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 Ancient Landscape Reconstruction in Northern Bohemia is a joint research programme set up in the summer of 1990 by Marek Zvelebil, from the Department of Archaeology at Sheffield, with Martin Kuna and Jaromír Beneš, both at that time in the Institute of Archaeology in Prague. The project received the active support of Evžen Neustupný, Director of the Institute in Prague at that particular time.

There were several reasons for setting up such a project at that time. The communist regime had fallen about 8 months earlier, and the social and political climate was one of hope, optimism and a desire to establish new links, or to develop old ones with Western Europe which had been tenaciously maintained despite official disapproval of the communist government of the previous 40 years. President Havel issued a call, prominently displayed for example at the Czechoslovak Embassy in London, to Czechs and Slovaks living abroad to join in the reconstruction and the development of the country so it could resume its place as a full and active member of the community of nations in Western Europe.

The Department of Archaeology at Sheffield had already established links with the Institute of Archaeology in Prague through the research of John Collins, Chris Gosden and Chris Cumberpatch in Bohemia. Building on these contacts, and responding to the general climate of the time, one of us (Marek Zvelebil) approached colleagues in Prague with an outline for a landscape-oriented research project. From the British side, the focus of interest was on the application of landscape archaeology to the archaeological record in Central Europe, on the development of the cultural landscape, on the investigation of the Mesolithic/Neolithic transition in Bohemia, and on the potential contribution landscape archaeology can make to the reconstruction of landscape destroyed by modern mining activity. From the Czech side, interest focused on the enrichment of settlement archaeology, already well developed in Czechoslovakia, by cross-fertilisation with approaches current in Western Europe, on the development of field survey and other techniques for recording of spatially-referenced data, on the development of Sites and Monuments Records and on the implementation of palaeoecological research. The research programme of ALRNB reflects these research interests and practical objectives.

Since 1992 the Czech part of the team co-operating within the ALRNB project (Martin Kuna and a group of specialists from the Department of Landscape Archaeology of the Institute of Archaeology, Prague) has received a special grant from the Czech Academy of Sciences to reinforce the activities of the joint project. This research
programme has been named the Landscape and Settlement project. It operates within the same territory (Central Bohemian transect) and is primarily aimed at research intensification with the special goal to study ancient settlement patterns and prehistoric community areas as well as to develop methodologies for archaeological heritage management.

The overarching aim of the project is to develop a programme of long-term ancient landscape and settlement studies in the Northern half of Bohemia within a general framework of rescue contingencies, which apply to both sub-surface and surface archaeological residues (for a more detailed discussion of our objectives, see the following papers in this volume). Within this programme, the duration of the present research project is expected to last five years from the first season of fieldwork in 1991.

The theoretical, research-oriented objective of the project is to gain an understanding of the evolution of cultural landscape and of the social transformations associated with it. At present, clusters of prehistoric and early medieval settlement have been located and excavated in areas selected on the basis of earlier research interest and rescue considerations. The principal fieldwork of the project consists of systematic survey using surface and sub-surface techniques as well as remote sensing of two transects extending from the Kráňov hory mountains on the Czech-German border across the basins of Labe and Otava to the foothills of the uplands of Southern Bohemia (see Fig. 1). Such a trajectory covers a comprehensive range of habitats and landscape types. It also extends from marginal zones across the traditional area of prehistoric and early historical settlement, thus enabling us to monitor changes in the general extent of the settlement area. Such a survey will then act as a control over the landuse and settlement patterns already noted as a result of previous research, and will provide an independent set of data for the understanding of ancient landscapes.

As a landscape archaeology programme, our research is structured to include a number of complementary approaches (Fig. 2). Sampling in space is accomplished by surface collection through fieldwalking and of a survey of woodland habitats by test pitting; vertical control is gained by test excavation and coring of target deposits. The archaeological fieldwork is integrated with palynological and geomorphological sampling, aerial photography, archival research and processing and analysis of finds.

To date, the fieldwork has been carried out by Czech and British teams during the main field seasons of the project, and by Czech teams throughout the year as the opportunities arise. The first field season, held in the summer of 1991, resulted in the implementation of the first stages of field survey: the subdivision of transects into the ecological zones on the basis of relief, present-day vegetation and soils (see PETKE and SÁDLÍK, this volume) the initial analysis of aerial photographs, historical landuse evidence and the archaeological archives; as well as palynological and geomorphological test survey and the collection of five pollen cores.

Research in 1992 occurred in two stages. During the spring and autumn field campaigns (March–April; October) two teams continued the surface field survey in both the Northern and Central Bohemian transects. In August and September, the research team involved 20–25 people engaged in field survey, sub-surface testing and finds processing. In addition to fieldwork, other analyses were carried out in passing during the last two years. These included aerial photographic analysis, aerial reconnaissance, archival studies, pollen analysis, botanical survey, archaeozoological analysis, archaeobotanical analysis, pottery and lithic research, database computerisation and computer-aided mapping.

In the series of papers that follow this introduction, we report on the results of our work after 18 months of research in our first major publication. In the contribution by PETKE and SÁDLÍK, the ecological zoning of our transects is explained. The paper by KUNA, ZVELEBLIČ, FORSTER and DRESLER ŘEVID addresses the relationship between field survey and landscape archaeology, and the methodology of our field survey design. The paper by BUTLER summarises the pollen analysis carried out to date, and discusses our palaeoenvironmental reconstruction strategy. The paper by BEECH summarises the archaeozoological

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Fig. 2. ALRNB: The structure of research. Bold frame indicates the current state of research.
and archaeobotanical analyses carried out to date and describes the methodology employed as well as some preliminary results. The paper by Kuná and Křivánek describes the application of geophysical survey, while Gojda reports on the use of aerial photography in our project. The paper by Beneš, Brána and Křivánek describes the historical changes in the landscape during the last 200 years. Although not covering all aspects of our research, this collection of papers offers a summary of most of its aspects to date.

In addition to primary research, our project was involved in supporting other activities, which benefited both Czech and British research. Three members of the British team spent extended periods of time in Prague (two for ten and one for five months) on British Council Scholarships. One of these, Mark Beech, remained in Prague and now works as an archaeozoologist in the Environmental Department at the Institute of Archaeology. At the same time, a number of Czech archaeologists have spent two to four weeks in Sheffield on study trips or have participated in research programmes organised by the Department of Archaeology there. These exchanges have resulted in a rapid intake of information by both sides and in the exchange of knowledge and opinion which has enriched the lives of all concerned. It is too early to estimate the effect this is having on Czech or British archaeology, and it will be interesting to see how the contribution of the project will be assessed in a few years. We hope it will be for the best.

Finally, we are pleased to acknowledge the financial and logistical support offered to us by funding agencies in Britain and the Czech Republic. The British Academy has been our most generous supporter so far. Funds were also received from the Society of Antiquaries, the Czech Academy of Sciences, the University of Sheffield, the Town Council of Most, and, indirectly through scholarships, the British Council. The Institute of Archaeology in Prague, the Field Research Stations in Most and at Březany and the Department of Archaeology in Sheffield have helped enormously by providing vehicles, accommodation and equipment either free of charge, or for only a minimal payment. To our funding agencies, as well as to our archaeological institutions, we extend our heartfelt thanks.

Particular thanks should go to several colleagues who carried out rapid analyses of material collected from the field survey: prehistoric pottery (Milošav Štahla, National Museum, Prague, and Štěpán Smkol, Inst.of Rescue Archaeology, Most), prehistoric lithics (Slavomír Vencl, Inst.of Archaeology, Prague) medieval pottery (Jan Frölik, Inst.of Archaeology, Prague, and Petr Medina, Inst.of Rescue Archaeology, Most), archaeobotanical analysis (Eva Hajnalová, Inst.of Archaeology, Nitra, Slovak Republic). We would also like to thank Pat Foster and Roman Křivánek for drawing many of the figures included within the papers. Finally, thanks should go to Mark Beech for correcting the English of all papers in this volume.

SOUHRN


Cílem projektu je studium vývoje kulturní krajiny a sociálních transformací, které z proměnami krajiny souvisí. Nejúčelovější metodou teoretické práce jsou systematické povrchové průzkumy (obzory), doplnění postpovrchovým vzkováváním, výstavě a rekultivací hřebínků. Práce jsou soustředěny do dvou transektech, protnutých částečně charakteristických krajinných typů ve staré sídelné oblasti a na jejích okrajích (Krušné hory, Kokořínsko, Říčansko).

Předložené články shrnují dosavadní výsledky projektu. Těžší činnosti prozatím spočívají v intenzivním rekognoscovacím území, zjišťení jeho potenciálu pro studium sídelních a paleoekologických otázek a formulaci adekvátních pracovních metod, z nichž část nemá v české archeologie požitečnou tradici (např. paleoekologický výzkum v nižších oblastech, plochý povrchový sběr, stolové průzkumy S. Buttera a M. Kany s kol.). V roce 1991 bylo dokončeno geologické členění zkušeného území (viz článek L. Peška a J. Sádlo), vstupní analýza leteckých snímků, historických map a archivních nálezových fondů; v r. 1992 se práce soustředily (vedle povrchových sběrů a postupného zpracování starších sázek) na dávkový průzkum (stolové článek M. Gojdy), archeoekologické průzkumy (příspěvek R. Křiváneka a M. Kany), geobotanické a paleoekologické studium (S. Butler), archeozoologické analýzy (M. Beech), tvorbu a plánku počítačových databází. Soubor následujících studií shrnuje tyto výsledky, které jsou prvním ucelenějším výstupem projektu v závěru jeho první, počáteční etapy (ukončení projektu je plánováno na r. 1995).

ENVIRONMENTAL CONDITIONS
WITHIN THE ARLNB RESEARCH TRANSECTS

PŘÍRODNÍ PROSTŘEDÍ VE STUDOVANÝCH TRANSEKTECH ARLNB

J. Sádlo – L. Peška

This article describes particular parts of the studied transects using a geophysical-environmental perspective. The environmental landscape is divided into units, named "ecozones". These eozones are on the one hand, consistent internally, but on the other hand, contain some degree of internal, mostly mosaic diversity. The description of borders between zones and short characteristics for each eozone are also documented, along with some numeric data for different zones.
300 m above sea level (more than 95% of settlement for Neolithic and Eneolithic cultures, Rolf 1983). Other characteristics and attributes of the areas inhabited by agrarian societies during prehistory and later periods are that their location predominantly coincides with the substrata of the Bohemian cretaceous plateau, monotonous relief, the occurrence of loessic deposits or other calcareous substrata with fertile soils (chernozems, rendzina etc.) and thermophytic areas (Ložek 1981). From this point of view, the transects, in the positions where they were delimited, realistically represent the situation in the northern half of Bohemia. Each transect covers major lowland areas and also the elevated contact zones (fig. 1 and 2) with a different geological composition.

