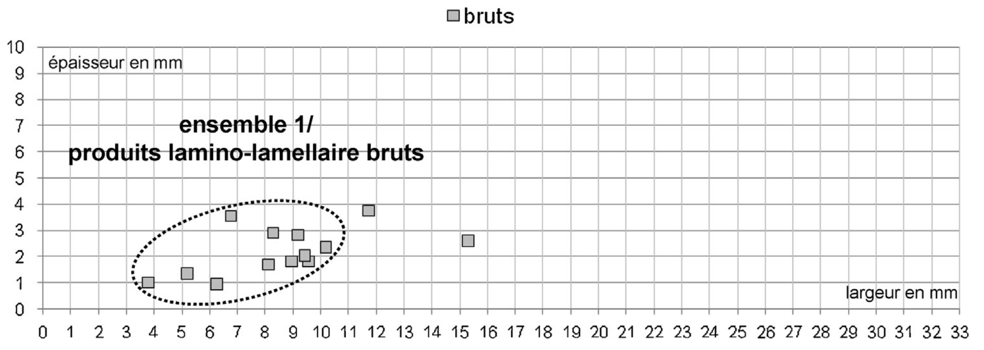

Fig. 12. Rapport entre largeur et épaisseur de l'industrie lithique sans numéro d'inventaire (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics without inventory numbers (blade-bladelet blanks).

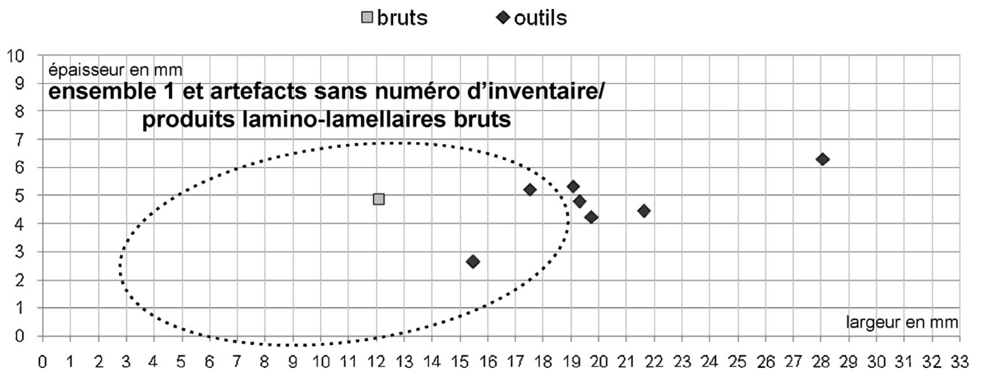

Fig. 13. Rapport entre largeur et épaisseur de l'industrie provenant des fouilles de l'année 1983 (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics excavated in 1983 (blade-bladelet blanks).

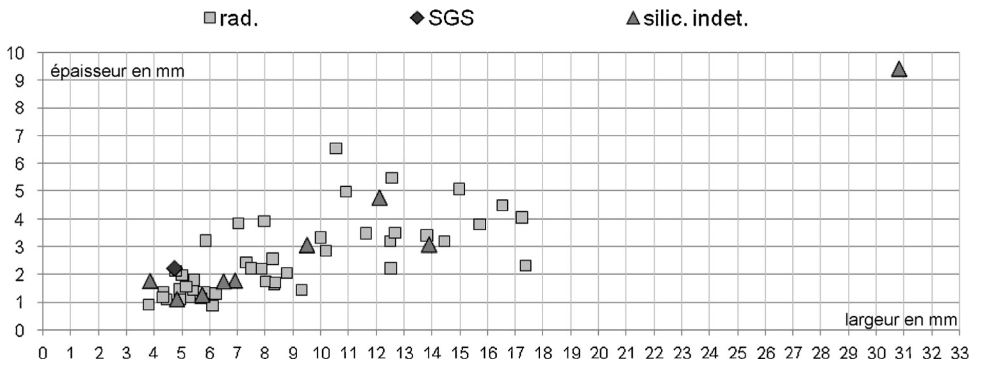

Fig. 14. Rapport entre largeur et épaisseur de l'industrie lithique provenant des fouilles de l'année 1982 (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics excavated in 1982 (blade-bladelet blanks).

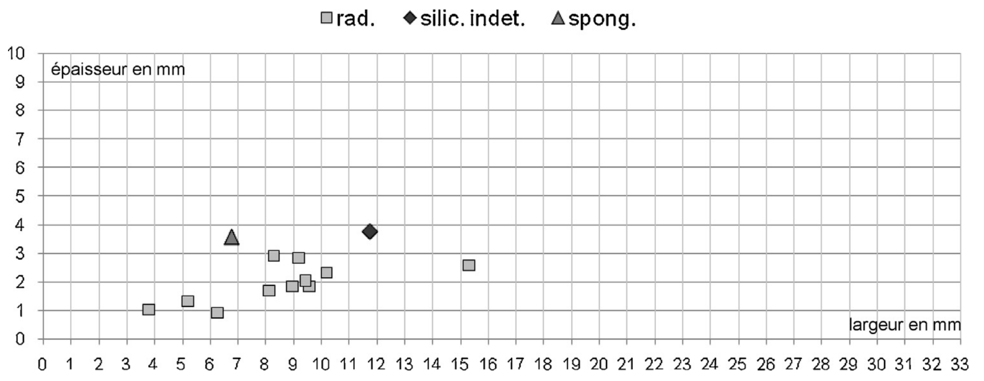

Fig. 15. Rapport entre largeur et épaisseur de l'industrie lithique sans numéro d'inventaire (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics without inventory numbers (blade-bladelet blanks).

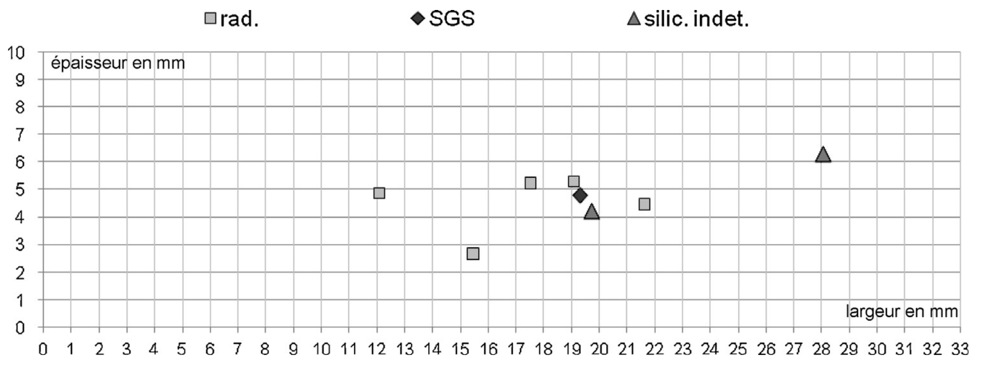

Fig. 16. Rapport entre largeur et épaisseur de l'industrie lithique provenant des fouilles de l'année 1983 (supports lamino-lamellaires).
Relation between the width and the thickness of the lithics excavated in 1983 (blade-bladelet blanks).

peu d'industrie du Paléolithique supérieur d'Europe centrale, qui ont fait l'objet de reconnaissance des techniques, nous sommes forcés d'aller chercher des points de comparaison dans le Gravettien occidental. À titre d'exemple, dans le Gravettien français, le tableau des techniques est plus diversifié (Klaric, 2003; Pelegrin, 2012). L. Klaric a identifié l'utilisation du percuteur tendre minéral dans certaines séries gravettiennes du nord de la France et de Belgique et la percussion tendre organique dans les séries du sud de la France (Klaric, 2004). Pour le moment, l'état des recherches sur la question en Europe centrale ne permet pas discuter des changements des techniques au cours du Paléolithique supérieur. À titre indicatif, nous connaissons une seule collection où le débitage au percuteur tendre minérale est majoritaire. Il s'agit de la collection du ramassage de surface de Dolná Krúpa (Slovaquie occidentale). Le matériel lithique homogène, fait en partie sur le silex jurassique de Krakow pour produire de petites lames fines, ne permet malheureusement pas d'attribution culturelle plus précise.

Les observations effectuées à Předmostí III sont en concordance avec celles observées sur les autres sites gravettiens.

Les critères qui ont permis notre diagnostic à Předmostí III se basent sur ceux décrits par J. Pelegrin (Pelegrin, 2000 : 77) :

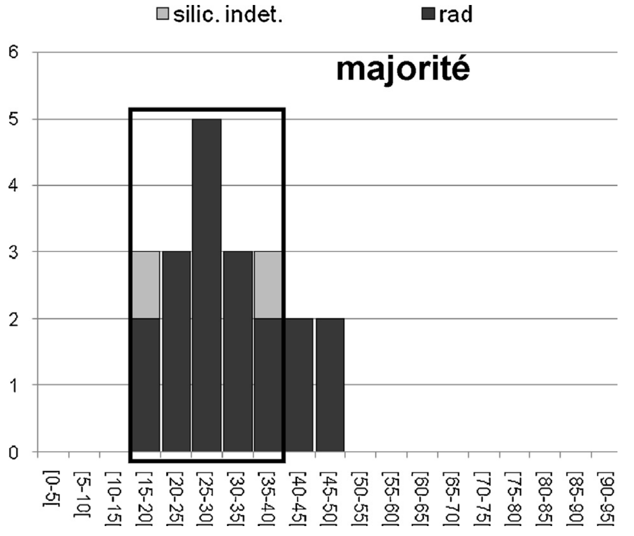

Fig. 17. Fouille réalisée en 1982 (ensemble 1). Longueurs en mm de l'industrie lithique brute et de l'outillage (supports lamino-lamellaires).

The excavation realized in 1982 (assemblage 1). The length of the non-retouched lithics and lithic tools in millimeters (blade-bladelet blanks).

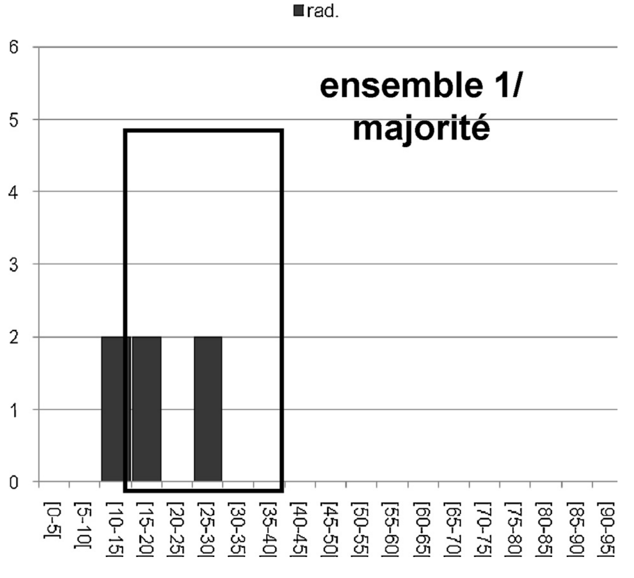

Fig. 18. Longueurs en mm de l'industrie lithique brute de l'ensemble sans numéro d'inventaire (supports lamino-lamellaires).

The length of the non-retouched lithics indicated in milimeters without inventory numbers (blade-bladelet blanks).

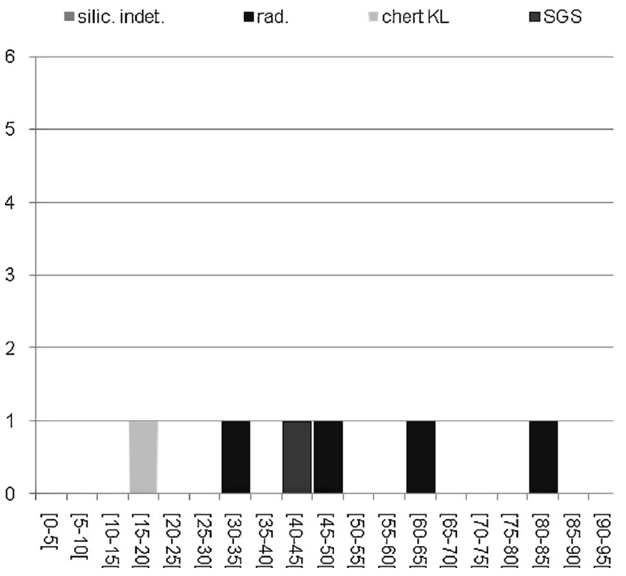

Fig. 19. Fouille réalisée en 1983 (ensemble 2). Longueurs en mm de l'industrie lithique (supports lamino-lamellaires). *The excavation realized in 1983 (assemblage 2). The length of the lithics indicated in milimeters.*

- « talon d'épaisseur réduite mais notable. . .lèvre régulière ». . .
- « absence de marque d'impact sur le talon ».

L'échantillonnage examiné (supports lamino-lamellaires) est composé de 24 pièces (Tableau 12 ; Fig. 20). La percussion directe au percuteur tendre organique est reconnue dans plus de la moitié des cas. Seuls 4 supports sont débités au percuteur tendre minéral (sous produits de débitage). Les pièces non diagnostiquées sont surtout composées par des lamelles dont les petites dimensions ne permettent pas le diagnostic.

En général, les techniques de débitage résultent des observations des produits issus de la séquence du débitage lamino-lamellaire. Étant donné la présence à Předmostí III, d'un artefact en ivoire de mammouth à stigmates compatibles avec un percuteur, nous avons élargi les observations sur les produits non lamino-lamellaires provenant des autres séquences de la chaîne opératoire comme la préparation ou la mise en forme (éclats de dégrossissage, d'aménagement

Tableau 12
Předmostí III. Techniques de débitage des supports lamino-lamellaires (percussion directe).
Předmostí III. Blade-bladelet debitage techniques (direct percussion).

	Brut 1982	Outils 1982	Brut 1983	Outils 1983	Sans No d'inv.	Total
Tendre organique probable	2	2	2	4	2	12
Tendre organique possible	1					1
Tendre minérale probable	2	2				4
Tendre indéterminée		1				1
Indéterminée	4	2				6
Total	9	7	2	4	2	24

Fig. 20. Techniques de percussion directe reconnues à Předmostí III (photos M. Polanská).
Techniques of direct percussion recognized on lithics artifacts from Předmostí III (photos by M. Polanská).

de crête, de mise en forme, etc.). Parmi les pièces diagnostiques, une seule est débitée au percuteur minéral dur, les autres sont débitées au percuteur tendre organique.

Nous avons déjà souligné la coexistence des deux techniques de percussion directe (tendre organique et minérale) au cours du Gravettien, sans toutefois la justifier ou la replacer dans une séquence de la chaîne opératoire. La collection de Předmostí III comprend un échantillon restreint de pièces lithiques, en conséquence le nombre d'artefacts débités au percuteur tendre minéral peut sembler mineur par rapport aux autres collections examinées. Cette technique est pour le moment peu reconnue dans les ensembles gravettiens d'Europe centrale, sans être liée à la phase de la mise en forme ou de la préparation. Même si elle est plus diagnostiquée dans les sous produits lamino-lamellaires issus de la phase d'entretien du débitage, il y a toujours quelques cas provenant du plein débitage. La question pourra être débattue après avoir systématisé cette approche à d'autres ensembles, plus importants quantitativement, et provenant de conditions homogènes où nous pourrons passer à un autre niveau d'approche.

5. L'industrie en matières dures animales (un fragment de percuteur en ivoire de mammouth ?)

L'industrie en matières dures animales de Předmostí III est représentée par deux artefacts, décrits par B. Klíma comme : « un broyeur en ivoire décoré par une série d'incisions parallèles et un fragment d'un « d'un objet en forme de battoir » aménagé en partie sur la compacte d'un fémur de mammouth (sic) » (Klíma, 1985 : 8).

C'est l'analyse du débitage du premier artefact qui nous paraît la plus intéressante, notamment du fait de sa ressemblance avec les percuteurs décrits par L. Steguweit entre autres dans les collections de Pavlov I, de Dolní Věstonice I et de Předmostí Ia (Steguweit et Trnka, 2008).