Aims and methods

In this article we describe the basic characteristics of the natural environment within the studied transects. Our descriptive technique is based on the methods employed in the natural sciences (particularly those utilized in geomorphology and phytogeography), a method based on the classification of the environment using landscape units, i.e. units which do not exclude some internal variations. Such units delimited in this project are named "ecozones". The selection of these ecoszones represents our attempt to split the study area in order to reflect the following genetic parts each with different origins:

1. the original and basic environmental characteristics of the study area, independent of human impact (macroclimatic features, geological substrata, etc.),
2. the characteristics, which are the result of a complicated dynamic feedback relationship between human impact and the natural environment (vegetation), and
3. to a limited level even the direct anthropogenic phenomena which form a picture of the contemporary landscape.

This procedure is also based on the fact that the landscape of central Europe was continuously under an anthropogenic influence and thus, can only be described as an artefact (Ložek 1973).

Using the aforementioned genetic parts we define selected ecoszones in order to find units which are (despite some levels of their inner mosaic diversity) (a) consequently consistent internally, and (b) contain sufficient amount of distinctive features differing them from contact ecoszones.

We dedicate large importance to vegetation information in the process of delimitation of the ecoszones. It is the vegetation which sensitively reflects it by composition the complex of site conditions, taking into account also historical contexts. The description of vegetation units is based on the syntaxonomical rules of the Zürich-Montpellic school, which is broadly used in Central Europe. The nomenclature used is identical with those units used by Moravec et al. (1983a; 1983b).

The genetic components are "theoretically" non-independent, but particular landscape phenomena and even some complex environmental characteristics may be the result of the simultaneous influence of different parts (cf. pedogenesis). For this reason we do not differ between the described parts in the following description.

Results

The area of research transects (each 50x10 km) have been divided into 13 different ecoszones (fig. 1), which with the exceptions of the floodplain zones are broadly comparable in size (fig. 3). The extent of the ecoszones is large enough to include a sufficient number of settlement sites, including their catchment areas. It is therefore possible to carry out the comparison of settlement patterns between different ecoszones.

Central transect

1. KOKOŘÍNSKO

This area is a landscape with a striking micromosaic, formed as a result of the substantial interference of geomorphological and geological features.

The main landscape pattern is based on a continual environmental gradient between more xerothermic conditions in the southern part and cooler, wetter, mesothermic conditions in the northern part. This area is basically a sandstone plateau (neither calcareous nor acidic), with a cover of extended deep loess. Sandstones are eroded in a complicated system of deeply cut canyons and dry valleys with flat floors and steep slopes with pronounced rock edges. It is a variegated mixture of geological substrata (acid sandstone as well as calcareous loess) and microclimatic stands (warm, dry upper valley borders, as well as, wet, dark and cool glens), and this forms a mottled type of vegetational mosaic. Rich oak–hornbeam forests (Melampyro-Carpinetum) exist locally on loess, while at the same time, pure acid sandstone sites are covered with such vegetation ranging from acidophilous oak forests to pine forests (Vaccinio–Quercetum and others). In the valleys there are acidophilous wood–beech forests (Luzulo-Fagetum) and in canyons with a climatic inversion there are also locally fir forests (Luzulo–Abietetum). There is a clear diffuse border between the thermophytic and mesophytic zones in this area. Recently, forests survive mainly close to the borders of the terrain.

2. VŠETATSKO

This is an area with a rough mosaic of well delimited smaller landscape units, showing similar composition to the Vranáko ecoszone in the northern transect. Such a region was typically used as agricultural land in prehistory. It is a flat terrain laying on a limestone bedrock, with predominantly sandy or clay soils with variable moisture content.

The flatter parts are covered with acid pine–oak forests on thin soils based on fluvial sands and gravels. Within broad depressions there are thick deposits of calcareous bogs. Prolongated smooth marlite hills form on slopes, the so-called "white slopes" (sheet slides of turf on steep slopes build by white clays and marls) which are vegetated mainly with xerothermic grass vegetation. The original vegetation cover can be reconstructed as patchy alkaline pine–oak forests. The original open land in this area is documented by plant relics growing on bogs, white slopes and sand stands.

The whole area was markedly deforested and now has a low density with regards to the pattern of human settlements.

3. Labe floodplain

This area is the broad fluvial plain of the Labe, with a complicated mosaic of elevations formed of gravels and sands which have been transformed and remodelled during the last glaciation, being split by boggy and loamy palaeochannels. With the exception of these palaeo-channels, the plain is covered mainly with sandy soils without substantial floodplain deposits.

The area at the present time is partly covered by alluvial elm–oak forests (Ficario–Ulmetum) and partly, by fragments of rich meadows (Seratulo–Festucetum and others), which represent relicts of phytocoess who have been formed during the Middle Ages.

Fig. 1A. Central transect: Maps of study transects, indicating the limits of ecoszones (left side) and basic elevation structure (right side). Ecoszones are numbered on the right side of each transect using the same numbers as in the text.
There is psammophylic vegetation (Thymo-Corynephorion, Jurineo-Koelerietum) on the dryer sandy elevations which may indicate continuous or shifting terrestrial open areas. The communication network follows the boundary of the alluvium, while large settlements are situated within the fluvial plain.

4. BRANDÝSKO

This is a warmer lowland area covered by loessic deposits, lying within the traditional utilised agricultural zone. It is a flat landscape with a dispersed network of larger streams. The substrata are formed by cretaceous sandstones, argillaceous sandstones and claystone mostly covered by layers of loess. Algokin phanitic (lydite) locally create knobs (small mounds of harder rock created by erosional processes).

From the vegetational point of view this is a typical thermophytic area with patches of brown soils in a chernozem matrix. It contains numerous pasture remains of xerothermic vegetation (with Koelerio-Phleion and Festucion valesiaceae), but the number of species is low as there has probably been prolonged, severe human impact in this area. As a result of this no real floristic indicator of the previous open landscape was documented.

5. VIDRHOLEC

This landscape area is a slightly undulating plain in an area of oak–hornbeam forests. It is a senile penepelvic relief with a flat, wet dispersed border between the Labe and Vitava catchment areas, being drained by parallel small streams. The substrata is formed by mineral poor ordovician slate and protozoic greywacke covered with brown soils, with pseudo–gley and a small limited areas of chernozems on loess deposits in some places.

This is an area of mesophytic with a slightly continental climatic influence. The vegetation mosaic is formed of cooler forms of oak–hornbeam forests, lime–oak forests (Tilio–Betuletum) and wet acidophilous birch–oak forests (Molinio–Quercetum). Open land is locally covered by xerothermic vegetation of synanthropic pastures (Koelerio–Phleion). The broad scale landscape mosaic contains a sparse network of settlements. This area largely consists of open land with the exception of one large forest complex at Vidrholec.

6. ŘÍČANSKO

This region is an elevated (fig.2) and cooler area with undulating to hilly relief, formed mainly by granite substrat. This represents the southeastern part of the transect areas and directly connects with the crystallinitic covering the southern half of Bohemia. It is recently characterised by the occurrence of beech, fir and acidophilous oak forests on prevailing poor brown and pseudo–gley soils. Its geological composition is formed by mineral rich granite from the central Bohemian pluton, weathered at elevation into boulder fields. It is a spring area with borders dividing the catchment areas of the Vitava, Sázava and Labe rivers. The area is broadly similar to some districts of the Bohemian–Moravian uplands.

Until the last century we can reconstruct the typical vegetation as representing colder mesophytic with extended forests of mainly acidic biotopes, partly mesic (Luzulo–Fagetum, Luzulo–Quercetum) and partly humid to wet (Molinio–Quercetum, Luzulo–Abietetum). Possible open areas can be characterized by poor types of meadows and pastures (Trifolio–Festucetum, Polypogo–Nardetum) and wet meadows (Calthion). This region has a structure which can be described as a small grain landscape pattern.

Description of borders of particular ecozones:

Vletatský / Kokotínský: This border follows the upper edge of slopes coinciding with the limits of the acidic sandstone. This is also represented by a vegetational interface.

Labe floodplain: This border follows the limits of the former floodplain terrace which is clearly visible as a step in the terrain.

Vidrholec / Brandýsko: This border follows the southern limits of the loess area of the thermophytic zone. In the western part the border follows the limits of richer substrata in accordance with the map of potential vegetation (Moravec–Neuhaus & al. 1992).

Říčansko / Vidrholec: This border separates the elevations of more than 400 m a.s.l. with the more forested landscape on a granite substrata.

Northern transect

1. KRUŠNÉ HORY (ORE MOUNTAINS)

The northern part of the studied transect is situated on the slopes of the Krušné hory mountains. Steep slopes from the base (300 m a.s.l.) to the upper ridge of the mountain plateau (around 950 m a.s.l.) are formed by granite and gneiss bedrock. They are divided by deeply cut parallel valleys. At the base of these slopes there are large dejectional cones. The slopes are covered with loamy scree material. The proper mountain plateaus lie outside the studied area.

In this zone there is a very large soil/climatic/vegetation gradient. Increasing altitude is connected with climatic changes towards more wet and oceanic conditions, whilst at the same time, soils are changing from brown soils to scree rankers, and finally to podzols. In accordance with this, the vegetation is changing from oak–hornbeam forests (Melampyro–Carpinetum) to maple–lime scree woods (Tilio–Acerion) and finally to eutrophic herb–rich beech forests (Pajion), or acidophilous woodrush–beech forests (Luzulo–Pajion).

The vegetation mosaic of this zone is extremely variegated but regularly developed. The slope base forms a pronounced contact border between ecozones.