5.1. Analyse descriptive de la pièce archéologique en ivoire de mammouth : état, morphologie, données métriques.

Il s'agit d'un fragment distal d'ivoire de mammouth de 13,5 cm de long. Malheureusement, il est partiellement abîmé et restauré (partie proximo-mésiale ; Fig. 21). De plus, il manque la surface extérieure de l'ivoire, dont le détachement est probablement dû à des processus post-dépositionels (Fig. 22). Une épaisse couche de vernis a également provoqué une altération de la couleur d'origine et empêche aujourd'hui une analyse très approfondie des différents stigmates.

Toutefois, nous pouvons signaler la présence de deux ensembles de lignes incisées parallèles, visibles sur la partie mésiale de l'objet et qui s'apparentent peut-être à des éléments décoratifs (Fig. 21). En effet, de tels décors sont relativement fréquents sur certains objets en matières dures animales du Pavlovien morave mais ils forment rarement une composition ornementale élaborée (Svoboda, 1995). Dans le cas de l'artefact de Předmostí III, leur organisation ne confirme, ni n'exclut, leur caractère fonctionnel ou décoratif.

En raison de l'altération de la partie distale de l'artefact (Fig. 22), les stigmates sont visibles uniquement sur une portion de la partie active. Cette zone, de moins de 4 cm^2, est caractérisée par une série de dépressions et d'entailles de formes différentes (entailles longitudinales en forme de demi-lune ou subrectangulaire) qui se développent de la partie distale jusque sur la face latérale (Fig. 22). La morphologie de la partie active est légèrement arrondie et présente un « méplat biseauté ou chanfrein[6] ».

Malheureusement, en raison de la mauvaise conservation de la surface de l'artefact et en l'absence d'autres objets en ivoire de mammouth à Předmostí III, il nous est impossible d'analyser plus en détail les autres stigmates liés au débitage ou à la fonction de l'objet. Toutefois, il est possible de proposer des analogies avec le matériel d'autres sites gravettiens moraves et des percuteurs expérimentaux.

[6] Par le terme « méplat biseauté ou chanfrein », nous désignons la partie légèrement biseautée, située environ à un centimètre du bord. Cette bordure est marquée par des entailles en marches d'escalier et qui sont transversales par rapport à l'axe de la pièce.

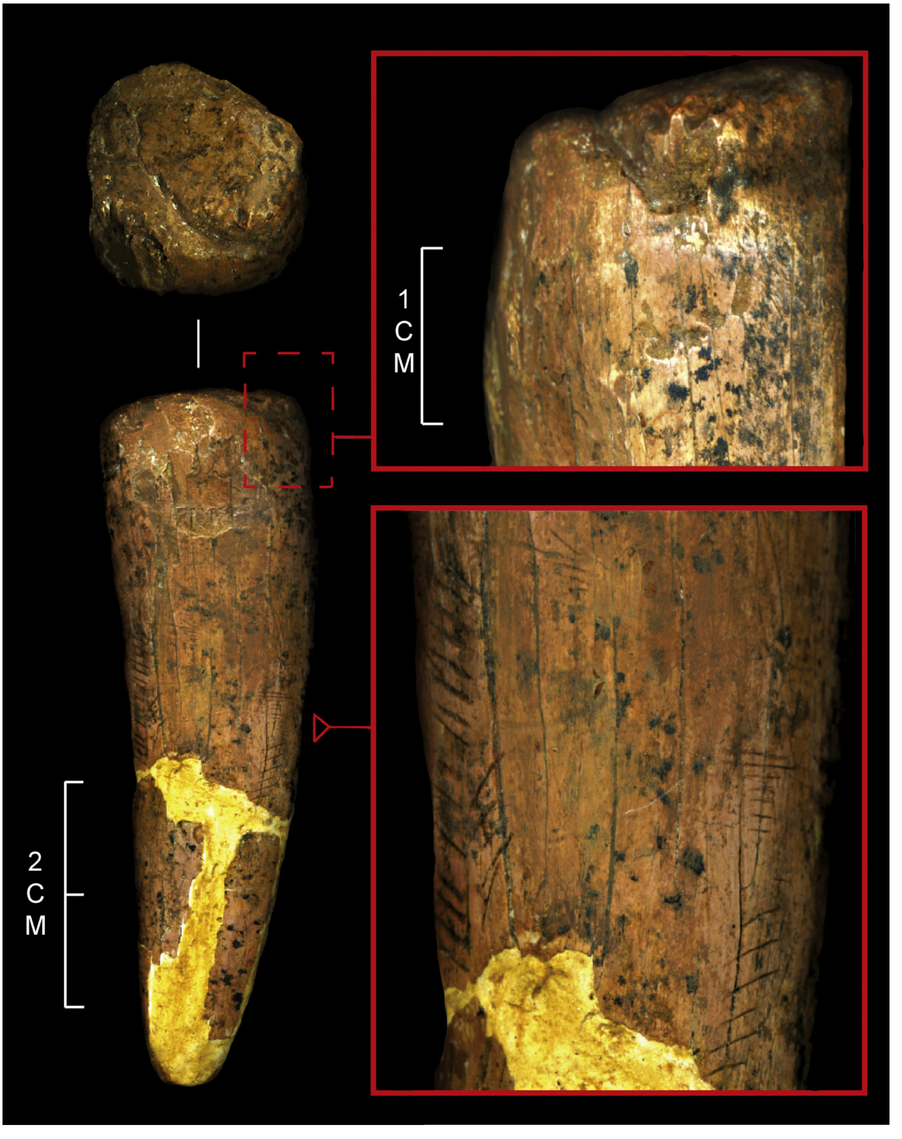

Fig. 21. Percuteur tendre organique possible en ivoire de mammouth de Předmostí III (photos et DAO B. Hromadová).
Possible organic hammer made from mammoth ivory at Předmostí III (photos and CAD by B. Hromadová).

À titre indicatif, L. Steguweit a identifié plusieurs objets en rapport avec les débitages des supports lithiques en Moravie et en Autriche (e. g. Pavlov I, Předmostí Ia, Dolní Věstonice I ; Steguweit, 2005; Steguweit et Trnka, 2008). Il s'agit en occurrence de ce qu'il a interprété

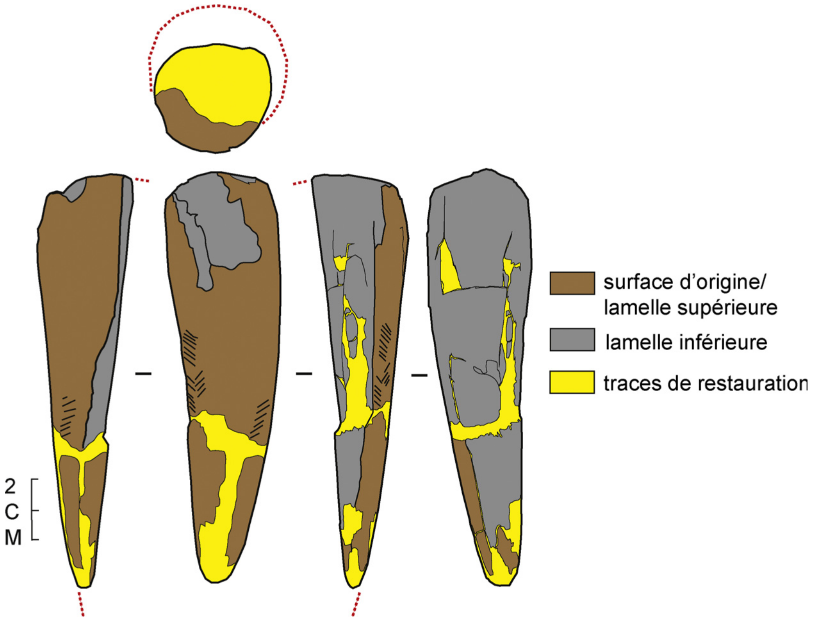

Fig. 22. La représentation graphique du percuteur possible en ivoire (DAO B. Hromadová et M. Polanská).
Grafic representation likely possible hammer of tusk (CAD by B. Hromadová and M. Polanská).

comme des percuteurs et des « punchs » en ivoire. En se basant sur des expérimentations réalisées sur de l'ivoire d'éléphant, l'auteur a souligné la solidité et le poids idéal de l'ivoire pour le débitage de supports laminaires (Steguweit, 2005 : 181). En Russie, G. A. Khlopachev a signalé la texture spécifique de l'ivoire, qui assure une bonne résistance mécanique lors de son emploi comme percuteur (Khlopachev, 2006 : 19), contrairement aux expérimentations réalisées en 2010[7] qui ont démontré une mauvaise résistance aux « chocs sur un talon » de l'ivoire provenant du permafrost (cet ivoire s'étant lentement desséché après son prélèvement hors du permafrost).

Nous pensons que les artefacts décrits comme « punchs » par L. Steguweit dans les collections mentionnées méritent un réexamen approfondi. Premièrement, les stigmates d'écrasement dans la partie distale d'un punch ne suffisent pas à eux seuls pour le classer dans la catégorie des punchs (chasse-lame). En effet, le frottement de cette partie distale sur la corniche du plan de frappe laisse d'autres stigmates caractéristiques (par exemple des bourrelets de compactage ou des éraflures longitudinales) qui aide à confirmer la fonction de la pièce (communication personnelle de J. Pelegrin). Deuxièmement, la présence de punch suggère le débitage par percussion indirecte, ce qui n'est pas le cas dans le Pavlovien de Dolní Věstonice I. Si à Předmostí Ia, nous avons identifié avec L. Klaric plusieurs lames débitées par percussion indirecte, nous pensons que celles-ci appartiennent très probablement aux occupations néolithiques par ailleurs identifiées sur le site. En l'état de nos connaissances, la percussion indirecte n'a jamais été identifiée formellement dans des ensembles du Paléolithique supérieur en Europe. Cette

[7] Cette expérimentation fut réalisée en juin 2010 à l'initiative de B. Hromadová, et avec le concours de J. Pelegrin, lors du stage techno-tracéologique à Zaraysk (Russie). Les résultats sont pour le moment préliminaires et seront complétés par d'autres essais.

technique de percussion n'apparaît formellement, en Europe, que vers la fin du Mésolithique (Pelegrin, 2006 : 40). De ce fait, il faudrait s'assurer avec certitude que l'artefact identifié á Předmostí est bien un punch et il faudrait également écarter la possibilité qu'il appartienne a un ensemble culturel beaucoup plus récent.

5.2. Analyse descriptive du percuteur expérimental en ivoire de mammouth : état, description

La surface du percuteur expérimental a, dans un premier temps, été débarrassée de la couche de cément (partie la plus dure du matériau) qui présente 2 à 4 degrés de dureté selon l'échelle de Mohs. En conséquence, nous avons utilisé comme percuteur le noyau en dentine (plus tendre) qui présente, selon N. K. Vereschagin, 2 degrés sur l'échelle de Mohs (Vereschagin et Tikhonov, 1986 : 6). C'est un tronçon de la partie distale d'un ivoire de mammouth avec une densité importante et un poids de 270 g qui a été utilisé pour aménager le futur percuteur. Cette partie de l'ivoire, mûrement choisie, devait assurer une dureté adéquate (Vereschagin et Tikhonov, 1986). Cependant, la zone active s'est déformée très rapidement (en comparaison avec le bois de cervidé traditionnellement utilisé par les expérimentateurs) et ce seulement après quelques coups. La matière du percuteur expérimental semblait relativement molle et plastique, malgré son état de dessèchement à l'air libre durant quelques années après son prélèvement dans le permafrost. Dans ce contexte, la question qui se pose est : quel rôle joue l'état de la matière première lors de l'acquisition ? Il s'agit notamment de déterminer si lors de l'aménagement des outils (en l'occurrence des percuteurs), les hommes préhistoriques utilisaient l'ivoire d'individus morts depuis peu de temps ou s'ils le ramassaient dans un état physique notablement altéré (sec ou craquelé sous l'effet du gel) très longtemps après le décès de l'animal ; ces deux conditions d'acquisition se répercutant de fait sur les propriétés mécaniques de la matière première.

Du point de vue des stigmates visibles sur la partie active du percuteur expérimental, on peut observer des entailles profondes et longitudinales en forme de demi-lune ou subrectangulaire (Fig. 23) organisées de manières linéaires qui se développent en petites plages sur la surface écrasée (répétition des coups au même endroit).

5.3. Analyse descriptive du percuteur en ivoire de mammouth de Pavlov I : état, description

Une organisation semblable des stigmates est visible sur le percuteur en ivoire, identifié à Pavlov I lors de la campagne de 1953 (Fig. 24) (Steguweit et Trnka, 2008). Il s'agit d'un tronçon d'ivoire de mammouth, dont la partie distale présente une surface bombée et convexe. La zone active couvre toute la partie distale de l'objet (abîmée par de multiples dépressions dues aux coups successifs) et se poursuit jusqu'à la face latérale. Toute la morphologie de la zone active rappelle fortement celle des percuteurs en bois de cervidé du fait de l'utilisation de la totalité de la partie distale du percuteur lors du débitage (Averbouh, 1999 ; Stodiek, 1990).

La face latérale est légèrement biseautée et forme une deuxième surface active présentant des négatifs de coups, organisés linéairement. Les coups portés sur la face latérale ont sans doute bien endommagé la surface de l'ivoire et lui ont causé quelques déformations, alors que la bordure résulte de la séparation du tronçon du reste de l'ivoire. La forme de la bordure suggère l'utilisation de l'une des techniques d'enlèvement par percussion avec la formation d'une gorge d'entaillage préparée pour séparer le support du futur percuteur. L'approfondissement progressif de la gorge, par lequel se creuse le négatif d'enlèvement, a finalement donné au tronçon sa forme conique caractéristique (Khlopachev et Giria, 2010 : 36). L'approfondissement du méplat est

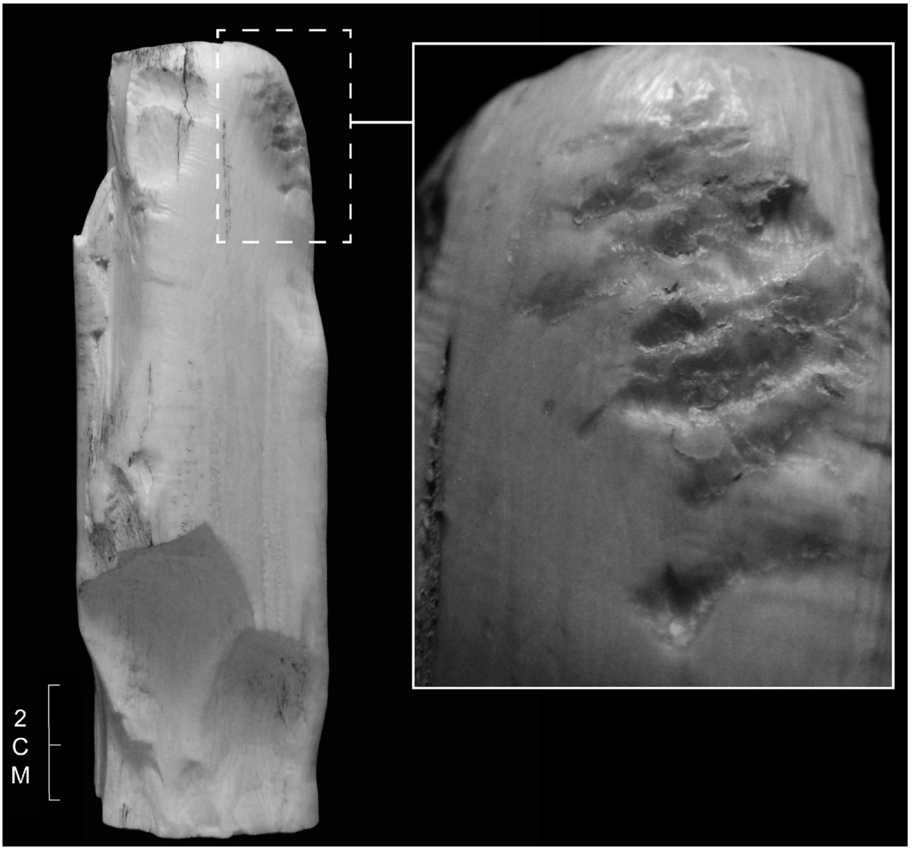

Fig. 23. Percuteur tendre organique expérimental en ivoire de mammouth (photos et DAO B. Hromadová).
Experimental organic hammer made from mammoth ivory (photos and CAD by B. Hromadová).

causé par l'emploi de cette zone « en prise en marteau ». En d'autres termes, la partie convexe de la face latérale est employée quasiment perpendiculairement par rapport à l'axe du débitage pour porter un coup sur la matière première lithique.

L'orientation et l'organisation des négatifs des coups sur la partie distale et la face latérale présentent de légères différences. À l'avenir, il serait intéressant de procéder à des analyses complémentaires et de comparer les stigmates identifiées lors de différentes phases du débitage laminaire (comme c'est le cas pour les percuteurs en bois de cervidés ; Averbouh, 1999). L'état très abîmé de la surface, la forme, ainsi que la profondeur des entailles observées à la fois sur le percuteur de Pavlov I et sur le percuteur expérimental n'excluent pas un emploi identique des deux objets (si tant est qu'au moment de leur utilisation les ivoires aient présenté des propriétés physiques comparables).

5.4. Comparaison des zones actives du possible percuteur en ivoire de Předmostí III, du percuteur de Pavlov I et du percuteur expérimental

La synthèse de la comparaison des deux outils (percuteur expérimental, et percuteur identifié à Pavlov I) nous conduit vers l'objet de Předmostí III. Malgré l'absence d'informations

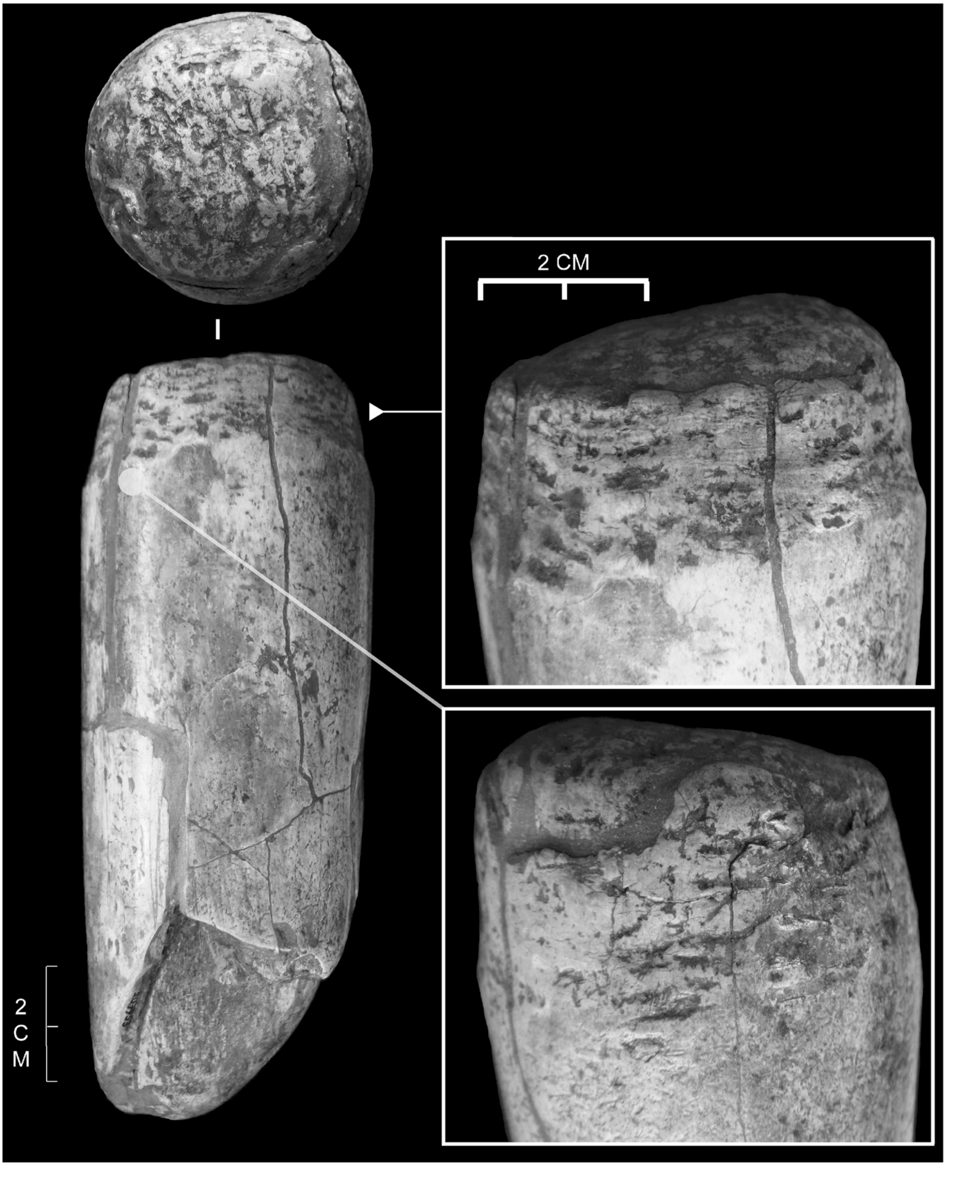

Fig. 24. Percuteur tendre organique en ivoire de mammouth, identifié à Pavlov I par L. Steguweit (année de fouille 1953 ; photos et DAO B. Hromadová).
Organic hammer from mammoth ivory, identified at Pavlov I by L. Steguweit (excavated in 1953; photos and CAD by B. Hromadová).

taphonomiques et d'observations technologiques sur la transformation de la matière dure animale sur le site, il nous est néanmoins possible de comparer les surfaces actives des objets mentionnés (Fig. 25).

La morphologie générale et la localisation de la surface active sur l'outil de Předmostí III (Fig. 22) comme celui de Pavlov I (Fig. 24) indique son emploi lors d'opération de débitage lithique. L'analyse approfondie des stigmates fonctionnels est impossible à cause de la mauvaise

Fig. 25. Stigmates de l'utilisation de la partie active des percuteurs en ivoire (percuteur possible, percuteur expérimental et percuteur identifié à Pavlov I).
Traces of utilisation in the active part of the ivory hammers (likely hammer, experimental hammer, hammer from Pavlov I).

conservation de la surface et de la couche épaisse de vernis. Néanmoins, grâce aux rapprochements et comparaisons que nous pouvons faire avec le percuteur de Pavlov I, il est possible d'identifier certains détails techniques de l'utilisation du percuteur de Předmostí III. Sur ce dernier, la bordure présente les restes de la forme conique du tronçon (comme dans le cas du percuteur en ivoire de Pavlov I), mais l'objet semble avoir été utilisé « en prise en pinceau ».

La localisation et l'orientation des stigmates visibles sur la pièce ainsi que l'absence de surface de détachement et des autres détails techniques caractéristiques de l'utilisation d'un « punch » (Hahn, 1991 ; Provenzano, 1998) contredisent l'hypothèse que cet artefact correspond à ce type de pièce intermédiaire.

C'est notamment grâce à cette observation que nous pensons que cet objet a pu servir de percuteur, et qu'il faudrait le distinguer de l'ensemble des objets connus sous l'appellation de « marteaux-pillons-broyeurs ». Cette catégorie est une classe générique assez vague crée par B. Klíma (1967), qui inclut vraisemblablement des outils de fonctions différentes (Goutas, 2013, communication personnelle M. Rašková-Zelinková).

5.5. Lien entre le percuteur possible en ivoire et la production lamino-lamellaire sur le site

À Předmostí III, la production lamino-lamellaire est effectuée sur le site au percuteur tendre organique (cf. supra), ce qui concorde avec la présence, la description et l'interprétation de l'objet en ivoire comme percuteur tendre organique. Toutefois, l'analyse du matériel lithique débité au percuteur en ivoire et la publication sont toujours en cours de réalisation (Hromadová, article en préparation). Il s'agit de déterminer si les stigmates observés sur les produits débités à l'ivoire sont les mêmes que lors de la production au percuteur de bois de cervidé. D'après les premières observations effectuées par J. Pelegrin, les différences sont mineures (communication personnelle).

Selon L. Steguweit, les produits présentent souvent des cassures dues au débitage, situées sous le bulbe ou dans la partie proximale (Steguweit et Trnka, 2008 : 161). Nous pensons qu'il ne faut pas généraliser ces observations. Premièrement, L. Steguweit a utilisé comme percuteur un ivoire d'éléphant dans un état très évolué (desséché). Deuxièmement, nous rappelons que la technique utilisée (percussion indirecte) par L. Steguweit n'est pas conforme aux techniques de débitage observées sur les sites gravettiens d'Europe centrale (e.g. Polanská, thèse en cours ; Polanská, 2013).

6. Un galet anciennement interprété comme enclume

Un galet, anciennement interprété comme une enclume, avait été mis au jour, lors de l'année de fouille de 1982 (Klíma, 1983). Contrairement à l'interprétation de B. Klíma, l'objet ne porte pas de traces d'impacts (Fig. 26). Il présente des bords lisses sans traces d'impacts et les petites dépressions localisées sur l'une des faces semblent naturelles. La collecte des galets plats dépourvus de traces visibles d'utilisation (ramassés probablement dans la rivière de Bečva proche du site) est attestée à Předmostí Ia depuis le Paléolithique moyen (Klíma, 1990 : Figure 44).

Fig. 26. Galet sans traces d'utilisation (photo M. Polanská).
Pebble without traces of utilization (photo by M. Polanská).

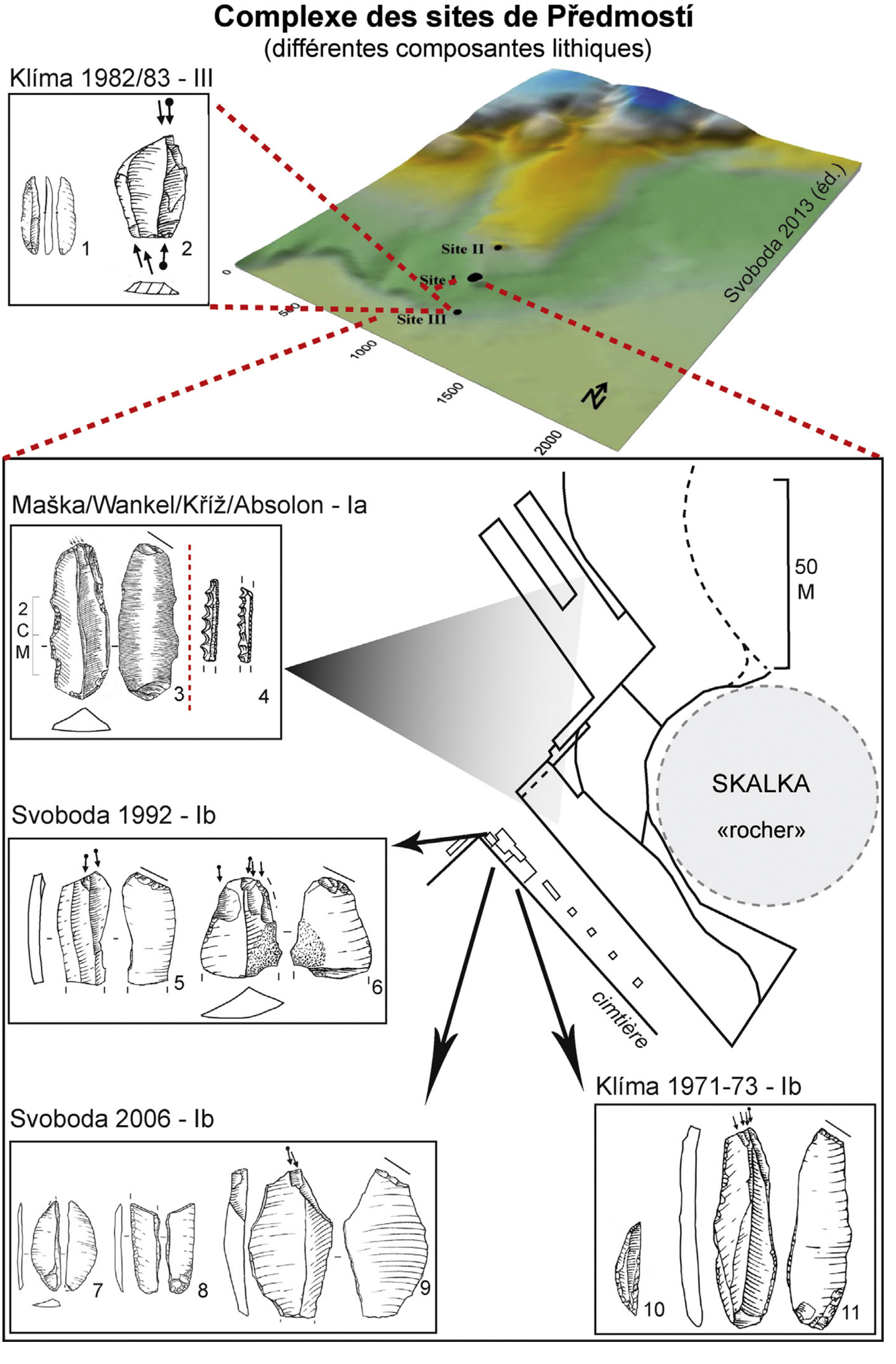

Fig. 27. Différentes composantes lithiques du complexe des sites de Předmostí. (dessins : 1, 5–9, 11 M. Polanská, 2,10 B. Klíma, 3 d'après Absolon, 1947, 4 d'après Absolon et Klíma, 1977).

Different lithics components at site complex of Předmostí. (drawings: 1, 5–9, 11 by M. Polanská, 2,10 by B. Klíma, 3 after Absolon, 1947, after Absolon, Klíma 1977).

Les petits galets et les fragments de plaquettes sont souvent interprétés dans le Pavlovien morave comme des enclumes ou des retouchoirs. En réalité, peu de ces artefacts ont fait l'objet d'une analyse approfondie pour fonder ces interprétations. Il faudrait pour étayer cette hypothèse procéder à une réanalyse au cas par cas. Dans la pratique, les petits galets de rivière peuvent être utilisés comme préparateurs. Ce type d'artefact est utilisé, à titre d'exemple, pour les microfacettages des plans de frappe. Ils portent alors des émoussés ou des rayures sur les bords et sur les extrémités. Concernant les retouchoirs, nous en connaissons en os avec des traces situées au milieu des pièces. Ceux en pierre sont connus, par exemples, dans les collections gravettiennes de Kostenki I/1, Kostenki IV, Borschevo II, Shan-Koba (e.g. Semjonov, 1953).

7. Conclusions

Les données stratigraphiques de Předmostí III suggèrent la position secondaire du matériel lithique et en matières dures animales due aux phénomènes de solifluction. La faune, partiellement étudiée, est dominée par le mammouth. Néanmoins, l'ensemble de l'industrie lithique de Předmostí III est homogène et son aspect microlithique n'a pas une signification culturelle, mais est lié au débitage à partir de galets de rivière. Elle est répartie entre trois séries cohérentes d'un point de vue culturel, qui attribue l'ensemble au « groupe à microlithes géométriques » (28,000/27,500–26,000/25,500 BP non calibré) du Pavlovien d'Europe centrale. La présence d'artefacts de la phase de préparation de mise en forme, d'aménagement et de ravivage d'outils témoignerait en faveur de taille in situ. Du point de vue de la reconnaissance des systèmes techniques, la collection de l'industrie lithique de Předmostí III a une valeur peu significative. Or, la récente analyse de Předmostí Ib (fouille 2006) et de Pavlov I, et plus particulièrement l'association d'un microlithe géométrique à un couteau de Kostienki, a permis l'attribution culturelle au « groupe à microlithes géométriques » du Pavlovien d'Europe centrale. Cette composante industrielle est représentée pour le moment à Pavlov I (certains secteurs), à Milovice IV et dans d'autres localités de Předmostí I (Polanská, 2011, 2013, thèse en cours) (Fig. 27). Dans le locus Ia, cette industrie est mélangée avec le groupe à microscies (Polanská, thèse en cours ; Polanská, 2013). Předmostí III est donc un autre ensemble dans le complexe des sites de Předmostí I, où est représentée cette composante à côté de celles de Ia et Ib.