2. BÍLINA BASIN

The basin of the original Bílina river is formed in a rift depression filled with tertiary and quaternary lake sedimentsation. The dominant feature of this area was the Komořany lake (out of studied area), whose residue was destroyed during the past few decades. The original flat terrain of clay, sand and gravel deposits were vegetated with floodplain forests. Probably there would have been alluvial alder–asph (Pruno–Fraxinetum) and elm–oak (Ficario–Ullietum) forests in the wetter places whilst oak–hornbeam forests (Carpinion) predominate in the drier biotops. This area was deforested for a long time, and since the Middle Ages has been destroyed by local coal mining. The modern macro–disturbances have totally changed the previous existing structures and the relief of the landscape.

3. STŘEDOHORÍ

This zone is an elevated hilly country with a contrasting mosaic of smoothly modelled long slopes created on marlrite and clay substrata, and steep slopes of large volcanic hills with pyroclastic bedrock. This zone lays in the rain shadow of the Krušné mountains. It is the thermophytic affected by slightly continental climatic conditions. The area is predominated by brown soils and rankers.

Fig. 1 B. Northern transect: Maps of study transects, indicating the limits of ecozones (left side) and basic elevation structure (right side). Ecozones are numbered on the right side of each transect using the same numbers as in the text.
This area is an important centre of Central European xerothermic vegetation. The diversity of geological substrata, geomorphology and historical development of this area is projected by the large diversity of vegetation: semixerothermic oak forests (Potentillo-Quercetum), oak-hornbeam forests (Melampyro-Carpinetum) and xerothermic steppe formations. In some places it is possible to observe, within local areas, indications of land which remained open for considerable periods of time.

### 4. 

This is a cold forested area laying above 450 m a.s.l. in the complex of the Milešovka mountains. The zone belongs to cold mesophyticum on purer brown soils with a higher precipitation level when compared with the contact zone.

### 5. ŽEJDLÍK

This zone is a lowland area divided by straight ridges of marlrite "white slopes" and small solitary volcanic hills. These prominent structures form important components in the landscape, increasing the level of diversity within the zone. The area with chernozem soils contains numerous indications of a continuum of open land. This zone belongs to the thermophyticum with a continental climatic influence. A dispersed net of parallel streams covers the area, which is almost completely deforested. Our reconstruction of this zone would suggest that it was predominantly an area of xerothermic oak forests (Potentillo-Quercetum).

### 6. OHRÉ FLOODPLAIN

This is a comparatively small, flat area of the Ohré floodplain with alluvial elm-oak forests (Ficario-Ulmetum) and rich meadows (Alopecuron) growing on a floodplain substrate. This zone is enclosed within a corridor of steep slopes. At the present day there are no settlements in this zone.

### 7. VRANSKO

This is a flat to moderate area, slightly elevated towards Džbán, dividing the Vltava and Ohré catchment areas. It is a fairly dry region with sparse, straight streams and a low density of human settlement. The bedrock is formed by limestones and sandstones, covered by loess. The area belonging to the thermophytic zone is largely deforested. It is possible to make a preliminary reconstruction of this area as being covered with xerothermic oak forests (Potentillo-Quercetum), acidophilous oak forests, with the subsequent emergence of oak-hornbeam forest (Melampyro-Carpinetum). There is a geologic brake in this zone, called Šebín and Máčuv důl, which forms a slope with different conditions vegetated by rich forests.

### Description of borders of particular ecozones:

The Bílina basin is restricted by the base of the České středohoří and Krusné hory mountains.

Hradišťany / Středohoří: The border divides the vegetational zones of thermophyticum and mesophyticum.

Žejdlik / Středohoří: the border approximately follows the extension of the flat plains and more hilly terrain of the České středohoří.

The Ohré floodplain is restricted from both sides by hypometrically limited the extension of the Holocene terrace.

### Notes:

1. The use of published map sources.

All of the following maps were consulted for information: e.g. Balatka et al. 1962; 1966; 1975; Mikýka 1969; Horný 1989; Zoubek 1990; soil maps 1:50000, 1:10000, the fast military "Josef II." (1780s) mapping, etc. No single map has been used in a mechanical fashion, or in all its detail.

In archaeology the most broadly used maps for vegetation interpretation are those of the reconstruction of the potential vegetation (Mikýka 1969). However, there are several reasons why, in our opinion, this map cannot be used blindly:
1. The changes of the content of particular mapping units. For example: The mapping unit acidophilous oak forests team Mikytry is broadly present in the Žičany and Vidhrolec eozones. This approximate unit, on the basis of the present knowledge, consists of two different types of vegetation: acidophilous oak and fir forests. These two different units not distinguished on the map are good distinctive feature within the mentioned eozones.

2. The changes in ecology of some units. The ecological features of some areas allow us to reconstruct in particular places different units. For example: Some elevations of Brandýsko should be covered with acidic oak forests and not with eutrophic oak-hornbeam forests. A similar situation is in Vranisko, where we reconstruct subacidophilous and acidophilous oak forests and not oak-hornbeam forests.

3. There is a danger of broad scale generalisation. Even manuscripts of works in the scale 1:75 000 are not able to express fine mosaics of different vegetation types. For example: in the Kokořínsko eozone, only two out of six frequently occurring but scattered units were approximately mapped.

4. The level of averaging of units utilised. For example: oak-hornbeam forest has to be used for practical purposes as one group without differentiating particular associations. Although simply on the association level of this unit (Tilio-Betuletum / Melampyro-Carpinetum) we can identify very marked differences between Vidhrolec and Brandýsko.

5. There are also differences between the potential and real past vegetation. For example: pine-oak forests, which were mapped as potential vegetation in the Vltavetsko eozone, had until this century psamophilous grass level vegetation, and therefore we reconstruct relict pine forests in these places.

2. The term – continually open land:

Continually open land has contrasting vegetation to forest areas, although we do not necessarily believe that it was a stable long-time persisting extensive "steppe" area. Instead, we think that it was rather the effect of small gaps in the forest, and/or patches of open land which were a refuge for non-forest species surviving there from the early postglacial period.

On the basis of modern field research we can expect that the open land indicators would survive even in very small natural forest clearances, with the size of a few tens of square meters. Such clearances would not have been fixed or stable but migrating. This explanation is however concerning the biology of these indicators and is not dealing with the questions of an origin and survival of chernozem soils.

SOUHRN

V projektu ALNRB je zkoumán vztah území České kotleiny. Ve dvou transektech (souvislých průběhů 50 x 10 km) jsou prototypy některých černozemních oblastí původního otevřeného a testovány okraje vážně zafírových poloh.

V tomto příspěvku podáváme popis základních charakteristik přírodního prostředí v transektech. K popisu jsme zvolili metodu používání přírodněvědných oborů (vzhledem geomorfologii a fytogeografii), kterou je klasifikace prostředí pomocí krajinných částí, tedy jednotek, které zároveň nevyužívají jistou vlnní různorodost.

Tyto jednotky v projektu nazýváme ekosystémy, jsou naším pokusem klasifikovat zkoumaná území tak, aby členění odrazilo následující složky:

1) primární environmentální charakteristiky nezávislé na lidském impaktu (makroklíma, geologické podklad).
2) charakteristiky, které jsou výsledkem složitých přírodněvědeckých působení mezi lidským impaktem a přírodním prostředím (vegetace),
3) v jisté míře i přímé antropogenní fenomény formující současný obraz území.

Toto vyimezení legitimujeme tím, že středoevropská krajina je výsledkem interakce s člověkem a tudíž je dostatečně popisovatelná pouze jako artefakt.


Ačkoliv jsou jednotlivě jmenované složky vzájemně principálně odlišné, jednotlivé krajinné části a složky přírodního prostředí mohou být konfigurovány jakožto výslednice více složek zároveň (cf. pedogeneze). Proto jezou jsou v následujících popisech oddělovány.

Středočeský transek členíme na 6 dobové oddělitelné ekozóny:


Velmi stručný popis přírodních poměrů a charakteristických znaků jednotlivých ekozón byl podán v práci Beneš et al. 1992. Podrobnější je podle hlavního obsahu tohoto příspěvku. Vymezení ekosystému je patrné z připojených mapek (fig. 1-6) – či v podrobné mapek (fig. 7). Jejich výsledkem je přibližná srovnávání v připojené tabulce (fig. 2). Základním principem je rozdělení jednotlivých ekosystémů podle další tabulky (fig. 3). Závěrečné poznámky diskutují problémy Mikytry (1967) rekonstrukci mapy a pojem kontinuálního bezlesí ve vztahu k rostlinným indikátorům tohoto typu krajiny.

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A STRATEGY FOR LOWLAND PALYNOLOGY IN BOHEMIA

STRATEGIE PALYNOLOGICKÉHO VÝZKUMU NÍŽINNÝCH OBLASTÍ ČECH

Simon Butler

There is currently a large discrepancy in the distribution of palynological and archaeological sites in the Czech Republic; pollen sites are concentrated in the uplands, archaeological sites in the lowlands. Sub-surface exploration of the lowland landscapes of central and north-west Bohemia by the ALRNB Project has recently discovered many well-stratified Holocene sediment sequences in the river valleys of the region. These previously unstudied deposits have been found to contain well-preserved pollen and other biological remains, and to hold enormous potential for much-needed palaeoenvironmental research in this key area of Central Europe. The present report describes the sub-surface survey strategy, and presents some of the lithostratigraphic and palynological results obtained so far.

Introduction

Palynological and associated palaeoenvironmental research within the Ancient Landscape Reconstruction Project (ALR) contributes towards a regional-scale study of the development of Bohemia’s natural and cultural landscapes over the past c. 10,000 years (the Holocene period). The main aim of the palynology is to explore change and variability in the vegetation of the region as a means of tracing ecological, land-use and settlement histories, and the varying intensities of past human impact on the landscape. As part of a landscape archaeology project the palynological research is coupled with archaeological field surveys of the region, so allowing the possible connections between environmental variability and change and past human settlement and economic activities to become particularly well highlighted.

Previous pollen work in the Czech Republic has tended to concentrate on the vegetational history of the upland regions, where the natural occurrence of lake and mire deposits has provided suitable sites for study. Figure 1 shows this bias towards upland locations above c. 350 metres above sea-level (m.a.s.l.). However, the known distribution of archaeological sites, particularly from prehistory, shows a very clear concentration in the lowlands below c. 350 m.a.s.l., where there is a scarcity of natural lake and mire deposits (the "old settlement area" or "Oikumenae", Fig. 1). Consequently, there is currently very little palynological information of direct relevance to understanding the changing nature of prehistoric settlement and land-use patterns in Bohemia, and their role in vegetation changes and landscape development through time. Palynological research within the ALR project is attempting to fill this gap in knowledge.

Outline of Existing Knowledge

At the upland pollen sites it is difficult to detect evidence for human activity prior to the Medieval period (c. eighth to fourteenth centuries A.D.), although many of the available pollen profiles display

Fig. 1. Distribution of existing pollen sites in the Czech Republic. Site numbering, with the exception of site 30, follows Rybníčková and Rybníček (1988), who provide a full list of references.

Dotted area = land below 350 metres a.s.l.
Shaded rectangles = ALR study transects.
a mid-Holocene stratigraphic hiatus in which the Atlantic (Neolithic) period is missing. Pollen data from the Sub-Boreal and Early Sub-Atlantic periods (c. 5000 B.P. to c. 700 A.D.) has so far suggested only limited and perhaps mostly pastoral farming, apparently restricted to alluvial habitats. The evidence consists of the appearance of meadow and pasture plants and occasional cereals within Alnus and Picea dominated floodplain forests. Large-scale deforestation of upland areas with mixed arable and grazing activity is evidenced for the Medieval period, particularly during the twelfth-fourteenth centuries A.D. This has been linked to major increases in soil erosion and stream flooding, leading to marked increases in the rate of accumulation of flood loams in the river valleys (e.g. Opravil 1983).

Not surprisingly the earliest evidence for human activity so far recorded in pollen data from Bohemia comes from one of the few existing lowland sites; Komořany (Janoušková 1988; Neustupný 1985). Unfortunately the evidence is not very clear due to a general predominance of tree pollen throughout, with large fluctuations in the relative representation of individual tree taxa. The clearest evidence for increases in agricultural land is marked by increases in Gramineae, Cereal–type and *Platycodon lanceolata* pollen representation. It appears to date mainly from the late Iron Age period, with a subsequently even more dramatic impact from Medieval farming. There are some earlier increases in the representation of *Platycodon lanceolata*, Cereal-type and *Brassicaeae* pollen which suggest possible Bronze Age and Eneolithic human activity, but it becomes increasingly difficult to establish with certainty anthropogenic influences prior to the late Sub-Boreal period at the site. Of the other lowland pollen sites, the most recently published is that of Jankovská (1992) in the Doksy district (Fig. 1, site 30). Unfortunately, however, the deposits at this site cover only the earlier Holocene period up to Later Atlantic times, and there is no clear evidence for human activity in the pollen record.

Pollen work from the other two lowland sites (Fig. 1, sites 19 and 20) was undertaken in the 1940’s and 1950’s, and is of very low resolution due to poor pollen preservation, erosional hiatuses or lack of detailed analysis.

A Strategy for Lowland Palynology in Bohemia. The ALR study region, which covers a total area of 1000 sq. km, has been divided into 13 major landscape units (ecozones) which recognise environmental differences within the region (Pekel – Sádlo, this volume). The ultimate aim of the palynology is to investigate vegetation and land–use histories within each ecozone by producing at least one complete Holocene pollen profile from each zone. The ecozones vary in size and shape, with the smallest covering an area of c. 5 sq. km. and the largest c. 150 sq. km. Ideally, each selected pollen site should be located more or less centrally within its ecozone, and should possess a pollen–catchment area which roughly matches the size of the ecozone (Fig. 2a).

Surface pollen studies from America and N.W. Europe indicate that different types of depositional site "sense" the landscape at different spatial scales (Bradshaw 1991; Prentice 1988). For example, a large lake or open mire will receive more pollen from a wider area than a small lake or wooded mire. Pollen data from a large lake would generally provide a coarse–grained, regionally–integrated record of the vegetation averaged within a c. 20–30 km. radius of the lake. Pollen data from a small wooded mire would be more heavily influenced by locally–growing vegetation and would therefore generally provide a more fine–grained, spatially–precise view of the vegetation growing within a few hundred metres radius of the site. Thus, as part of a regional–scale pollen study, each selected ALR pollen site should ideally be a reasonably large lake or open mire.

Unfortunately, most of the lakes within the study region appear to have been artificially created in recent centuries, and there are few

Fig. 2. (a) Hypothetical ideal distribution of reasonably large lakes and their pollen–catchment areas (one in each ecozone). (b) Actual distribution of sites investigated so far.
obvious mire sites. There was therefore a primary need for sub-surface exploration of the region, using coring techniques in combination with test-pitting and the examination of any existing exposures, in order to determine the nature and distribution of available deposits as a basis for assessing and selecting sites for further study. Preliminary field reconnaissance, coupled with examination of soil survey maps and aerial photographs, focused our attention on river valley alluvial sites as the most likely sources of sediment sequences capable of yielding Holocene pollen profiles. This ties—in very well with the archaeological aims of the project, because proximity to sources of water is likely to have been an important factor in the location of prehistoric settlements in Bohemia. Thus, prehistoric settlers may also have focused their attention on the river valleys.

Sub-surface work has so far been carried out at 15 locations covering 8 of the 13 ecozones (Fig. 2: b). Selected palynological sub-samples have so far been analysed from 10 of the 15 sites. A total of seven radiocarbon-dating samples have also been submitted. A pollen sub-sampling strategy, whilst ultimately aiming towards landscape reconstructions, was initially designed as a preliminary assessment of the palynological potential of the region. Thus, a broad-scale coverage of the new sites has aimed to (a) assess their degrees of pollen preservation, and (b) provide sketch outlines of their pollen biostratigraphies in order to estimate their age spans and information potential. The results have so far pointed to the existence of well preserved pollen records at 8 of the 10 sites; the remaining 2 sites (sites 7 and 15) proved unpalyniferous. The results provide an effective basis from which to

Fig. 3. Site 1 percentage pollen diagram.

Fig. 3a. Cont.
design more comprehensive sub-sampling strategies; a more comprehensive analysis has already been completed from site 1.

**Analytical Procedure.** Pollen samples were processed using alkaline digestion followed by acetolysis, dehydration and mounting in silicone oil. The mineral component was removed by sieving at 150 microns and 10 microns, with swirling and retention of the 10 micron sieve retent. Identifications were carried out at 400x magnification until a total of at least 500 identifications were made in each sample. The results are expressed as a percentage of total land pollen (trees + shrubs + herbs), except for Pteridophyta spores and aquatics, which

![Diagram](image)

**Fig. 4. Stratigraphy of deposits at site 2, Vinof.**

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are expressed as a percentage of total land pollen + total spores, and total land pollen + aquatics respectively.

Results from the Central Transect

Site 1: Vodňádské Bučiny, near Svojšinec, Šifanec ecoregion. A small spring-flush mire of only a few metres diameter, located at c. 390 m a.s.l. in a large area of remnant woodland at the southern–most extreme of the study region. The site has accumulated a 1.2 m thick deposit of silty peat above a stoney base. A complete pollen diagram with 10 cm sampling interval has been constructed from the peat, and this has been divided into 3 local pollen assemblage zones (Fig. 3).

Zone VB1: This zone is characterised by tree and shrub pollen values of 70% or more of total land pollen (TLP), and Gramineae pollen values of less than 20% TLP. At the start of the zone tree and shrub pollen values exceed 90% TLP, and indicate the former existence of a mixed coniferous–deciduous woodland dominated by Abies and Fagus with an admixture of Quercus, Pinus and Betula, and a field layer rich in ferns. The presence of such high proportions of Abies and Fagus pollen at the base of the profile suggest a later Holocene date for the start of organogenic infilling of the hollow (probably around c. 2000 B.P. according to the isopollen maps of Rybníček & Rybníček 1988). The site probably lay just above the altitudinal border between upland Abies–Fagus forest and lowland Quercus and Pinus forests.

Almost as soon as sedimentation began, there was a sharp reduction in the representation of Abies and Fagus pollen, which suggests some destruction of the woodland. It seems to have been replaced by a wet meadow community characterised by Gramineae with Cyperaceae, Filipendula and a range of other herbs including possible agricultural/settlement ground indicators such as Rumex, Artemisia, Compositae tubuliflorae, and Plantago lanceolata. Cereal type pollen is also recorded, size measurements of which place them mostly in the Avena/Triticum category of Andersen (1979). Taken as a whole, this pollen assemblage from zone VB1 suggests that nearby clearance of the native Abies–Fagus woodland for the creation of pasture and arable land led to waterlogging of the hollow, and development there of a semi–natural wet meadow community. The opening–up of the woodland allowed a peripheral expansion of the light–demanding trees Betula and Corylus. Towards the top of the zone there is a slight recovery in Abies pollen frequencies, perhaps as a result of some woodland regeneration.

Zone VB2: This zone is characterised by a further decrease in tree and shrub pollen values to less than 60% TLP, and an expansion in herbaceous taxa, particularly Gramineae and cereal type. This points to a second and more extensive clearance phase, possibly associated with an expansion in arable farming. The destruction of woodland seems to have been initially quite severe, with a drop in tree and shrub pollen values from 73% to 40% TLP. Fagus was almost completely lost, and Abies remained permanently reduced. The more open conditions did, however, favour some subsequent regeneration in Soli, Betula and Pinus, although total tree and shrub pollen values remain below 60% TLP throughout zone VB2.

Zone VB3: This zone is characterised by a slight recovery of tree and shrub pollen values to between 60% and 70% TLP, achieved mainly by increases in Carpinus, Quercus, Alnus and Betula. This recent reforestation indicates a recent decline in agricultural activity around the site. The temporary increases in Galium type, Cruciferae and Caryophyllaceae pollen across the zone VB2/VB3 boundary may reflect a brief period of intensive grazing or fodder cultivation on the wet meadow itself, perhaps following the eighteenth century decline of the three–field system.

Site 1 Summary: The pollen diagram from Vodňádské Bučiny has provided a record of native forest history, over the past 2000 years or so, along the altitudinal border between the southern Bohemian uplands and the central Bohemian lowlands. The record of human impact in the pollen diagram is surprisingly good, given the nature of the site; a very small mire surrounded by forest. This suggests that past human activity was located quite close to the sampling site, probably within c. 1 km. The accumulation of silty peat at the site seems to have begun as a result of hydrological and erosional effects of nearby forest clearance for agriculture. The quantity of Abies and Fagus pollen suggest that the first clearance phase (VB1) is of Iron Age or later date. The second and more extensive clearance phase (VB2) may represent agricultural expansion during the high Middle Ages (12th–14th centuries A.D.). A radiocarbon dating sample from the zone VB1/VB2 boundary has been submitted in order to assess this. More recently still there has been a contraction in farming land around the site.