La présence d'un percuteur tendre organique possible en ivoire de mammouth et la compatibilité de celui-ci avec la technique du débitage reconnue, fait de Předmostí III le premier site d'Europe centrale où a été tenté ce type d'approche. Cette démarche doit être complétée à l'avenir par l'étude d'autres sites.

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3.5.7 Palaeolithic/Mesolithic stratigraphic sequences at Údolí Samoty and Janova Zátoka Rockshelters

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PALAEOLITHIC/MESOLITHIC STRATIGRAPHIC SEQUENCES AT ÚDOLÍ SAMOTY AND JANOVA ZÁTOKA ROCK SHELTERS (NORTHERN BOHEMIA)

This paper is an addition to a series of previous publications discussing the recent Mesolithic discoveries in the sandstone areas of Northern Bohemia, Czech Republic (Svoboda 2003; Svoboda et al. 2007; Šída / Prostředník 2007; Šída / Prostředník / Kuneš 2011). During the 2007-2011 research, previously unknown Late Palaeolithic horizons have come to light below the Mesolithic layers, in sedimentary deposits at the base of two rock shelters, thus providing a more complex evidence of the Pleistocene/Holocene transition and subsequent development. We studied the formation processes of these stratigraphic sequences at two different types of rock shelters – Údolí samoty and Janova zátoka (**fig. 1**). At Údolí samoty (okr. Česká Lípa) we documented a thick sequence with a complex stratigraphy while at Janova zátoka (okr. Děčín) we recorded just a thin sedimentary sequence, partly affected by post-depositional processes. At both sites, we also addressed the question of a change in environment and in resource exploitation around the Pleistocene/Holocene boundary (**tab. 1**).

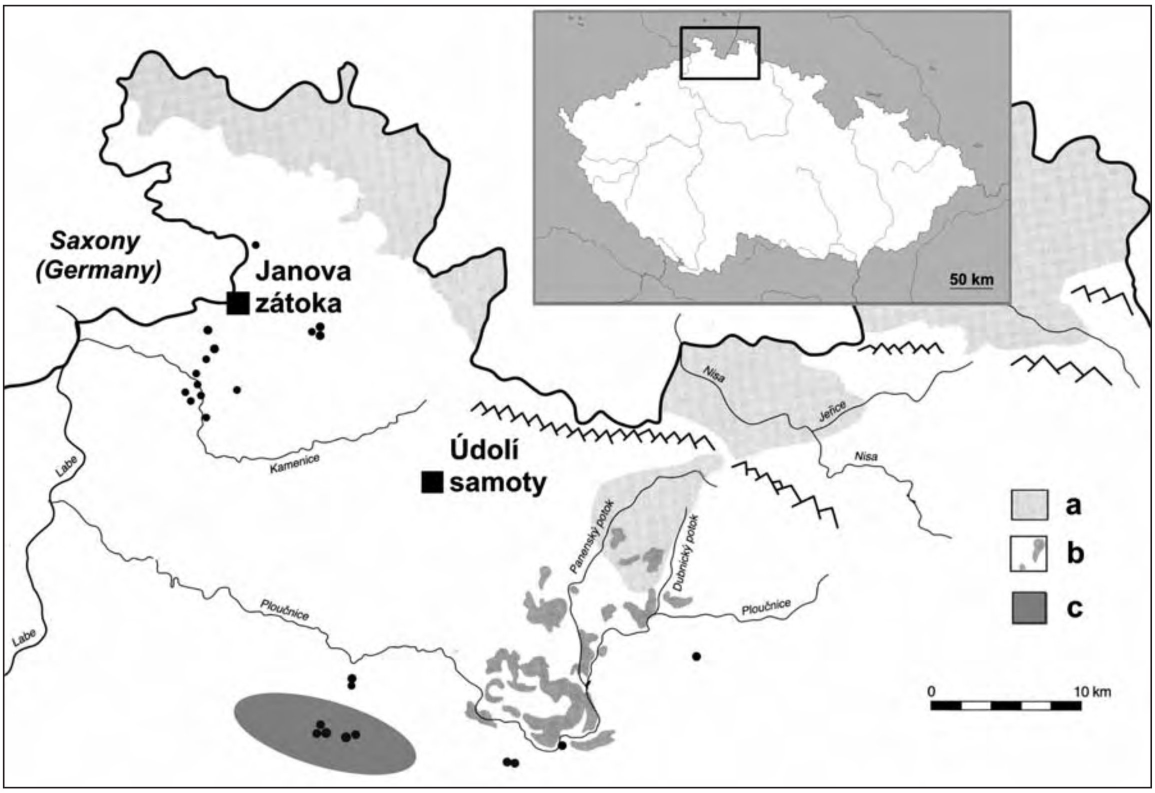

Fig. 1 Map of Northern Bohemia (Czech Republic) showing the locations of Údolí samoty (okr. Česká Lípa), Janova zátoka (okr. Děčín), related Mesolithic sites (●), and local raw materials. – Patterns: **a** extension of glacial sediments with occurrences of erratic flints (after D. Nývlt in: Svoboda 2003, fig. VI, 1); **b** fluvial deposits with rare erratic flints; **c** approximative concentration of the Stvolínky-type quartzites. – (Map J. Svoboda).

sample no.	site	depth/ context	result (BP)	result (cal BC)
Poz-43847	Údolí samoty	pit/upper	115±25	not calibrated
Poz-43848	Údolí samoty	pit/bottom	139.15±0.4	not calibrated
Poz-48373	Údolí samoty	120-140 cm	7960±50	6882±113
Poz-43850	Údolí samoty	165 cm	8730±50	7770±102
Poz-43849	Údolí samoty	180 cm	9360±50	8641±64
OxA-25772	Údolí samoty	270 cm	11750±50	11684±127
Poz-23176	Janova zátoka	25 cm/pit	9250±60	8466±95
Poz-48371	Janova zátoka	60 cm	1960±25	not calibrated
Poz-23178	Šamanská rokle	110-120 cm	8170±50	7187±85
Poz-23177	Prasečí kámen	90-100 cm	7940±50	6863±122
Poz-23179	Šibeniční kámen	110 cm	7510±50	6360±67

Tab. 1 Radiocarbon dating of Údolí samoty, Janova zátoka, and other rock shelters excavated after 2005 (for related ^{14}C dates from Northern Bohemia see Svoboda 2003; Svoboda et al. 2007; Šída / Prostředník / Kuneš 2011). All dates are from charcoal. – Calibrated by OxCal 4.1. using calibration curve IntCal09.

Fig. 2 Údolí samoty (okr. Česká Lípa). Location of the rock shelter dominating the shallow valley, during excavation in 2011. – (Photo J. Svoboda).

ÚDOLÍ SAMOTY (LONELINESS VALLEY), K. Ú. RADVANEC, OKR. ČESKÁ LÍPA

Údolí samoty consists of an isolated, north-south oriented valley in the Cretaceous sandstone formation at the foot of the Lusatian Mountains. Geographically, it represents a potential link between the Mesolithic provinces of Česká Lípa Basin to the south and Bohemian Switzerland to the northwest. The rock shelter is located in a prominent position above a brook, near an active water source, and at the place where the valley becomes narrower (**fig. 2**). As a result of weathering of the sandstone ceiling and continuous influx of allochthonous sediments from above throughout the Late Pleistocene and Holocene periods, a sedimentary sequence – 3 m thick – has been deposited during this time span. Therefore, this rock shelter offers a longer and more diversified stratigraphic record.

This location was first recognised as an archaeological site during our regional field surveys in 1999. The first test trench exposed a stratigraphic sequence up to 70 cm thick, with a recent darkish forest soil, followed by whitish sandy layers containing pottery and charcoal, and whitish and yellowish sand with two lithic artefacts and charcoal. A subsequent trench dug in 2003 revealed a more complex stratigraphy, 2 m deep, with intensive Mesolithic occupation at the base (Svoboda 2003, fig. 17, 2). In 2011, an area of 2.5 m × 2.5 m was excavated completely and reached solid bedrock at a depth of 3.2 m.

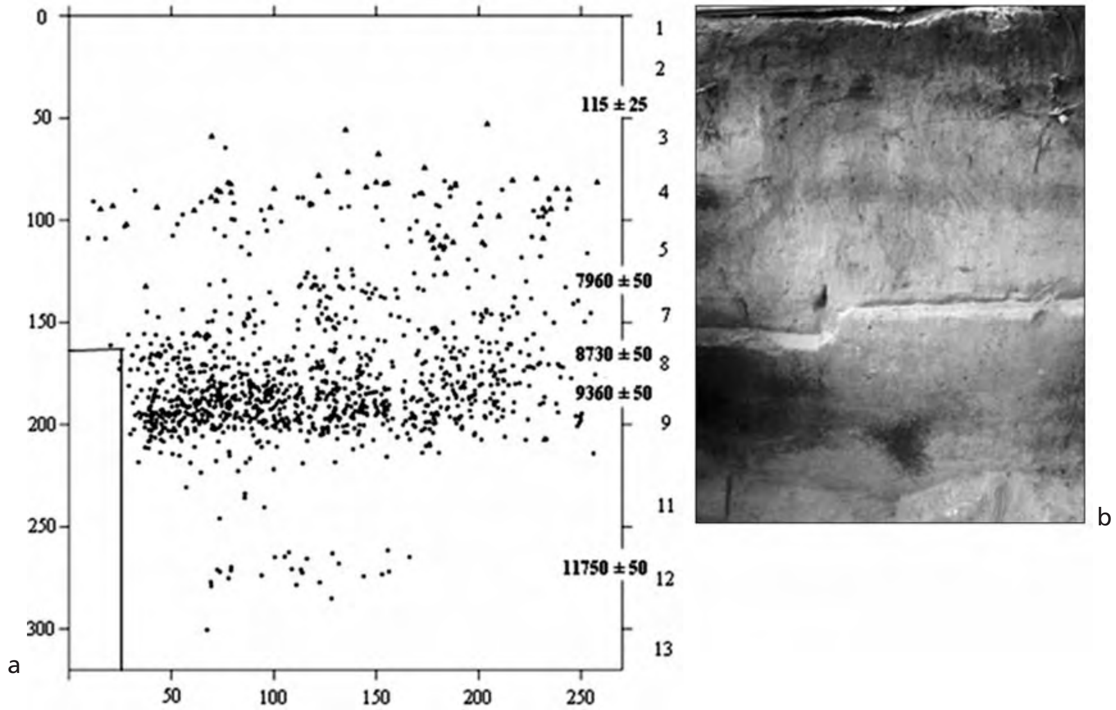

Fig. 3 Údolí samoty (okr. Česká Lípa). Stratigraphic section. – **a** distribution of lithic artefacts (●) and ceramic fragments (▲) in the layers 1-13. – **b** photodocumentation of the same section (before excavating the layers 11-13). – (a graphic M. Novák; b photo J. Svoboda).

Stratigraphic section

This massive sedimentary sequence formed relatively rapidly due to both local weathering and influx of allochthonous material. Effects of bioturbation are visible on the boundaries between the layers, as small dots caused by edaphon activity. A fissure in the central part of the rock shelter ceiling allows continuous water seepage, which has resulted in the formation of two deep longitudinal pits in the sediments below, marked by light-coloured infill bordered by rusty-coloured margins. These pits also served as natural traps for the archaeological material.

Generally, the sequence of the layers can be characterised as follows (**fig. 3**):

1. Darkish forest soil, with needles, depth 0-20 cm;
2. Light-greyish sandy layer, with subrecent disturbances and features (pits), depth 20-30 cm (in depressions 40 cm), ^{14}C dated 100-150 BP;
3. Whitish coarse-grained sand, with charcoal, depth 30-70 cm;
4. Brown-to-greyish sandy/loamy sediments, with effects of edaphon activity (4a – dark brown; 4b – greyish, fine-grained, with charcoal), depth 70-110 cm;
5. Whitish sand, with charcoal, depth 110-120 cm (maximum 130 cm);
6. Yellow, coarse-grained weathered sand (only along the rear wall of the rock shelter);
7. Dark yellowish sand, with charcoal and effects of edaphon activity, depth 120-160 cm (maximum 170 cm), ^{14}C dated 7960 ± 50 BP;
8. Sublayers of orange burnt sand, with charcoal and burnt bone fragments (locally at the base of 7 and inside 9);
9. Dark greyish, sandy/loamy layer, with charcoal, effects of edaphon activity, and depression features at the base, depth 160-200 cm (in depressions 220 cm), ^{14}C dated 8730 ± 50 BP and 9360 ± 50 BP;
10. Light greyish sand, with charcoal, depth 200-220 cm;

11. Whitish-to-yellowish coarse-grained sand, with undulated rusty bands, depth 220-270 cm, ^{14}C dating failed;
12. Dark greyish sandy location, with charcoal, depth 270-280 cm, ^{14}C dated 11 750 ± 50 BP;
13. Whitish coarse-grained sand, with undulated rusty bands, depth 280-320 cm;
14. Cretaceous sandstone bedrock.

The excavation record, including 3D recording of artefacts and additional material from sieving or floating the sediments, makes it possible to reconstruct the individual archaeological horizons in greater detail. In this preliminary study, we present a coarse-grained separation of the 3 m deep section into seven basic material units, including two units containing ceramics (Late Bronze Age to Aeneolithic periods, with Mesolithic admixture at the base), followed by four Mesolithic units and a Late Palaeolithic unit at the base.

Anthracological analysis and vegetation reconstruction

Unit 1, 0-70 cm, predominantly Late Bronze Age period
The upper part of the section is characterised by low species diversity with a high proportion of *Pinus sylvestris*. The low species diversity is probably due to the anthropogenic activities affecting the surrounding vegetation.

Unit 2, 70-120 cm, predominantly Bronze Age/Aeneolithic
Species present in this unit include a high proportion of scots pine and a low proportion of spruce, beech, oak, birch and aspen/willow. Low species diversity is often associated with the Late Bronze Age environmental collapse (Ložek 1998). The layer at a depth of 100-120 cm has a high proportion of oak charcoal. The occurrence of scots pine, spruce, hazel, birch and beech charcoal indicates an increase in species diversity. Hazelnut shells are found in this layer.

Unit 3, 120-160 cm, Mesolithic
The layer at a depth of 120-140 cm has a high proportion of oak charcoal. The occurrence of scots pine, spruce, hazel, birch and beech charcoal indicates an increase in species diversity. Hazelnut shells are increasing in quantity. A layer at a depth of 140-160 cm contains a large amount of oak charcoal. *Pinus sylvestris* and *Corylus avellana* are still very frequent, *Tilia* sp. and *Populus*/*Salix* are still commonly represented and *Acer* sp. occurs for the first time.

Unit 4, 160-180 cm, Mesolithic
This unit is characterised by a high proportion of *Pinus sylvestris*, accompanied by lime and hazel. Oak and spruce/larch charcoal are rare. Hazelnut shells are very common. The species composition is similar to the overlying layer (140-160 cm).

Unit 5, 180-200 cm, Mesolithic
This unit is characterised by high quantities of charcoal. The layer is distinguished by a high proportion of hazelnut shells. *Pinus sylvestris* dominates and *Corylus* charcoal is widespread. The occurrences of oak, spruce/larch, lime and aspen/willow charcoal were recorded at similarly low proportions as in unit 4.

Unit 6, 200-240 cm, Mesolithic
This unit shows a significant decrease in species composition. *Pinus sylvestris* was dominant and hazelnut shells were frequent. Spruce/larch and oak occurred rarely. A layer at a depth of 220-240 cm did not contain any charcoal. It is not known if the absence of charcoal was indicating reduced anthropogenic activity or the rapid sedimentation of sandy material.

Unit 7a, 240-260 cm, Late Palaeolithic/Mesolithic
The species composition of the layer at a depth of 240-260 cm is similar to the species composition of the 200-220 cm layer. *Pinus sylvestris* was widely spread, the abundant presence of spruce/larch charcoal has been documented, and hazelnut shells are occasionally present. The species composition indicates the deterioration of environmental conditions.

Unit 7b, 260-300 cm, Late Palaeolithic
This unit is noticeable for its small quantity of charcoal. *Pinus sylvestris* was a dominant species and hazelnut shells were rare. The layer at a depth of 260-280 cm contained smaller amounts of charcoal and the species diversity is quite low. Only charcoal of coniferous species (*Pinus sylvestris, Larix*/*Picea*) were found here.

Unit 7c, 300-320 cm, Late Palaeolithic
This unit is characterised by low amounts of charcoal. The surrounding vegetation can be described as a sparse pine forest. *Pinus sylvestris* is a dominant species and spruce/larch and birch were common. Hazelnut charcoal is very rare and a very small charcoal fragment of a deciduous tree (cf. *Frangula* sp.) was also found (**fig. 4a**).

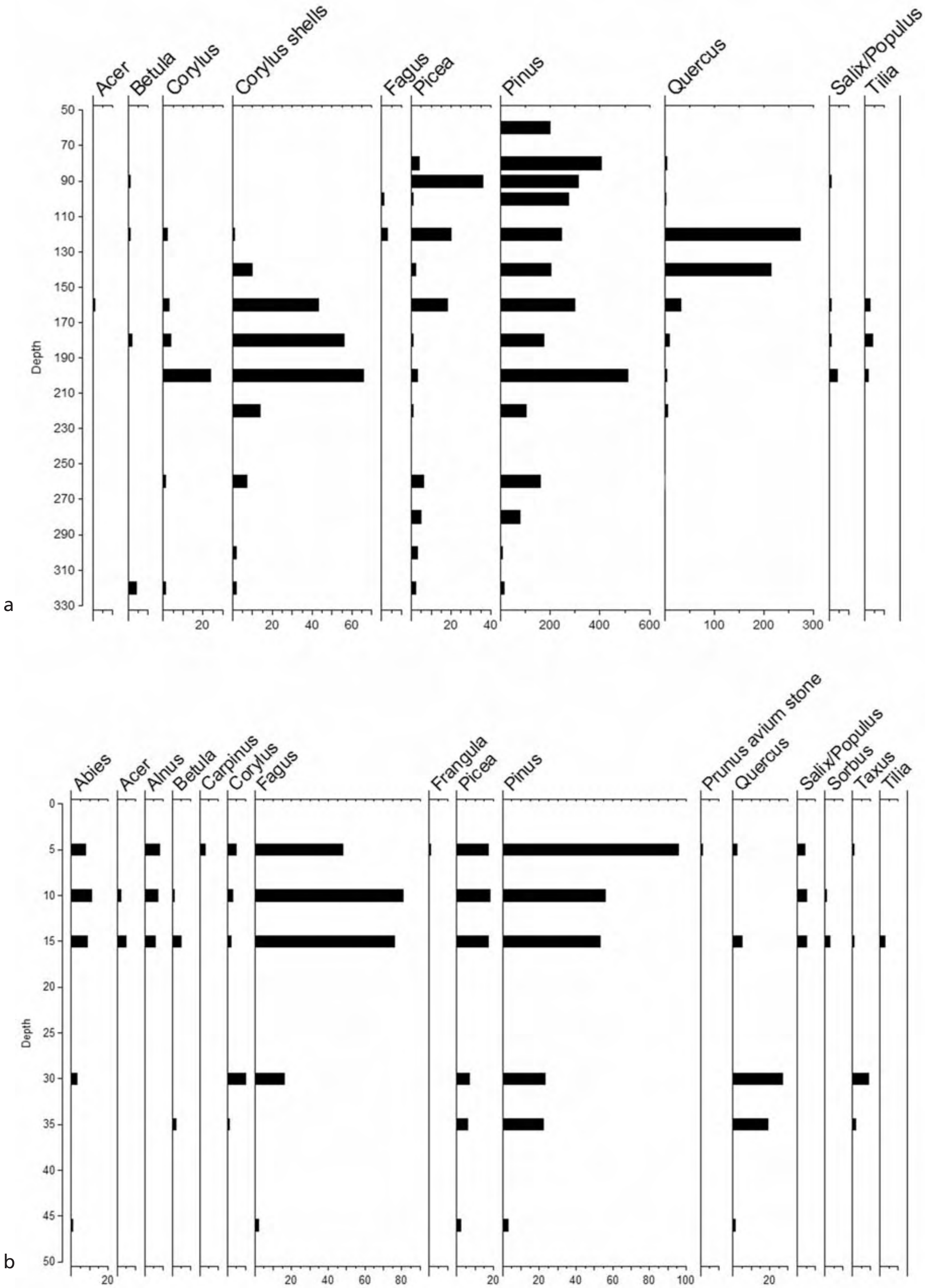

Fig. 4 Údolí samoty (**a**) and Janova zátoka (**b**): palaeobotanical spectra, based on macroremains. – (Illustrations J. Novák).

	5-3 cm				3-2 cm								
	unit 3	unit 4		unit 5	unit 3		unit 4		unit 5			unit 6	
	C	CS	C	CS	CS	C	CS	C	S	CS	C	CS	C
stage 0 (unburnt)												1	
stage I (<50 % carbonised)											1		
stage II (>50 % carbonised)	3							1		2	1		
stage III (fully carbonised)								4			1		
stage IV (<50 % calcined)	2					4		2			1		1
stage V (>50 % calcined)	1	1		1	8	24	2	5	1		2		2
stage VI (fully calcined)	1		2		6	13	4	5			1		
total	7	1	2	1	14	41	6	17	1	2	7	1	3

Tab. 2 Indeterminate bone elements from Mesolithic units at Údolí samoty in relationship to their burning stages (after Cain 2005;

Vertebrate remains

Unit 1, 0-70 cm, predominantly Late Bronze Age period
Two indeterminate bone fragments were found during sieving. Both were compact bone segments which had undergone the burning stage V (on the scale used in Cain 2005 and Bosch et al. 2012), which means that more than 50 % of the organic composition was calcined.

Unit 2, 70-120 cm, predominantly Bronze Age/Aeneolithic
The bone and teeth assemblage of two fragments recorded during excavation and 94 fragments discovered during sieving could not be determined with the exceptions of two diaphyseal pieces from a small-sized mammal (such as *Vulpes* sp. or *Lepus* sp.). The bone material is highly fragmented – bone pieces are usually smaller than 3 cm. We suspect that this fragmentation was caused by burning, because the majority of the fragments (84 pieces) belongs to the burning stages IV-VI (less than 50 % of organic composition calcined up to fully calcined bones). Almost all pieces are compact bones or combinations of compact and spongy bone.

Unit 3, 120-160 cm, Mesolithic
In this unit, 18 bones were recorded in 3D and 1225 bones during sieving. They are highly fragmented, mostly from burning. Fragments that were identified include five *Cervus elaphus* antler pieces and one *Sus scrofa* upper molar piece. Four tooth fragments were assigned to cervids, two tooth crown fragments probably belong to a boar (cf. *Sus scrofa*) and one distal part of a phalanx was from a small-sized mammal. Middle-sized mammals (such as *Cervus* sp. or *Sus* sp.) were represented by 19 pieces and small-sized mammals by 41 tooth and bone pieces. All fragments were identified as parts of skulls, diaphyses and ribs.

Unit 4, 160-180 cm, Mesolithic
In this unit, 105 bones were recorded during excavation and 738 bone and tooth fragments during sieving, again fragmented and mostly burnt. Pieces that were identified suggest a similar species and skeletal segment composition as in unit 3, but the species identification was only possible for mid-sized mammals (13 pieces) and small-sized mammals (10 pieces).

Unit 5, 180-200 cm, Mesolithic
The bone and tooth assemblage of twelve 3D recorded fragments and 137 fragments found during sieving are mostly unidentifiable, with the exception of one proximal part of a phalanx of a small-sized mammal. As in the previous units, all bones were highly fragmented and burnt.

Unit 6, 200-240 cm, Mesolithic
In this unit, 10 bone fragments were recorded and 47 bone and tooth fragments were found during sieving. As in the previous units, the assemblage is highly fragmented (smaller than 3 cm), burnt and mostly unidentifiable, with the exception of a part of an upper boar molar (*Sus scrofa*) and parts of teeth and diaphyses from a mid-sized mammal.

Unit 7, 240-300 cm, Late Palaeolithic
The bone assemblage of 3 recorded fragments and 17 fragments found during sieving is similar to the previous units. Almost all bone pieces represent compact bone and were burnt at the stages IV-VI (**tab. 2**).

2-1 cm									<1 cm								
unit 3		unit 4		unit 5			unit 6		unit 3		unit 4		unit 5			unit 6	
CS	C	CS	C	S	CS	C	CS	C	CS	C	CS	C	S	CS	C	CS	C
			1			1						3			1		
5	1		1			2			1	2	1	7					
	16		2					2	4	18	1	19		2	8		
2	8		1	2		1		2	1	17	1	37	5				1
10	26	6	21		2	5	1	2	25	95	14	65	2	2	14	3	4
37	68	20	32		2	8	2	4	110	203	61	110		13	31	2	6
37	80	4	38		2	1			77	250	58	226	2	7	54	35	12
91	199	30	96	2	6	18	3	10	218	585	136	467	9	24	108	40	23

Bosch et al. 2012). – Abbreviations: S spongy bone; CS compact-spongy bone; C compact bone.

Archaeological features and artefact assemblages

Unit 1, 0-70 cm, recent to Late Bronze Age period

Although this unit was largely affected by subrecent and recent disturbances and features (cf. the first two ^{14}C dates), no recent artefacts were found in association. Several predominantly recent pits were recorded to a depth of 70 cm, one of them filled with atypical pottery fragments. A small piece with a (probably) horizontal linear pattern dating to the Late Bronze Age period (Ha A-Ha B; depth 30-40 cm), was associated with 47 other, undatable pottery sherds, and two lithic artefacts.

Unit 2, 70-120 cm, predominantly Bronze Age/Aeneolithic

The ceramic assemblage of 63 fragments includes only a few ceramic sherds determinable in terms of chronology: a fragment with a parallel finger pattern dating to the Bronze Age (middle or late, depth 100 cm), and a funnel-shaped rim dating to the Bronze Age or Aeneolithic (later Funnelbeaker culture – Baden – Řivnáč, depth 100 cm). The other fragments allow only a general dating to ceramic prehistory. Most of the 53 artefacts recorded during excavation and 373 artefacts discovered during sieving are made from flint. Artefact types include flakes, chips, blades and microblades. The most typical objects are a bifacially flaked arrowhead, Bronze Age/Aeneolithic in age (with a concave base, depth 105 cm), and an admixture of some Mesolithic artefacts (a backed microblade and a geometric microlith at the base of this unit).

Unit 3, 120-160 cm, Mesolithic

Extensive areas covered by ash and red-burnt sand occur at the base of this unit, but no regular hearth came to light. In the centre, two deep pits created by water erosion from the ceiling fissure were unearthed, and on the sides, two larger sandstone blocks more than 1 m in size, weathered from the rock wall and ceiling, were documented. Smaller stones, especially volcanites, occurred in clusters. An assemblage of 133 artefacts recorded during the excavation and 1794 artefacts discovered during sieving are mostly made from flint. Other raw material types include Bečov-type quartzite, fossil wood, and, as a rare exotic import, a radiolarite bladelet (no. 123, determined by A. Přichystal). Artefact types include small flakes and chips, microblades and a few regular blades. Isosceles triangles appear in a series (some are made from Bečov-type quartzite). Other types present are pointed backed microblades, microburins, splittered pieces, and retouched blades. One blade has a lateral polish (**fig. 5a**).

Unit 4, 160-180 cm, Mesolithic

An assemblage of 226 artefacts recorded during excavation and 2341 artefacts discovered during sieving are mostly made from flint, several pieces from Bečov-type quartzite and a few individual objects from Tušimice-type quartzite and another bladelet of radiolarite (no. 242). The sieved material includes a large series of geometric microliths: predominantly isosceles and scalene triangles (some of them made from Bečov-type quartzite), some of them reaching extremely small dimensions of only a few millimetres, accompanied by a few narrow trapezoids on blades (intermediate triangle/trapeze forms). Other pieces include microlithic endscrapers, backed pointed microblades and notched blades (**fig. 5b**).

Unit 5, 180-200 cm, Mesolithic

An assemblage of 493 artefacts recorded during excavation and 451 artefacts discovered during sieving are mostly made from flint, with a low proportion of the Bečov-type quartzite, and others (partly burnt and form-

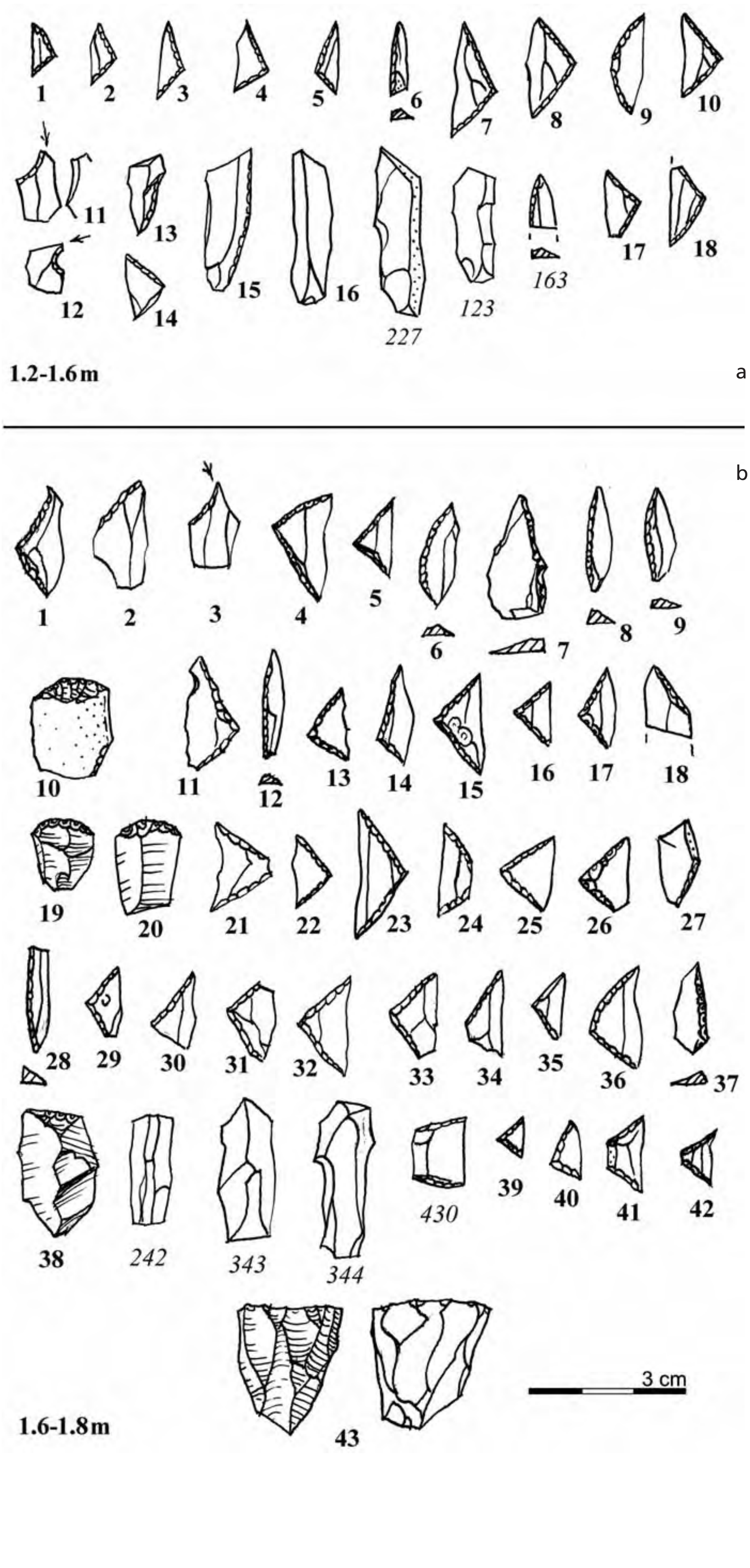

Fig. 5 Údolí samoty (okr. Česká Lípa). Lithic artefacts. – **a** unit 3 (1.2-1.6 m), recorded artefacts (*italics*) and sieved artefacts. Flint, quartzite, radiolarite. – **b** unit 4 (1.6-1.8 m), recorded artefacts (*italics*) and sieved artefacts. Flint, quartzite, radiolarite. – (Drawings J. Svoboda).