Sites 2, 3 and 4: Vinořský Potok, Branišovské ecorezone. Vinořský potok is a 15 km long tributary stream of the Labe (Elbe) river, with archaeological evidence for multi–period occupation along the valley edges. Three coring localities were chosen along the course of the stream valley; one at the valley–head (site 2; Vinoř, c. 245 m a.s.l.), one in mid–reach (site 3; Podolánka, c. 220 m a.s.l.), and one towards the confluence with the Labe (site 4; Hrubý rybník, c. 200 m a.s.l.). At each locality transects of cores or test–pits were laid across the valley in order to examine the depth and nature of alluvial deposits.

Results: The observed stratigraphy at site 2 (Fig. 4) comprises a general sequence of sandy clays at the base, with occasional stones, overlain by more organic clays and silty peats, with a dark, well humified peat layer in mid sequence. The sandy and stoney clays at the base of the sequence probably represent channel and occasional overbank deposits of the stream, whereas the overlying peaty deposits suggest a change to more swampy conditions with slower moving water. A rising water table presumably caused more persistent and widespread waterlogging across the valley floor, leading here to silty peat formation. The darker, more humified peat layer in mid sequence probably formed during a period of relatively lower water–levels, or at least slower water level rise in relation to the rate of peat accumu-
The subsequent return to more silty deposition above suggests a return to more swampy conditions, during which the rate of peat accumulation was less able to keep pace with the rise in the water table.

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**Table 1. Selected pollen results from site 2 expressed as %TLP.**

At sites 3 and 4 (not illustrated) the stratigraphy is comprised predominantly of up to 3 m. thickness of clayey flood-foams overlying less organic sands and clays below. Peat development is much less pronounced than at site 2. However, a thin layer of peat is present at c. 1.7 m depth within the flood-foams at site 3 (Podolanka), and there is a peaty loam soil layer containing Roman Iron Age pottery at a similar depth at site 4 (Hrubovský rybník). These may both correlate with the more pronounced peat layer in mid-sequence at site 2, which may have been a more sensitive indicator of local hydrological changes.

Two pollen samples have been analysed from site 2: one from below the dark, humified peat layer (2.7 m depth), and one from above (1.7 m depth). A synopsis of the results is shown in **Table 1.** The lower of the two samples records a total herb pollen value of 60% TLP and is dominated by Cyperaceae and Gramineae, much of which may have been derived from locally growing wetland taxa on the valley floor. However, traces of cereal type pollen (Avena/Triticum category), together with Centaurea cyanus, Artemisia and Plantago lanceolata point to the existence of some agricultural land in the vicinity, probably on the flatter land above the steep slopes of this narrow valley, where it is still found today. Much of the tree pollen, with Quercus and Pinus as the most abundant taxa, may have been derived from local woodland growing within the narrow valley. The presence of such small amounts of Abies and Fagus pollen suggest either a mid-late Holocene date (Atlantic/Sub-Boreal), or a much more recent date (e.g. Medieval). The upper sample (1.7 m) contains a much reduced total tree pollen value (22% TLP). All tree pollen taxa are affected with the exception of Pinus, which shows a small increase to 11.5% TLP. There is a striking increase in the representation of Avena/Triticum pollen, whose value of 9% TLP is a clear indication of an expansion in arable farming. Two radiocarbon dating samples have been submitted from the same depths as the two pollen spectra. These dates are required in order to establish a correlation between the pollen spectra and the local archaeology: Neolithic, Eneolithic, Bronze Age, Hallstatt, La Tène and Slavic period remains are known from the tops of the immediately adjacent slopes.

**Summary of sites 2, 3 and 4:** The lithostratigraphic and palynological results from these three sites are very promising, and indicate that further work would prove highly rewarding. The record of agricultural activity in the pollen spectra from site 2 in particularly striking, such that the completion of a pollen profile from this sediment sequence is likely to provide a good record of the changing nature and intensity of adjacent settlement and land-use through later prehistoric and historic times. Reconstruction of such fluctuations in human impact on the landscape would allow some assessment of their possible connections with the postulated hydrological and erosional changes thought to have been responsible for the observed alluvial stratigraphy at sites 2, 3 and 4. For example, did the first wave of local prehistoric forest clearance initiate rising water levels, increased flooding and the deposition of flood-foams, and did renewed clearance at a later date (Iron Age or Medieval?) then cause renewed flooding of stabilising alluvial peat surfaces?

**Sites 5 and 6:** Palaeoemaders in the Labe valley ecozone. The Labe river valley in Central Bohemia is characterised by numerous infilled palaeoemaders, which represent old courses of the Labe channel. The infill deposits of these palaeoemaders are of interest as potential sources of stratified Holocene pollen sequences. Two sites so far have been investigated:

**Site 5: Ověří.** Archaeological surface field surveys by the ALR project in the area west of Ověří have been supported by a sub-surface test-pitting and coring programme which forms the subject of a separate report by Zvelebil, Butler and Foster (in preparation). The site is located on the northern side of the Labe valley where two very clear river terraces represent the remains of former floodplains of the Labe river. The Geological Survey of Czechoslovakia (1:50,000 drift series) assigns the higher, northern terrace (c. 171 m a.s.l.) to the "Riss" glacial period and the lower, southern terrace (c. 166 m a.s.l.) to the "Würm" glacial period (the last glacial stage). The so-called "Würm" terrace extends south for c. 1 km until another drop in elevation of a few metres onto the present-day ("Holocene") floodplain.

A large palaeoemader occurs on the "Würm" terrace at the base of the "Riss" terrace edge. If this represents an old course of the Labe channel itself, rather than a tributary stream, then its position upon the "Würm" terrace indicates that the channel was cut-off and abandoned before the river incised its lower (Holocene) floodplain to the south. Palaeoecological and dating evidence from the channel infill deposits are clearly of interest in being able to establish a date for channel abandonment, and in providing a record of subsequent environmental changes on the terrace.

A sediment core was retrieved from the deepest point in the palaeoemader, where four main stratigraphic units were recorded: 4: 0–58 cm: Phragmites peat. Slightly silty. 3: 58–104 cm: Very dark brown peaty silt. Abundant molluscs 2: 104–140 cm: Greyish-brown peaty silt. Coarse grey sand at 110.5–111.5 cm, 112–113.5 cm. 1: 140–146 cm: Coarse sands and gravels in organic matrix. Limit of coring at 146 cm due to gravel.

Four pollen samples have so far been analysed from the sequence, one from each of the four stratigraphic units (Fig. 5). The basal sample was taken from the organic matrix of the sands and gravels, which were probably deposited when the channel still contained its stream. It contains 96.6% tree pollen, dominated by Quercus at 50% TLP and suggests that before channel abandonment the surrounding floodplain was densely covered by Quercus woodland, probably with a Corylus understory and with an admixture of Pinus, Ulmus, Alnus, Betula and Tilia. This native woodland could date back as far as the mid-Holocene Atlantic period, but probably no earlier. If the channel still contained its active stream when this basal unit was deposited, then abandonment of the channel and subsequent incision of a lower floodplain to the south must also have occurred no earlier than the Atlantic period. The so-called "Würm" terrace upon which the old channel is located therefore seems to have continued in use as an active floodplain well into the Holocene period.

The subsequent infill deposits are characterised by radically different pollen spectra. To begin with there is a massive decline in Quercus pollen frequencies to just 16% TLP. This suggests large-scale destruction of the Quercus woodland. However, total tree pollen representation remains high (86% TLP), with Pinus now assuming...
dominance at over 30% TLP. The spectrum suggests that *Pinus*, and also *Alnus*, successfully colonised the former but now ruined *Quercus* woodland area. There is no palynological evidence to suggest that any of the *Quercus* woodland was replaced by agricultural land.

*Pinus* seems to have maintained its competitive edge throughout the period represented by the infill deposits, and is still the dominant tree of the area today. The drop in its values to 28% with the onset of peat growth in unit 4 seems to be a result of increased Cyperaceae pollen input, probably from local sedge growth on the peat. However, small increases in other herbaceous taxa in the same sample, including Cerealia type, *Centaurea cyanus*, Chenopodiaceae, *Rumex* type and *Plantago lanceolata*, also suggest that some *Pinus* woodland on the surrounding terrace was replaced by agricultural land at this time. The landscape by this time may have resembled that of today, with its mosaic of *Pinus* dominated woodland and cultivated fields, but a more complete pollen profile is required to establish this.

**Site 6:** Tišice. The Tišice palaeocean is located c. 3 km downstream of Ověřky, apparently also upon the so-called "Würm" terrace. It has been exposed by commercial quarrying which has removed the top 1 metre or so of surface deposits down to the water-table. Extraction of the surrounding sands and gravels has left a submerged section through the upper layers of the palaeochannel fill, from which samples were retrieved by the author using diving equipment. The stratigraphy comprises a 1.3 m thick peat deposit, with abundant wood remains, overlying 30 cm of gravelly peat and then sands and gravels below. A radiocarbon-dating sample and a dendrochronological wood sample have been submitted from the base of the peat infill.

Four pollen samples have so far been analysed from the peat infill (figure 6). The diagram can be divided into two local pollen assemblage zones; T1 and T2. The earlier zone (T1) contains over 90% tree pollen, dominated by *Quercus* and *Alnus* at around c. 30% TLP each. A heavily forested environment of largely deciduous character is indicated; *Quercus*, *Tilia*, *Ulmus*, and *Fraxinus*, perhaps with a rich understory of *Coriaria* shrubs. The woodland spread onto the dappled, peaty soils of the old channel itself, where *Alnus* has been particularly well favoured. Zone T2 displays a significant fall in deciduous woodland pollen representation, particularly for *Quercus*, and a corresponding rise in *Pinus* and *Picea* pollen values. This suggests destruction of much of the deciduous woodland and its replacement by conifers. A fall in total tree pollen representation to 75–80% TLP and a rise in Gramineae pollen values to 15–20% TLP suggest: that, whilst the area remained well-forested, the change to a more coniferous character was associated with a change to a more open, herbaceous-dominated understory. There is no clear evidence for agricultural or settlement ground in the pollen spectra, although forest grazing remains a possibility.