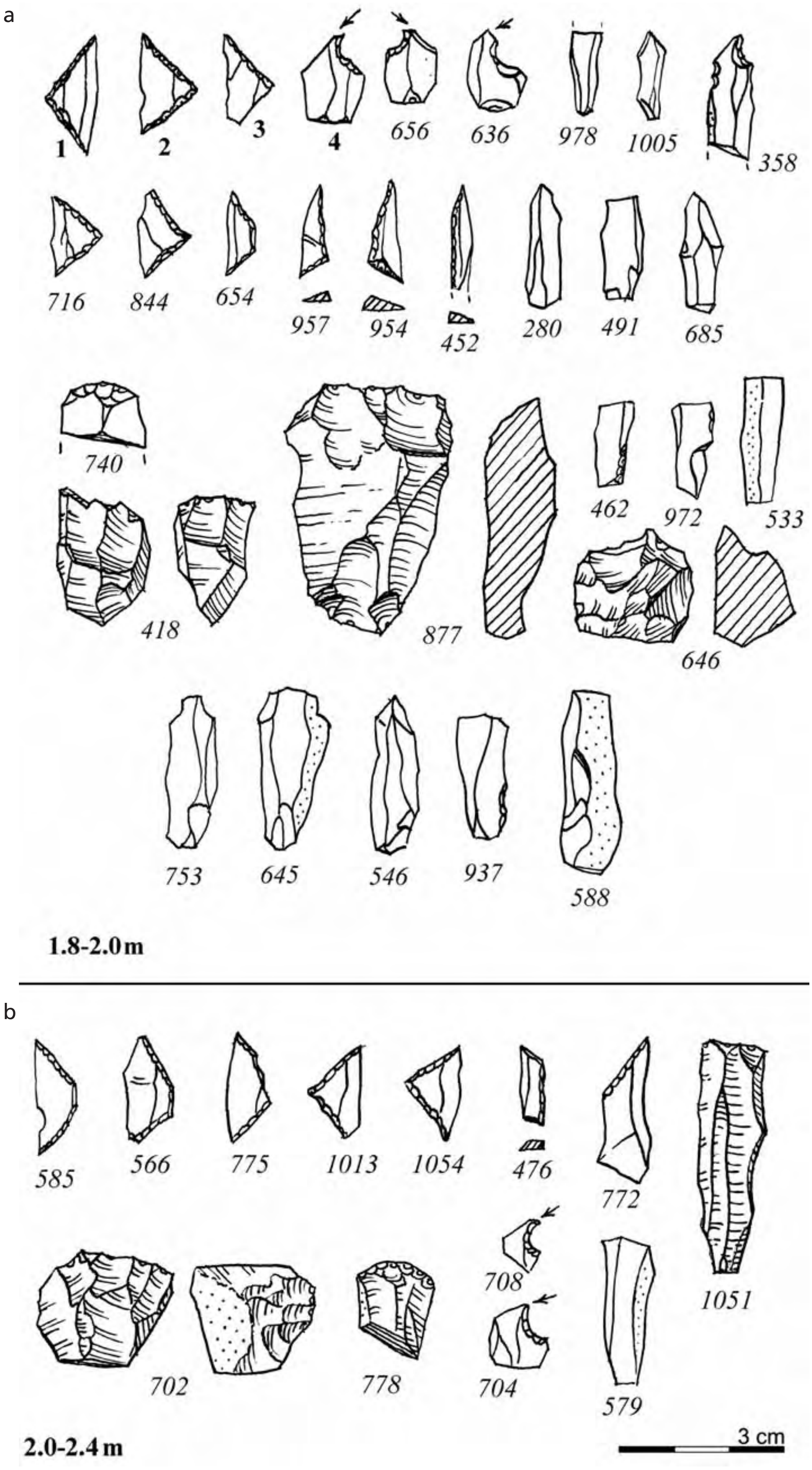

Fig. 6 Údolí samoty (okr. Česká Lípa). Lithic artefacts. – **a** unit 5 (1.8-2.0 m), recorded artefacts (*italics*) and sieved artefacts. Flint and quartzite. – **b** unit 6 (2.0-2.4 m), recorded artefacts (*italics*) and sieved artefacts. Flint. – (Drawings J. Svoboda).

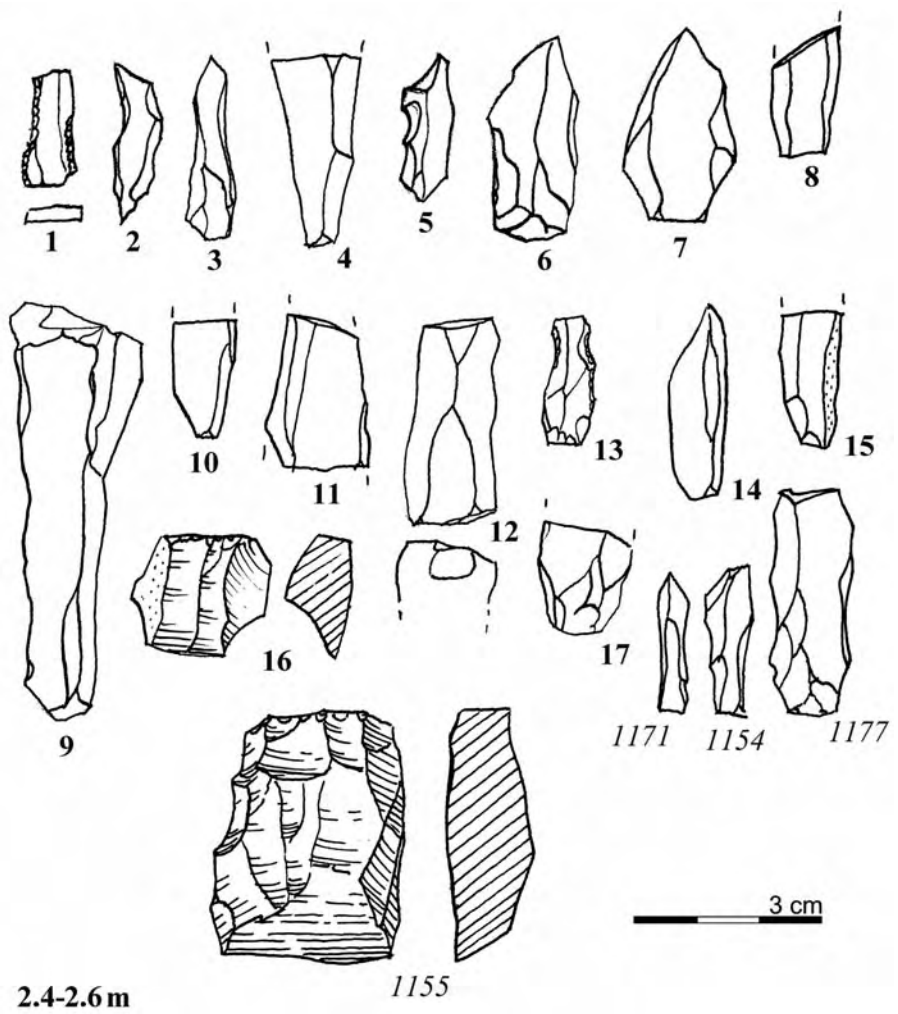

Fig. 7 Údolí samoty (okr. Česká Lípa). Lithic artefacts: unit 7 (2.4-2.6/3 m), recorded artefacts (*italics*) and sieved artefacts. Flint and porcellanite. – (Drawings J. Svoboda).

ing a cluster). Microblades were produced from cubical/conical microcores and flat cores. Typical are isosceles and scalene triangles accompanied by narrow trapezes, several microburins, a backed pointed microblade, and an endscraper (fig. 6a).

Unit 6, 200-240 cm, Mesolithic
An assemblage of 128 artefacts recorded during excavation and 124 artefacts discovered during sieving are mostly made from flint, with a few objects from Bečov-type and Stvolínky-type quartzites (cf. fig. 1). This is a blade and microblade industry produced from unipolar and bipolar cores. Typologically, this unit includes a series of isosceles triangles, narrow trapezes on blades, a truncated blade and a backed microblade, accompanied by an endscraper and two microburins (fig. 6b).

Unit 7, 240-300 cm, Late Palaeolithic
An assemblage of 27 artefacts recorded during excavation and 133 artefacts discovered during sieving are mostly made from flint, with about 20 % made from porcellanite. This is a blade and microblade industry, with one backed microblade and one with a notch. Three core fragments are made of porcellanite. Following A. Přichystal (pers. comm.) the porcellanite from this layer differs from the Bohemian key source at Kunětická hora (okr. Pardubice) and one may expect another, more local outcrop (fig. 7).

Typological comparisons

In the Central European context, the best comparable stratigraphic sequence to the units 3-6 at Údolí samoty is the Jägerhaus Cave near Beuron (Lkr. Sigmaringen) on the Upper Danube (Taute 1974; Holdermann 2006), which is characterised by a large variety of isosceles and scalene triangles. W. Taute (1974)

Fig. 8 Janova zátoka (okr. Děčín). Location of the cave in the wall of the canyon during excavation in 2010 (arrow). The river Kirnitz/Křinice creates the national boundary between Germany and the Czech Republic. – (Photo J. Svoboda).

first noticed that symmetrical and asymmetrical trapezes and trapezoid points may also occur in Beuronian A of the Jägerhaus Cave and M. Heinen (2012) records their restricted presence at sites in Northern Germany. In contrast to the Late Mesolithic rhomboids, these Early Mesolithic trapezes are generally smaller and made on narrow blades (»irregular« after Taute); there are even transitional forms between trapezes and triangles. Údolí samoty and other Bohemian sites differ most notably in their absence of Tardenois points.

JANOVA ZÁTOKA (JOHN'S SHELF), K. Ú. JETŘICHOVICE U DĚČÍNA, OKR. DĚČÍN

The Janova zátoka rock shelter faces north-northwest in the southern rock wall of the Křinice river meander (**fig. 8**). The rock shelter is an ideal location for fishing. Due to the composition and morphology of the Křinice area sandstones, rock shelters in the solid rocks are deeper than elsewhere, thus fitting the definition of a cave rather than a rock shelter. The influx of allochthonous sediments from outside was restricted and the sedimentary filling is relatively shallow. In contrast to Údolí samoty which has a complex stratigraphic sequence, Janova zátoka is a representative example of a site with a shallow stratigraphy, where the Mesolithic occupation remains occur just below the surface, and the lower part was locally affected by post-depositional processes (cryoturbation and bioturbation).

Today, the river forms a national boundary, which prevented recent anthropogenic disturbances. However, during the last two decades the site was used for temporary camping. On August 8, 2007, V. Sojka collected twelve small flakes and flint blades, burnt flint and quartzite, together with six sherds of medieval pottery, fragments of sedimentary rocks and animal bones on top of the disturbed surface. Subsequently, a standard microtrench was excavated, 1m×1m in size and 60cm in depth. A systematic excavation was conducted in July 2010 (**fig. 9**).

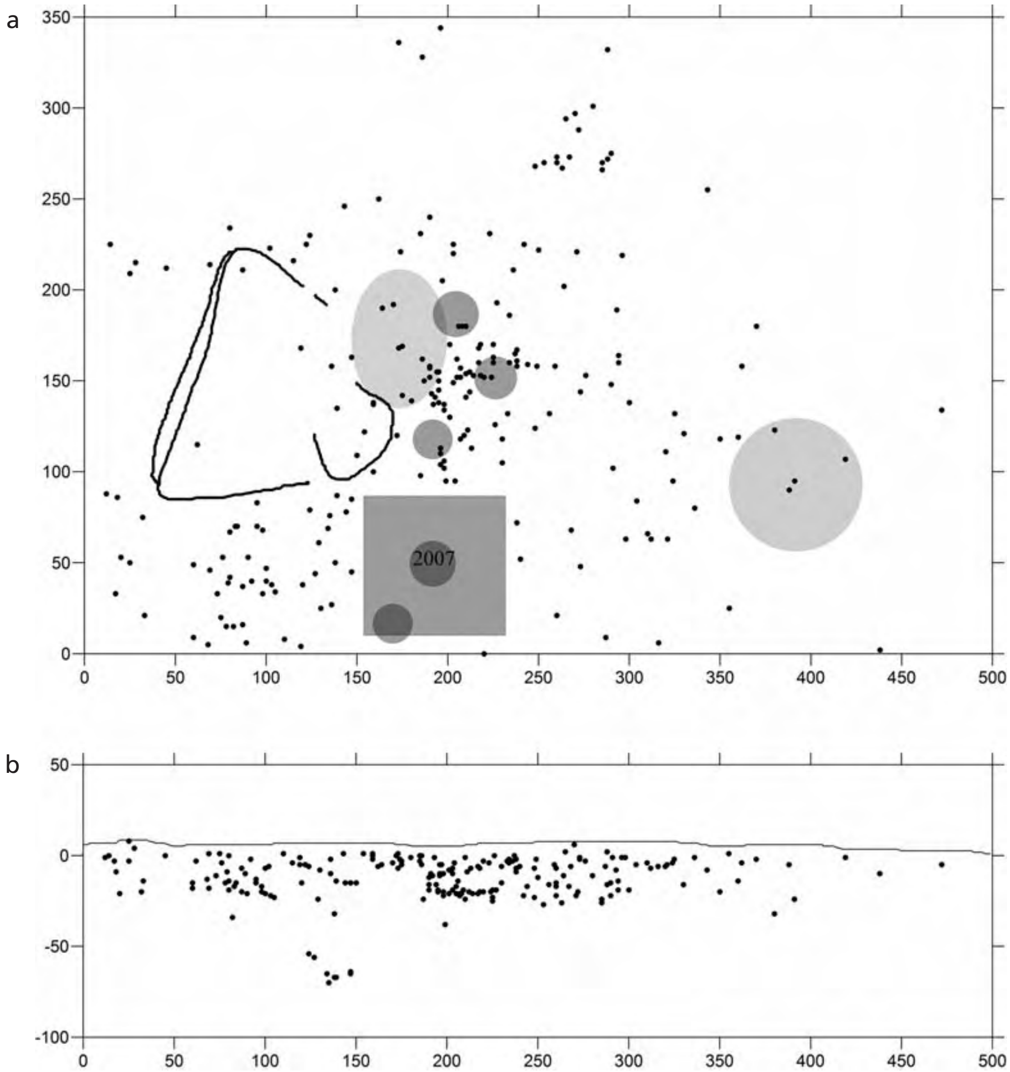

Fig. 9 Janova zátoka (okr. Děčín). Spatial distribution of lithic artefacts in the excavations 2007 (■) and 2010. – **a** horizontal distribution including a large boulder (left), an oval-shaped pit and five kettle-shaped pits (centre), and a circular hearth (right). – **b** vertical distribution of artefacts. – (Illustrations M. Novák / P. Hájková).