**Summary of sites 5 and 6:** The pollen sequences from both palaeocean fills show a good correlation in the apparent destruction of *Quercus*-dominated deciduous woodland and its replacement by *Pinus*-dominated coniferous woodland. Jankovská (1992) has recently published a pollen diagram from the Doksy district (figure 1, site 30), in which a rise in *Pinus* and *Picea* values and decrease in deciduous woodland taxa is assigned to the mid-Atlantic period at c. 6000 B.P. Results from the radiocarbon-dating samples collected at Ověřky and Tišice will help to establish whether the change here is of a similar date. Finer-interval pollen sampling is now required to investigate the cause of this dramatic early change in the character of the Labe floodplain forest.

**Sites 7 and 8:** Plovka Valley, Všetaty and Kokořín ecozones. Two sites were investigated in the Plovka (Vrustický potok) valley, c. 30 km long north–bank tributary of the Labe:

**Site 7:** Mělnická Vrutice. This is a large infilled calcareous lake basin with thick marl lake deposits overlain by c. 1 m thick calcareous peats. A core was retrieved for assessment of pollen preservation, but the results indicated a very poor state of preservation. Further attempts to isolate higher pollen concentrations from the sediments were impracticable.

**Site 8:** Hleďšte. Coring at the edge of a large marshy area which covers the present-day floodplain at this site revealed c. 60 cm of slumpy marsh mud overlying alluvial clays and sands down to a depth of c. 232 cm. Below this occurred a c. 40 cm thick marl peat deposit, apparently resting on a solid base, which proved the limit of coring. The stratigraphy suggests that a riverside peat deposit has been flooded, and buried under alluvium. Four pollen samples from the peat deposit contain very similar pollen spectra (figure 7). Total tree pollen values fluctuate around c. 50–60% TLP and are dominated by *Pinus* at c. 30–50% TLP. *Pinus* was clearly the dominant tree in the region, with an admixture of deciduous trees, notably *Quercus* and *Betula*. The present-day vegetation of the region is similar. The presence of small amounts of *Alnus* and *Fagus* (both under 5% TLP) may reflect a later Holocene spread of these taxa in the Kokořín area.

The local floodplain environment seems to have been dominated by Gramineae and Cyperaceae, perhaps forming a marshland habitat similar to that of today. Some of the Gramineae and other herbaceous taxa may have been derived from nearby farmland, but their representation is not high and suggests only limited agricultural activity. Further pollen sampling from the overlying alluvium is now required to test the hypothesis that forest clearance for agriculture within the stream catchment led to flooding of the riverside peat and its burial by alluvium. A radiocarbon date is required from the top of the peat in order to establish the date of its burial.
### Results from the Northern Transect

Seven sites have so far been investigated by coring and testing in the northern transect (Fig. 2: b). The results will form the subject of a later report, but two of the more interesting sites are briefly discussed below.

**Site 9: Vranský potok, Vranisko ecotone.** A potential small mire site was identified on the valley floor of the Vranský potok by Joe Claxton during his GIS work for the ALR project. Sub-surface survey has since confirmed the existence of marsh clays and peat deposits, together with fluvial deposits, reaching to over 6 metres in thickness. Preliminary pollen results from marsh clays towards the base of the sequence show a preponderance of Pinus and Betula pollen, possibly indicative of an early Holocene or Late Glacial age. This provides the earliest palynological material so far encountered by the ALR project, and there may be an entire Holocene pollen sequence at the site. Two radiocarbon dates have been submitted.

The site contains added interest in the occurrence of a thick exposure of loess on the valley side, with finds of Eneolithic Corded Ware pottery in the overlying chernozem soil. A layer of apparently redeposited loess occurs at the base of the slope, overlaying a marsh clay. Palynological work at the site might therefore also aim to assess the hypothesis that Eneolithic human activity initiated local slope erosion.

**Site 10: Kostelec nad Ohří, Ohře valley ecotone.** Sub-surface work involving over 30 boreholes was carried out at five localities in the Ohře valley in order to investigate the alluvial stratigraphy of the floodplain and its terraces. One of the more interesting transect of boreholes comes from site 10, where the c. 1 km long transect was designed to connect two areas which the geological drift map and aerial photographs suggested might be of interest; an area of mire deposits at the edge of the floodplain, and an area of aeolian sands towards the centre of the floodplain.

The borehole transect established that the aeolian sands rest on an island of fluvial sands and gravels within the present-day floodplain. There is evidence for soil development on the aeolian sands before their burial by c. 75 cm of flood loams. Some Late Bronze Age pottery was recovered from the buried soil, indicating that the aeolian sands were deposited before the late fourth millennium B.P. The basal sands and gravels slope away from the island and, with increasing distance, are overlain by progressively thicker flood loams. These flood loams reach c. 4 metres in thickness and their deposition has levelled out the former floodplain topography. The aeolian sand layer can be traced at a depth of c. 1 metre within the flood loams for up to c. 400 metres distance from the island. Either the underlying flood loams are of earlier–mid Holocene date, or the aeolian sands have here been redeposited by later Holocene floods.

The mire deposits at the other end of the borehole transect comprise c. 2 m thick laminated organic silts, resting on sands and gravels, and overlain by c. 2 m thick alluvial clays. The silts may indicate the former existence of a shallow lake or backswamp environment. A pollen sample from their upper layers suggests a mid–late Holocene date, and a partially deforested landscape with evidence for arable agriculture. There is considerable potential for further palynological and other palaeoenvironmental work at the site, aimed particularly at reconstructing the Bronze Age floodplain environment and land-use.

### Conclusion

The large spatial scale (1000 sq. km) and temporal coverage (10,000 years) of the ALR project, coupled with the heterogeneity of the landscape (13 main landscape units) and the almost complete lack of existing palaeoenvironmental studies, creates problems of scale and representation for an environmental programme which aims at a regional–scale understanding. This is compounded by the lack of large lakes and mires with large pollen–catchment areas, and the consequent reliance on floodplain deposits which may be unrepresentative of their respective ecotones, and which are subject to complex local variations within their own valleys. However, the sub-surface survey work carried out so far by the ALR project has established the existence of many well stratified Holocene sediment sequences in valley locations, and has indicated that these are capable of yielding geohazardological, bioarchaeological and dating evidence of prime importance in an understanding of Holocene landscape changes in the region. Continued analysis of the material already obtained will undoubtedly prove rewarding, whilst new material is also now required from the interfluvial areas and currently unexplored ecotones.

### SOUHRN

Palynologický a palaeoenvironmnetální výzkum v projektu ALRNB přispívá k poznání vývoje české krajiny za posledních 10000 let. Předchozí palynologický výzkum byl prováděn zejména ve výši položených oblastech, z rozdílného území pod hranici 350 m n.m., které představují tradiční sídelní ošikanu, prakticky neexistují záhodnější země (obr. 1). Absence plynových analýz z těchto oblastí je dána především nedostatkem vhodných lokalit, jako jsou přirozené jezera a močály. Předložené práce popisuje strategii palynologického přístupu v rámci projektu ALRNB, zaměřeného na vyhledávání alternativních zdrojů vhodných pro plynové analýzy v nižších oblastech.

Výzkum se soustředil na říční aluvia jako na místa s největší pravděpodobností výskytu stratifikovaných holocenních plynových profilů. To je ve shodě s archeologickými cíli projektu, protože
FIELD SURVEY AND LANDSCAPE ARCHAEOLOGY
RESEARCH DESIGN
METODOLOGY OF A REGIONAL FIELD SURVEY IN BOHEMIA
POVrchový průzkum a krajinářská archeologie
Program a metodika regionálního průzkumu v čechách
Martin Kuna – Marek Zvelebil – Patrick J. Foster – Dagmar Dreslerová

This article reports on the application of landscape archaeology in Bohemia, as a part of the two co-operating projects, Ancient Landscape Reconstruction in North Bohemia and Landscape and Settlement. The main aim within this paper is to present the methodology developed for an extensive program of surface collection survey on a regional scale with the conditions of the Bohemian landscape. The major goals of the survey are defined and the fieldwalking methodology, timetable of field survey campaigns, field availability, survey intensity and a critique and evaluation of the surface data are all discussed.

1. INTRODUCTION

Archaeology of prehistoric and historic landscapes is rapidly becoming a major research area for archaeologists in western Europe and North America. Until recently, archaeological investigations of
landscapes took the form of aerial photography or of investigations of field systems and standing monuments within the landscape. At the same time, the growing awareness of the limitations of site-oriented archaeology (i.e. Foley 1981; Neustupný 1982, 1986; Dunnell - Dancey 1983; Kuna 1991a; Rosstignor - Wandsemider 1992) resulted in the development and application of field surveys in order to collect information about human behaviour beyond the notional limit of archaeological sites. The integration of these two approaches is instrumental in the development of landscape archaeology.

In the following article we report on the application of landscape archaeology in Bohemia as a part of the two co-operating projects (Ancient Landscape Reconstruction in North Bohemia and its Czech partner, Landscape & Settlement cf. Zvelebil - Beneš - Kuna in this volume), and focus on the role of surface collection survey (field survey) in landscape archaeology in general and within the strategy of our project in particular.

2. WHAT IS LANDSCAPE ARCHAEOLOGY?

Various approaches with space as a central theme have a longstanding tradition in archaeology. These include spatial archaeology (i.e. Hodder - Orton 1976; Hodder 1978), geographical and locational models in archaeology (i.e. Clarke 1972), settlement archaeology (Chang 1968), off-site archaeology (Foley 1981), site-catchment analysis (Higgs 1972), etc. Czech archaeology, since the 1970's, has had a firm tradition of research within a framework of micro-regions and regions (Velinovský 1986; Beneš - Koutecký 1987; Smrž 1987; Gojda 1992) and the wider regional context of archaeological sites was theoretically reflected in the development of the community areas concept by Neustupný (1986) and Kuna (1991b, see below). Landscape archaeology, as we understand it, goes beyond these conceptual frameworks in two important aspects.

First, landscape archaeology looks at the spatial relationships of artefacts and features in order to infer the past use of landscape. The landscape in this framework then means a set of real-world features, natural or cultural, which give character and diversity to the earth’s surface (Roberts 1987). Archaeological landscapes can then be defined as a past surface within a defined span of time, which is subject to antecedent features and successive modifications. A past landscape surface can be buried, eroded, or modified by successive human activities or geomorphological processes. In landscape archaeology we are dealing, therefore, with both time and spatial dimensions at some hypothetical regional scale. The material residues of the time dimension consist of sedimentary deposits; the spatial dimension is expressed by the varied distribution of artifacts and other features over the landscape. Within this framework, the emphasis is on understanding the continuous structure of the human use of the landscape, and archaeological sites are simply locations of concentrated residues of human activity, whose behavioural meaning is to be established. Landscape archaeology recognises the fact that as a role, human behaviour does not occur only in, or indeed generate, spatially and temporally discrete archaeological residues (Kuna 1991a; Dunnell 1992; Zvelebil et al. 1992). Accordingly, in landscape archaeology, we regard the archaeological record as of a continuous character within a dynamic geomorphological context. There are no empty or meaningless spaces between settlement sites; consequently, we cannot understand the archaeological record outside the framework of landscape archaeology.

Second, landscape is seen as a surface where cultural and natural processes of one period leave traces which in turn constrain and influence the activities of subsequent inhabitants. In other words, landscape is not a passive recipient of human activities, but a dynamic and interactive element in the evolution of past societies (see also Roberts 1987; Fleming 1990; Beneš 1995). Constraints and opportunities produced by the antecedent use of the landscape have tended to be ignored by archaeologists so far. Yet the modern landscape as
a product of past cultural development is a clear example of a cumulative cultural development which imposes its own constraints — nowhere more so than in ex-socialist Czechoslovakia. For archaeologists this means that any attempt to understand past societies have to take into account the antecedent and successor use of the landscape occurring before and after the society under investigation. Landscape archaeology, therefore, cannot but adopt the time perspective of "longue durée" (Braudel 1980).

3. THE ROLE OF FIELD SURVEY IN LANDSCAPE ARCHAEOLOGY RESEARCH DESIGN

Field survey constitutes one of the key elements of a landscape archaeology research design. Information obtained through field survey has a number of advantages over excavation: it is organisationally and economically more easily obtained, it relates to the regional scale of human behaviour, and it does not result in the destruction of archaeological deposits (DunneII — Dancey 1983; Cherry 1983; Wandsnider — Camilli 1992). Bearing in mind the cost of alternative strategies, field survey is at present the only method which can realistically generate information about the distribution of artefacts in the landscape at the regional scale required by the landscape approach to archaeological reconstruction.

On the other side of the coin, field survey also faces serious methodological problems, prompting a debate about what survey results actually represent (Nowotny 1982; Schofield 1991; Vencl 1992a; Zeveelbl et al. 1992; Wandsnider — Camilli 1992 with reference). Major problems include sampling of artefact distribution patterns over space and time, the paucity of datable artefacts among surface finds, the palimpsest effect arising from the accumulation and mixing of chronologically unrelated remains, the bias introduced into the cultural interpretation through taphonomic processes, problems of palaeoenvironmental reconstruction and the definition of a regional scale itself (Zeveelbl et al. 1992). Overarching these concerns is the issue of representative sampling, which is especially relevant within the framework of a research design operating on a regional scale and in a long-term perspective.

4. ALRNB — LANDSCAPE & SETTLEMENT SURVEY PROGRAMME

The area of the ALRNB and of the Landscape & Settlement programme has been defined with the aim of investigating the interactive relations between the environment and human settlement against the background of various landscapes and environments of the Northern half of Bohemia. Two transects have been laid down with the general intent of cutting through the characteristic ecozones (Peško, Šádlo, in this volume) of this territory in the most economic way. In particular, this means the establishment of two transects through what is usually called the "old settlement area". This concept covers a territory of the main river basins of Eastern, Central and North-Western Bohemia, enclosing most of the fertile loessic lowlands, corresponding to the area below an altitude of 350 m (Fig. 1). This area was permanently and intensively occupied during all of the holocene prehistory and the Middle Ages. Since the Neolithic the boundaries of this area shifted only occasionally and, did not appear to expand substantially before the High Middle Ages (12th cent.AD) when a process of intensive colonisation (forest clearance) began.

In making this particular territorial choice several aspects of the selected area were considered. First, the spatial contiguity of the area made it possible to identify spatial patterns at various scales. The availability of relatively good and balanced archaeological records already known from the area with a satisfactory level of publication was a second consideration. As important advantage was the already established Sites and Monuments Records of the NW transect, kept within the Most branch of the Institute of Archaeology, and the archaeological topography of the Mělník District (Central transect), published recently by Sklenad (1982). The third important aspect of our choice was the inclusion of previous research programmes by some project participants into the current project (the large-scale excavations at the Lomský potok area in the NW transect and the intensive survey within the Vinořský potok micro-region in the Central transect) as well as the use of the already established detailed knowledge of the particular landscape (Benet — Koutek 1987; Kuna 1991b).

In addition to these practical considerations, our specific research interests played an important role. These included plans to map out the extent of the mesolithic settlement in the Labe basin and to test the model, outlined above, of the extent and inner structure of the "old settlement area" in prehistory. Finally, the northern transect deliberately bisects the industrial area of the Bílina basin, devastated by the surface mining of brown coal. The intention here was to carry out rescue survey of adjacent areas threatened by further mining, and to design a historically sensitive programme for the landscape reconstruction of the area on the basis of our research.

The suggested size and shape of the selected transects (50 x 10 km) reflects the ecological variability and the scale of the post-Mesolithic settlement pattern in Bohemia. The width of the transects (10 km) represents, according to our opinion, the minimal dimension which can both provide a relatively unbiased sample of site settlement distribution and display the presumed settlement patterns. The presence and density of the past activity areas within landscape samples smaller than this could be easily misrepresented, especially due to an irregular hydrological network (creating natural axes for past settlement activities) and the uneven spread of the modern industrial damage. In order to obtain a representative sample we clearly had to define an area big enough to overwhelm the influence of local and/or random factors.

In keeping with the general goals of the ALRNB project, as well as the specific aims articulated within the Landscape & Settlement research programme, the goals of the archaeological survey can be set up within the frames of the following points:

1. to define the extent of the whole settled territory within the two landscape samples as a way of establishing the general trends in the development (e.g. by gradual clearance or abandonment of its peripheries) of the whole Bohemian settlement okumenia and its changes through time from the Mesolithic till the postmedieval era, reflecting climatic, environmental and demographic factors;
2. to define the general population density within the studied area and the Bohemian territory as a whole and to monitor its changes through time;
3. to monitor variation in the past occupation intensity and use of individual ecozones or other territorial units (microregions) and to explain it in environmental, ecological or socio-economic terms (transhumanism specific resources and/or production areas, abandonment due to ecological crisis, climatic change or overexploitation of certain areas);
4. to identify settlement hierarchies (the size and distribution of community areas, the relation between central places and their satellites etc.) and to explain it in economic and social terms;
5. to describe the inner structure of the community areas (settlement patterns on local, community level) including the relations between habitation, production, burial and ritual areas;
6. to identify the main general as well as culturally specific factors (environmental, economic, social, symbolic etc.) in past site locational preferences, with the scope to develop predictive site location models for future survey and research;
7. to discover and define rare types of archaeological sites, indicating special activity areas and/or specific site locations in some periods of the past, which usually escape from being identified by traditional landscape surveys.
<table>
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<td>81</td>
<td>8.6</td>
<td>45</td>
</tr>
<tr>
<td>LATE IRON A (LT B–D)</td>
<td>356</td>
<td>75</td>
<td>4.8</td>
<td>41</td>
</tr>
<tr>
<td>ROMAN PERIOD</td>
<td>736</td>
<td>61</td>
<td>12.1</td>
<td>34</td>
</tr>
<tr>
<td>MIGRATION PERIOD</td>
<td>2</td>
<td>2</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>FLINTS</td>
<td>67</td>
<td>31</td>
<td>2.2</td>
<td>4</td>
</tr>
<tr>
<td>AXES ETC.</td>
<td>47</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Tab. 1. Find and polygon counts within the Vinoř brook survey project 1986–1991. "Polygon" means a sampling unit (field) within which the finds of the particular period were discovered. It is usually identical with "a site", but the correspondence is not perfect, for larger sites could have been divided into more polygons and/or walked repeatedly, producing thus more than one "polygon". Modern sherds were collected selectively.

<table>
<thead>
<tr>
<th>Period</th>
<th>Surface collection</th>
<th>Pit fill intrusions</th>
<th>Layers in depressions</th>
<th>Subterr. features</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER PALAEOL.</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>NEOLITHIC (LBK)</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>PROTOENOLITHIC</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>TRB/MICHELBERG</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>1</td>
<td>pit</td>
</tr>
<tr>
<td>MIDDLE ENEOL.</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>postholes</td>
</tr>
<tr>
<td>CORDED WARE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>graves</td>
</tr>
<tr>
<td>BELL BEAKERS</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LBA (KNOVÍZ C.)</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FBA (STÍTÁRY C.)</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>pit</td>
</tr>
<tr>
<td>BYLANY/HALLSTATT</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>pit</td>
</tr>
<tr>
<td>LATE IRON AGE</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 2. Comparison between various kinds of evidence at the multi-cultural prehistoric site at Praha 9 – Dolní Počernice (according to Vencel 1992a). In the first three columns rough estimations of the find numbers are given (+ 0–9, ++ ≥10). Surface finds were obtained during several field walking occasions before the rescue excavation. Second column describes secondary intrusions in the the fill of the sunken features, especially in the Corded Ware graves. Third column details finds within a few natural depressions discovered below the plough zone. Fourth column gives numbers of features cut into the bedrock. The last column explains the character of the features discovered (settlement pits, posthole structures, graves).
(8) to identify specific depositional and post depositional processes influencing the preservation of archaeological sites (erosion and accumulation of soil deposits etc.) and to locate areas most affected by these processes;
(9) to evaluate the reliability and explanatory power (regarding the settlement history of the area) of individual data sets collected by different research methods (occasional finds, recent rescue excavations, field walking within the project, air photography), to explain their specific bias and to contribute to the development of a plausible scheme for complex large-scale surveys in Bohemia.