The occupied Mesolithic area of c. 5 m × 3.5 m in size in the centre of the rock shelter was completely unearthed, reaching a depth of 160 cm. Control trenches on the peripheries and inside the shelter exposed only a sterile sandy layer which became shallower deeper inside the shelter.

Stratigraphic section

The section is thin and the influx of allochthonous material was limited. Boundaries between lithological layers are irregular due to recent disturbance, archaeological features, cryoturbation, and occurences of larger sandstone blocks. The largest block (120 cm × 120 cm) was found in the left part of the excavated area (**fig. 9**).

Generally, the sequence of the layers can be characterised as follows (**fig. 10**):

1. Darkish, loamy-to-sandy soil (0-15 cm);
2. Sandy layer, locally red- or grey-burnt (15-25 cm), ^{14}C dated 9250 ± 60 BP;
3. Greyish-to-brownish, loamy-to-sandy layer, with charcoal, locally having the character of a podzol (15-30 cm);

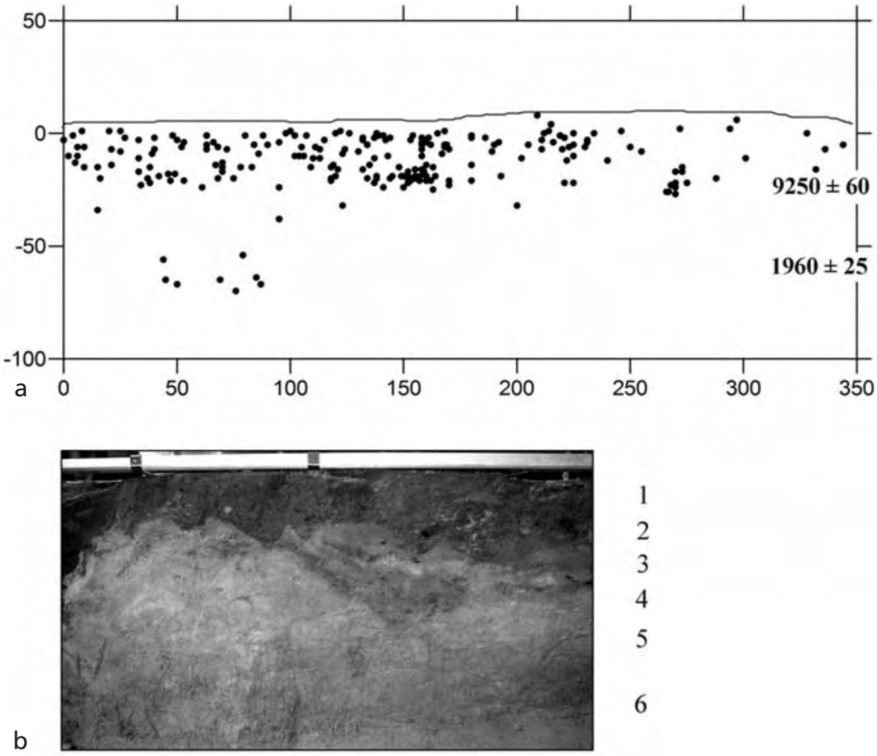

Fig. 10 Janova zátoka (okr. Děčín). Stratigraphic section. – **a** distribution of lithic artefacts in the layers 1-6. – **b** photodocumentation of the left and central part of the same section. – (a illustration M. Novák; b photo J. Svoboda).

4. Ochreous sandy layer, locally showing the effect of cryoturbation (20-40 cm);
5. Yellowish-to-ochreous sand with brownish bands, locally showing the effect of cryoturbation (30-60 cm);
6. Fine yellowish-to-whitish sand (60-160 cm), ^{14}C misdated 1960 ± 25 BP (probably due to local bioturbation), revision dating failed.

The excavation record, including 3D location of artefacts and additional material from sieving or floating the sediments, enables the reconstruction of four basic material units after approx. 15 cm intervals, separated into two Mesolithic and two Palaeolithic units.

Cryoturbation features in the layers 4-5

Cryoturbations are irregular structures occuring in loams and in regolith due to deep freezing and related frost processes, and they are characterised by undulated and dislocated layers and lenses. A precondition for their formation are stage-like changes of water/ice content which differentiate cryoturbation from the other earth movements. **Figure 11** shows a kettle-shaped frost pot. Fragments of rocks or gravels outlining margins of the feature are typical, frequently located diagonally or on the shorter edge and inserted during the frost heaving. There are two theories concerning the origin of frost pots: they are either an expansion of frost wedges or a depression resulting from heaving of fine-grained earths and sinking of the area between the above elevated earthy tongues. **Figure 11** shows a fine-grained layer below the frost pot, while cryoturbated earths are located above. Because permafrost is not a necessary precondition for its formation (if a sufficiently thick active layer was present; French 2007), the frost pot may have originated as late as the Late Glacial.

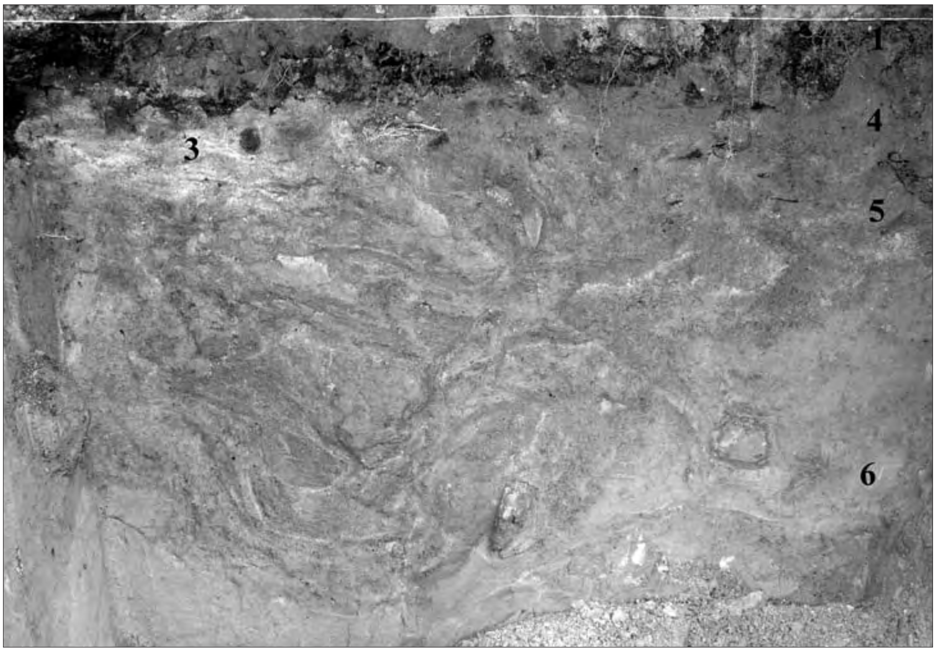

Fig. 11 Janova zátoka (okr. Děčín). Cryoturbation features. Numbers correspond to the layers in **fig. 10**. – (Photo J. Svoboda).

Anthracological analysis and vegetation reconstruction

Unit 1, 0-15 cm, Mesolithic with ceramic admixture
Beech and scots pine are the most common species in this unit. Spruce and silver fir occur frequently. The unit is remarkable for species-rich charcoal assemblages, as proved e.g. by the presence of *Acer* sp., *Alnus* sp., *Salix/Populus* sp., *Corylus avellana*, *Betula* sp., *Sorbus* sp., *Taxus baccata* and *Tilia* sp. charcoal.

Unit 2, 15-35 cm, Mesolithic
Two vegetation phases are documented in this unit. The younger phase (15-29 cm) shows an increase in species diversity. Oak and pine are still recognised as a forest dominant, but the expansion of beech and silver fir has already been reported here. The occurrences of hazel and yew have increased. An older phase (30-35 cm) is characterised by the presence of a sparse oak-pine forest with an occurrence of spruce, hazel and birch. Occasionally *Taxus baccata* charcoal was present.

Unit 3, 35-45 cm and deeper, Late Palaeolithic
This unit is characterised by an abundance of *Pinus sylvestris* charcoal, a common occurrence of *Picea/Larix* and a rare presence of *Quercus* sp., *Fagus sylvatica* and *Abies alba* charcoal. The ^{14}C date and the associated organic evidence suggest that the presence of oak, beech and silver fir in this basal layer is due to bioturbation (**fig. 4b**).

Leaving the evidence from the Pleistocene layer apart, it can be assumed that the Holocene vegetation near the site consisted of alluvial vegetation, a humid forest on the slopes and valley bottom and sparse pine forests in rocky areas and the edge of the plateau. The upper part of the section shows an increase in pine and a reduction in beech. The first occurrence of hornbeam in the section was found in this unit. Changes in the species composition are probably related to human impact on the vegetation communities.

Molluscs

Molluscs are rare and only terrestrial gastropod shells were identified. Most pieces are highly fragmented, which makes it very difficult to identify them, and their variability in section is low. Most fragments are sharply angular, the states of their surfaces preservations being variable.
Gastropod fragments were discovered only in the layers 1, 5 and 6. In the uppermost layer (1) one shell of *Discus perspectivus* and one shell fragment of *Clausiliidae* indet. have been identified. Generally, these

	5-3 cm	3-2 cm			2-1 cm				<1 cm					
	unit 2	unit 1		unit 2	unit 1			unit 2	unit 1			unit 2		
	CS	CS	C	C	S	CS	C	CS	S	CS	C	S	CS	C
stage I (<50 % carbonised)	1	1					1		2	2	3			
stage II (>50 % carbonised)		3	3	1		5	2			5	9			
stage III (fully carbonised)					1	2			1	4	1		2	1
stage IV (<50 % calcined)		5	4			5	5			19	29			1
stage V (>50 % calcined)		6	2			6	3	1	3	21	31	1	2	1
stage VI (fully calcined)					1		1		3	22	29	1	1	
total	1	15	9	1	2	18	12	1	9	73	102	2	5	3

Tab. 3 Indeterminate bone elements from Mesolithic units at Janova zátoka in relationship to their burning stages (after Cain 2005; Bosch et al. 2012). – Abbreviations: S spongy bone; CS compact-spongy bone; C compact bone.

gastropods are mostly silvicolous. The remaining material from this layer and all material from the layers 5 and 6 are unidentifiable. It is represented by shell fragments, probably mostly of the family Helicidae (owing to their general dimensions and subtle relics of their original colours – dark bands – perhaps they could be assigned to the proximity of *Cepaea* shells). The identified gastropods are presumably of local origin, but the presence of the Helicidae in the layers 5 and 6 is probably due to bioturbation.

Vertebrate remains

Unit 1, 0-15 cm, Mesolithic with ceramic admixture
In this unit, five bone fragments were recorded during excavation and 312 bone and tooth fragments were discovered during sieving. Almost all bones were fragmented and burnt at the stages IV-VI, thus the taxonomic determination was difficult. The few exceptions are the remains of cervids such as *Cervus elaphus* or *Capreolus capreolus* (part of astragalus, os triquetral) and suids *Sus* sp. (fragment of a lower incisor). Rodents were represented by *Clethrionomys glareolus* (1M1/, 2M/1), *Microtus* cf. *agrestis* (M/1) and *Sorex minutus* (fragment of humerus; a molar fragment, M12/), birds included Passeriformes cf. *Motacilla* (tarsometatarsus) and several very small fragments of indeterminate egg shells, amphibians by *Rana* cf. *arvalis* (ilium) and Anura cf. *Rana dalmatina* (cruris), and by several vertebrae from pisces (Piscea indet.). All these species are typical elements of a deep river canyon fauna. In addition, an admixture of recent or subrecent bones was determined during the excavation process on the basis of the absence of surface fossilisation and these were excluded from further examination (**tab. 3**).

Unit 2, 15-30 cm, Mesolithic
A bone assemblage of six bone and tooth fragments were discovered by sieving. As in the case of the unit 1, the bones represent small intederminate pieces with traces of burning. The exception is a rodent tooth, which was classified to *Microtus*? cf. *agrestis* (1M1/).

Unit 3, 30-45 cm, Late Palaeolithic
In this layer only two bone fragments were discovered by sieving: a piece of a long bird bone (Aves indet.) and one indeterminate burnt and calcined fragment (at the stage VI).

Unit 4, 45 cm and deeper, Palaeolithic
In this unit only seven compact bone or compact-spongy bone fragments were discovered by sieving, all burnt (at the stages V-VI).

Archaeological features and artefact assemblages

Unit 1, 0-15 cm, Mesolithic with ceramic admixture
This layer was largely disturbed by camping and other anthropogenic activities during the last few years and it also included eleven medieval pottery sherds (13^{th}-15^{th} centuries) and several iron sandstone fragments. An assemblage of 101 lithic artefacts recorded during excavation and 139 artefacts discovered during sieving were mostly made from flint. Several quartzite objects were

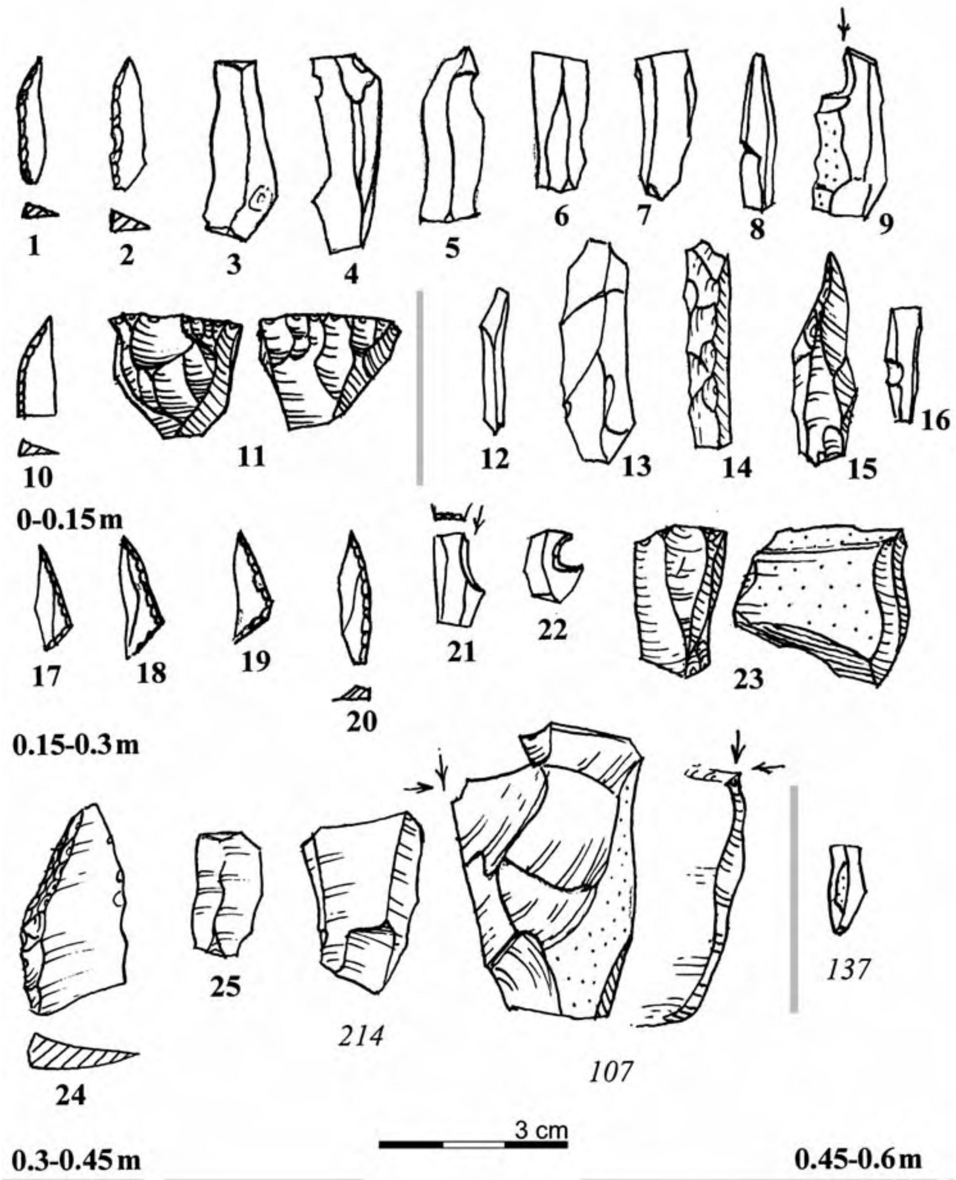

Fig. 12 Janova zátoka (okr. Děčín). Lithic artefacts: units 1 (0-0.15 m; **1-11**), 2 (0.15-0.3 m; **12-23**), 3 (0.3-0.45 m; **24-*107***), and 4 (0.45-0.6 m; ***137***), recorded artefacts (*italics*) and sieved artefacts. Flint, quartzite, white-patinated flint. – (Drawings J. Svoboda).

also present. Technological types include blades and microblades from unipolar and bipolar cores. Significant types are three backed pointed microblades and several burins, mostly on broken blades or fragments.

Unit 2, 15-30 cm, Mesolithic

At this depth, the layer was generally undisturbed. The base of the layer is covered by an extensive ashy and red-burnt area, and a regular circular hearth occurred in a shallow pan-shaped pit (diameter 70 cm, depth 10 cm) in the right section of the shelter. In the centre, aside from the largest sandstone block, an oval-shaped pit (70 cm × 45 cm, depth about 10 cm) and a group of at least five kettle-shaped pits were visible due to the dark humous filling and red-burnt margins (diameter 20-25 cm, depth about 15 cm); additional pits were not easy to see (**fig. 9**).

An assemblage of 67 artefacts recorded during excavation and 219 artefacts obtained from sieving includes a variety of raw materials such as flint, partly burnt, Bečov-type and other quartzites, and a few rare materials. It includes blades, crested blades, microblades and microcores. Significant microlithic types include elongated triangles and a backed pointed microblade associated with a microburin and a notched artefact (fish-hook?).

Unit 3, 30-45 cm, Late Palaeolithic

An assemblage of four artefacts recorded during excavation and 37 lithic artefacts discovered during sieving were made from flint, predominantly white-patinated. Significant types are an atypical backed pointed blade and a wedge-shaped burin.

Unit 4, 45 cm and deeper, Palaeolithic

An assemblage of six artefacts recorded during excavation and 13 lithic artefacts discovered during sieving were made from white-patinated flint. It includes a microblade and a series of small fragments and chips (**fig. 12**).

DISCUSSION ON HUMAN SUBSISTENCE

Lithic resources

The majority of the lithic raw materials is of local or regional origin (**fig. 1**). The southern boundary of glacial reposits with occurrence of erratic flint (*Feuersteinlinie*) lies a few kilometres north of both sites. Fine-grained quartzites of various colourations are present in adjacent Northwestern Bohemia (Bečov-type, Tušimice-type) and in Saxony (Profen/Zauschwitz-type), but one quartzite variety is also scattered as blocs over the Northern Bohemian plateaus (Stvolínky-type; cf. **fig. 1**). The porcellanite, described from Eastern and Northwestern Bohemian outcrops (Přichystal 2009), is expected to occur in Northern Bohemia as well, on contacts between the Cretaceous sediments and the volcanites. In contrast, the few pieces of radiolarite determined by A. Přichystal (pers. comm.) represent an exotic import either from the Czech/Slovakian borderland or from Austria, in both cases from several hundred kilometres distance.

Vegetational resources

In terms of vegetation (**fig. 4**), the Late Glacial layers at Údolí samoty are characterised by a low species diversity, anthracomass and only a low amount of hazelnut shells. The presence of hazel during this period is also supported by pollen diagrams from the nearby peatbogs of Mařeničky and Rozmoklá Žába in the Lusatian Mountains (Peša / Kozáková 2012, figs 3-4). The surrounding vegetation best corresponds to an open pine forest where the species composition indicates unfavourable enviromental conditions. In the Middle Mesolithic, the hazelnut shells and anthracomass show the highest quantity. The high amount of hazelnut shells probably correlates with the frequency of human occupation in the rock shelters. The same layers also show the highest species diversity. Surrounding vegetation can be reconstructed as a mosaic with the presence of sparse pine forests, species-rich oak forests (so-called *Quercetum mixtum*), hazel shrubs and early successional vegetation with aspen and birch. The highest amount of oak charcoal is recorded from the Upper Mesolithic period to the beginning of the agricultural period. During this transition time the presence of hazelnut shells is significantly reduced. In the post-Mesolithic layers, a significant decline of species diversity and an increasing representation of scots pine is recorded.

In sum, the almost continuous record of hazelnut shells at Údolí samoty, with a remarkable culmination during the Middle Mesolithic, differs from the hazel curves in the pollen diagrams from the nearby peatbogs. It may be interpreted as an evidence of human activity at the site.

Hunting and processing of the faunal remains

Hunting strategies at Janova zátoka and Údolí samoty were oriented on mid-sized (boars, roe deer or red deer) and small-sized mammals (hare or fox). In case of small animal remains such as birds, amphibians and rodents, we cannot decide whether they were collected by humans or whether they originate from bird's pellets, namely of falcon (*Falco peregrinus*), horned owl (*Bubo bubo*) or lesser spotted eagle (*Aquila pomarina*). Nesting of these species in the vicinity of both sites is highly probable.

As in other rock shelters in the Northern Bohemian region (cf. Horáček 2003; Svoboda et al. 2007), the largest proportion of animal bone and tooth assemblages from Janova zátoka and Údolí samoty are very small fragments, mostly smaller than 3 cm. Moreover, the majority of them was burnt (mainly at the stages IV-VI), although hearth structures were detected at Janova zátoka only. This high and noticeable degree of bone and tooth fragmentation and burning might result from targeted human activities which lead to the almost complete disintegration of animal tissues (cf. Delpech / Rigaud 1977; Lauwerier / Deeben 2011).
Several interpretative hypotheses can be proposed:

a) If bone was used as fuel, than we would expect the dominance of spongy bones;
b) If the aim was extraction of bone marrow or grease procurement, than the highly fragmented bone assemblage might not be associated with *in situ* burning. Even in this case we would expect the presence of spongy bones and a dark brown colouration (stage I/II) resulting from indirect heating;
c) If waste removal was the aim, than the high bone fragmentation, the presence of calcined bones, the presence of bones in a variety of burning stages, and the occurrence of other organic fuel (wood charcoal in this case) will support these hypotheses.

In sum, we suggest that the bone assemblages at both sites were most probably the final products of waste removal, although the previous stages such as bone marrow or grease procurement are not excluded.

Fishing

The location of the Janova zátoka rock shelter directly above the Křinice river (**fig. 8**) is optimal for fishing, but only several unidentified fish vertebrates from unit 1 may support this hypothesis. However, the preliminary reexamination of the fish remains from Dolský Mlýn (okr. Děčín), another rock shelter situated in a similar position above the adjacent Kamenice river, by L. Lõugas (pers. comm.) showed that some vertebrae come from some larger salmonid fish.
The find list at Dolský Mlýn according to the depths was as follows:

– 95-115 cm (post-Mesolithic) *Salmo* sp. – *vertebrae praecaudales* I (3 specimens), *vertebrae praecaudales* (6 specimens), *vertebrae caudales* (16 specimens) (expected body length c. 10-15 cm);
– 115 cm (Mesolithic) *Salmo* sp. – *vertebra caudalis* (expected body length c. 35 cm);
– 145-165 cm (Mesolithic) *Salmo* sp. – *vertebra caudalis* fragment (expected body length c. 50 cm), *vertebra praecaudalis* (expected body length c. 15-20 cm);
– 180-190 cm (Mesolithic) *Salmo* sp. – *vertebra caudalis* (expected body length c. 50 cm).

Thus in the Mesolithic layers, two caudal vertebrae come from c. 50 cm individual(s), one caudal vertebra from a c. 35 cm individual and one praecaudal from an individual smaller than c. 20 cm. Still after L. Lõugas, Atlantic salmon (*Salmo salar*) and sea or river trout (*Salmo trutta*) could be considered as representatives for such fish in the given area. Both the Kamenice river and the Křinice river are parts of the Elbe river drainage area. In the Elbe, salmonid fish have always been a part of the fish fauna, with the exception of a few decades of pollution at the end of the 20th century. Recently, the salmon spawning in the small tributaries of the upper part of the Elbe river was restored.

Although the new sites provided for the first time continuous stratigraphic and environmental records from the Late Glacial to the Holocene, no significant changes in settlement and resource exploitation strategies could be recorded at the Late Palaeolithic/Mesolithic boundary. These foragers were optimally adapted to the versatile landscape of sandstone plateaus and canyons throughout the climatic change, in order to exploit its changing vegetational and faunal resources.

Acknowledgements

We thank Josef Jíša for the support of the excavation at Údolí samoty and Petr Benda, director of the Bohemian Switzerland National Park, for the support of the excavation at Janova zátoka. In addition, we thank Václav Sojka for collaboration in the field, Antonín Přichystal for preliminary determination of lithic materials, Lembi Lõugas for fish remains, Ivan Horáček for microfauna, Petr Jenč for prehistoric pottery, and Michael Baales for comments. Ladislav Nejman helped with English corrections. The excavation was attended by anthropology students from the Masarykova univerzita, Brno, and the archaeology students from the universities at Hradec Králové and Olomouc. – This research is part of the Czech Grant Agency project »Before the Neolithic« (GAP504/13/08169S).

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Zusammenfassung / Abstract / Résumé / Resumé

Paläolithische/Mesolithische stratigraphische Abfolgen in den Abris Údolí samoty und Janova zátoka (Nordböhmen)

Dieser Beitrag ergänzt die Reihe von Veröffentlichungen zu den mesolithischen Forschungen unter Sandsteinabris in Nordböhmen (Tschechische Republik). Während der letzten Grabungen von 2007 bis 2011 wurden an zwei Stellen unter mesolithischen Horizonten erstmals auch (spät)paläolithische Fundschichten erreicht, die hier kurz vorgestellt werden. Unter dem Abri Údolí samoty kam eine mächtige und komplexe Sedimentfolge zutage, während das Abri Janova zátoka nur eine geringmächtige Sedimentüberlieferung aufwies. Trotz des Übergangs vom Spätglazial zum Holozän, der hier für diese Region erstmals innerhalb einer kontinuierlichen Sedimentfolge überliefert wurde, sind für die spätpaläolithischen und mesolithischen Fundhorizonte keine signifikanten Veränderungen in Siedlungsweise und Landschaftsnutzung feststellbar. Die Jäger und Sammlerinnen waren jeweils gut an die abwechslungsreiche Umwelt der Sandsteinplateaus und Canyons angepasst und nutzten die sich leicht verändernde Flora und Fauna optimal aus.

Übersetzung: M. Baales

Palaeolithic/Mesolithic stratigraphic sequences at Údolí samoty and Janova zátoka rock shelters (Northern Bohemia)

This paper adds to a series of previous publications discussing the Mesolithic discoveries in the sandstone areas of Northern Bohemia (Czech Republic). During the 2007-2011 investigation, Palaeolithic occupation layers were discovered below the Mesolithic. At the Údolí samoty rock shelter we documented a thick and complex stratigraphy while at the Janova zátoka rock shelter we recorded just a thin sedimentary sequence. Although both sites provided for the first time a continuous stratigraphic and environmental record from the Late Glacial to the Holocene, no significant changes in settlement and resource exploitation strategies could be observed. These foragers were optimally adapted to the versatile landscape of sandstone plateaus and canyons throughout the climatic change, and able to exploit its changing vegetational and faunal resources.

Séquences stratigraphiques du Paléolithique et du Mésolithique des abris Údolí samoty et Janova zátoka (Bohème du Nord)

Le présent article complète la série des publications précédentes concernant les abris mésolithiques situés dans les roches sableuses de la Bohême du Nord (République tchèque). Des couches paléolithiques ont été mises au jour dans le sous-sol mésolithique pendant la campagne de fouille 2007-2011. Pendant celles-ci, nous avons à la fois documenté une stratigraphie épaisse et complexe de l'abri Údolí samoty et découvert une autre, plus restreinte, dans l'abri Janova zátoka. Malgré une stratigraphie continue, allant du Tardiglaciaire jusqu´à l´Holocène, les changements observés dans les stratégies d´occupation humaine et l'exploitation des ressources paraissent minimes. L'adaptation aux paysages versatiles des plateaux sableux et canyons durant le changement climatique était dirigée vers une exploitation optimale des ressources végétales et fauniques. Traduction: M. Polanská

Stratigrafické sekvence paleolitu a mezolitu pod skalními převisy Údolí samoty a Janova zátoka (severní Čechy)

Tato studie navazuje na sérii předchozích publikací, které se týkaly mezolitického osídlení v pískovcové oblasti severních Čech (Česká republika). V letech 2007-2011 se podařilo objevit pod souvrstvími mezolitu rovněž paleolitické vrstvy. Zatímco převis Údolí samoty poskytl poměrně mocnou a komplexní stratigrafii, v převisu Janova zátoka byla sedimentární výplň mělčí. Přestože byl získán poměrně kontinuální stratigrafický a environmentální záznam od pozdního glaciálu po holocén, zásadní zlom v sídelních a potravních strategiích zaznamenán nebyl. Lovci a sběrači se adaptovali na pestrou krajinu pískovcových plošin a kaňonů napříč klimatickou změnou, s cílem maximálně využít dostupných rostlinných i živočišných zdrojů.

Schlüsselwörter / Keywords / Mots clés / Klíčová slova

Tschechische Republik / Spätpaläolithikum / Mesolithikum / Sandsteinregion / Abris
Czech Republic / Late Palaeolithic / Mesolithic / sandstone / rock shelter
République tchèque / Paléolithique final / Mésolithique / région du grès / abri
Česká republika / pozdní paleolit / mezolit / pískovce / skalní převis

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4 Závěr

Předložená práce nám poskytla antropologický vhled do predomestikačního vztahu člověka a zvířat ve vybraných kulturních kontextech mobilních společností současné arktické a subarktické Sibiře i společností pleistocénu a starého holocénu. Získané zkušenosti z prostoru severozápadní Sibiře jsme tak citlivě využili v rekonstrukci tohoto vztahu v archeologickém kontextu, čímž jsme získali komplexnější obraz jeho dynamiky z hlediska chronostratigrafického zařazení kontextu i ekonomicko-subsistenčních adaptací lidských společností v různých klimatických a biotických podmínkách. Sledované strategie odráží efektivnost kulturních adaptací minulých i recentních společností v exploataci dostupných živočišných zdrojů, přestože se pochopitelně liší skladbou fauny, její distribucí uvnitř sídliště i hierarchizací lidských aktivit uvnitř obývaného areálu. Ty se simultálně odráží v sezónním výběru polohy sídliště a v jeho vnitřním uspořádání (zóny domácí, aktivní a odpadní; lišící se vzájemně rozptylem osteologického materiálu), které zefektivňuje rozčlenění dílčích sekvencí zabití, bourání, stahování, porcování i následnou konzumaci těla zvířete (včetně likvidace odpadu). Uvedené vzorce lidského chování doplňují tendence opětovného použití výhodných poloh pro tábořiště, na které se tyto společnosti opakovaně vrací, stejně tak jako využití geomorfologie krajiny v moderování pohybu zvířat. Dokumentace etnologické sbírky z prostoru severovýchodní Sibiře nám dále ukazuje hraniční limit našeho komplexního pohledu na vztah člověk – zvíře v archeologickém kontextu, neboť dokládá, že ekonomická i symbolická rovina přispívá u každého živočišného druhu různě velkým dílem. Proto významnost konkrétního druhu nelze posuzovat bez znalosti jeho úplného kulturního kontextu.