Although collection of archaeological surface material as a method of information recovery was used as part of various regional archaeological projects in Bohemia during the last decades, its application and methodology were largely restricted by the prevailing site-oriented approach and period-specific goals. Little attention has been paid to Bohemia to systematic field walking and other kinds of surveys in relation to cultural heritage protection and management (Kuna – Klapstel 1990). In contrast to this, ambitious projects of this kind have been started in Poland (Domagalski 1984, Mazurowski 1980) and Hungary (Bakay – Kalicz – Sagi 1966), and intensive field walking has been, for example, effectively included into rescue archaeology programmes in the mining areas of Germany (Schwellhaus 1985). Hence, although there is a firm tradition of regional studies in Czech archaeology, very little has been done so far in the development of field survey methods, its specific theory and application. That is why, an articulation of a realistic scheme for a field walking programme on a regional scale, relating to the needs and goals of the ALRNB project and taking into account specific characteristics of the Bohemian landscape, may partly fill this apparent hiatus.

The territory which has been directly studied by the authors of this paper is the Central Bohemian transect of the ALRNB project. The process of articulating the survey scheme benefited from numerous debates within the ALRNB project team carried on throughout the first field campaign during the summer of 1991. Our later experience, collected consequently during the following field work campaigns changed, however, a lot of the original ideas. The scheme described here represents a model developed through practical experience gained in the field campaigns of 1991 and 1992. By the end of spring 1992 the present survey method had been formulated and implemented in the field, binding the two transects of the ALRNB project.

One of the goals of this paper is to suggest a survey method and strategy which can cope, on the one hand, with the study of a large territory, and, on the other hand, with the demand to provide quantitative, spatially controlled data referring to a regional scale. The main problem is to find a solution to these conflicting demands (cf. Gallant 1986). In order to explain our approach, it is now necessary to focus on the approach to field survey in Bohemia, and on the specific characteristics of the research territory, its archaeological record and the character of our particular expectations and targets.

5. GENERAL EVALUATION OF THE SURFACE DATA IN BOHEMIA

In Bohemia, field survey has generally received an unduly critical appraisal. In evaluating the various methodologies used in regional survey, E. Neustupný (1982) questioned the credentials of field walking, considering it the most unreliable of all field techniques used. He listed several reasons why the surface evidence produces inconsistent results being dependent on random, unpredictable, or at least hardly measurable factors: the variable depth of ploughing and its frequent variation, the depth of subsurface archaeological contexts, the depth of soil levels, the number of subterranean contexts on a particular site, the density of artefacts in the sunken contexts and the average typological distinctiveness of artefacts of a particular period.

It is apparent from this enumeration that surface scatters are approached as a certain kind of reflection of the subsurface contexts from which they derive. This seems an accurate assumption for the territory of Bohemia where the prehistoric record has not created any tell-like vertical stratigraphies, where the original prehistoric site floors have
been mostly destroyed by ploughing (if not removed by erosion) and where there is no direct proof for the survival of any detectable off-site activity remains with the exception of medieval masonry scatters.

In a similar vein, S. Vencel (1992a) has recently pointed out a lack of congruence in the composition of period-specific finds between surface data and the contexts which exist below the plough zone. Generalising from the surface collections and the results of a large scale excavation at Praha 9–Dolní Počernice he also stressed the unpredictable bias contained within the surface evidence.

Vencel's observation can be put into a wider perspective by considering the results of our own field walking survey in the Vinohrady area (Kuna 1990). This project, accomplished in 1986–1991, covered an area of about 150 km² (included, later, in the Central Bohemian transect of the ALRNB project) by a survey of variable intensity. Some of the results are summarised in Table 1. Although we are convinced that the population density within the survey area did not change drastically during most of prehistory, the pattern of observed site frequencies displays striking discrepancies between individual periods. The fact that these oscillations cannot be caused by the original variability in occupation density is best manifested in the Late Neolithic (Corded Ware and Bell Beaker) period which display one of the lowest numbers of finds collected by field walking but which, in fact, must have represented one of the densest occupation networks (mostly, of course, identified as inhumation cemeteries, undetectable by field survey). It seems that something similar may be characteristic for several other periods as well (some parts of the Neolithic and
Eneolithic, Early and Middle Bronze Age, Early Iron Age Bylany Culture, Migration Period). Such a pattern is, anyway, not unique within the territory of Bohemia. This is why, most of the agents creating patterns in the surface data cannot be random, but should be systematic and partly predictable.

Plough zone data represents a residue of evidence produced by the systematic, continuous destruction of the original archaeological contexts by natural agents and human activity. The goal of field survey is to collect a representative sample of artefacts from the surface and to use this sample to identify patterns of past human behaviour that have created the sample. At the same time, the evidence which archaeologists collect in the field is a product of several variables, only one of which is the original archaeological deposit itself. Cultural residues of past human activity undergo at least one, and perhaps several cycles of discard, burial, and return to the surface through ploughing or other activities. Displacement from the original position of discard can occur at any point in this cycle. This means that we have to make a clear distinction between the original assemblage at deposition and the archaeological sample collected at the surface (Fig. 2). Among the main post-depositional factors distorting the original pattern of human behavioural remains, there are especially important: artefact (pottery) decay, soil erosion/accumulation and displacement of surface scatters by ploughing.

In Bohemia, pottery fragments form over 95% of the surface evidence which, in itself, forms an interesting contrast to the archaeological record in, for example Great Britain. That is also why, some of the key factors in evaluating surface scatters are the durability of pottery exposed to the continental climatic conditions of Central Europe, freeze–thaw processes and the mechanical treatment of heavy agricultural techniques. Interestingly, the resistivity of pottery material to weathering and destruction has not yet been submitted to analysis in theoretical works (with the exception of Kirkby – Kirkby 1976). In spite of this, we can presume that the ability to withstand such attrition is an important factor, systematically influencing the pattern of surviving site distributions. The durability of pottery may be seen as quite variable, related, in most cases, to the firing temperatures. The decay of prehistoric pottery has not yet been exactly measured but some initial observations have been made. It is assumed that prehistoric pottery can disappear from the plough zone within a few years of exposure (Neustupný, pers. comm.). Higher decay rates, characteristic probably for most prehistoric pottery, inevitably led to the disappearance of sites which are either not represented by other artefacts as durable as lithics, etc. or which do not have a subterranean "supply zone" (pits, layers etc.) from which new artefacts could recently have been ploughed out. This probably does not give us much chance to discover many prehistoric off-site activity areas (except for lithic scatters) but also the identification of "regular" settlement sites of some periods might be quite difficult. The disappearance of surface sites due to pottery decay could be directly witnessed, for example, by the low–density scatters consisting of only post–Mesolithic flints, which were discovered during our field survey (Fig. 7: B). Settlement sites with shallow pits or no subterranean features certainly must have predominated in particularly periods of prehistory as a result of the specific culture norms, economic behaviour, etc. This may pose one explanation for the lack of surface finds of some periods of Bohemian prehistory such as the Corded Ware and Beaker period, even though this culture is extensively attested through cemeteries.

The advances in the technology of pottery production in the 12th century increased the chances of identifying the original surface scatters substantially. Medieval pottery survives relatively well on the surface and accounts for the easy recognition of medieval and post-medieval manuring and occasional rubbish scatters throughout the region. Examples of these have often been recovered during the ALRNB field work.

As noted above, erosion might be another process affecting prehistoric sites more than it is usually assumed. In Southern England, for example, it has been shown that prehistoric erosion affected about 16% of the territory to such an extent that prehistoric sites could have been damaged or removed. In the same way, an additional 3% of the territory has been covered by alluvium (Allen 1991). Assuming similar rates for Bohemia, a substantial part of the record would have been affected. We assume that erosion begins even on very moderate slopes which belong to areas clearly preferred for the location of sites in many periods of prehistory (Kulíš 1983; Kuna – Sáblína 1987). The loss of soil since the 5th millennium BC on Neolithic sites in Central Europe, which were often situated on moderate slopes between 2–4 degrees, is estimated as much as 50 cms (in Bohemia) or even more (estimations for the Neolithic sites upon the Aldenhofen Plateau in Germany, Pardal, pers. comm.) Such erosion must have substantially changed the original depth of all the occupation remains and removed the original site floors. Erosion (both arcaled and colluvial) within the deforested landscape must have already been initiated in prehistory (cf. Neustupný 1987, Drewett 1989) and intensified in the medieval to modern period. The cooperative farming of the last forty years, removing small islands of woodland, paths, field boundaries and using heavy machinery, only increased its rate of intensity.

Ongoing erosion is sometimes supposed to have a positive effect on the visibility of archaeological plough zone remains. Theoretically, soil erosion could become a process making the surface scatters gradually richer by removing the surrounding soil particles and cumulating artefacts on the visible surface (Bartlíf – Snodgrass 1988). This assumption does not, however, take into account the possibility that the artefacts appearing on the surface can be also removed with the soil or, at least, exposed to weathering and decay. The ability of artefacts to move on slopes due to erosion has been recently proved by Allen (1991). Even on sites where this is not the case, soil erosion increases the speed at which archaeological remains disappear because it exposes more and more artefacts to their natural decay. As a result only those sites which still include some deeper subterranean supply zone can be visible as surface scatters.

It is very probable that due to severe erosion the depth of ploughing is permanently increasing during recent years, providing us with a relatively good chance to monitor site distributions, but at the same time we are also slowly approaching the moment of complete destruction of many archaeological contexts. In this respect the site of Dolní Pochtovy (Venci 1992a) may be characteristic: a very high density of Middle Eneolithic pottery appeared within the modern plough zone but no subterranean features were present any more at the locality, although shallow sunken dwellings are usually typical for this period. It is very probable that this site was studied just in the transitional moment when the subsurface contexts changed into scattered plough zone finds, probably disappearing completely in the near future. It would be interesting to know how long such a "transitional" period may last but observations of this kind have not yet been carried out.

Erosion may have been fatal for sites which were once characterised predominantly by surface scatters and/or which were situated on steeper slopes. Such sites might have disappeared completely as a result of colluvial activity. A well–known example of such a case has been discovered by E. Neustupný (1965) at Tušimice, NW–Bohemia. At this site no Middle Eneolithic finds were found on top of the promontory (where they might be expected) and on its slopes. The only pottery fragments of that period were included in the fills of later graves, belonging to the Corded Ware culture, situated lower down the slope, indicating both the erosion of the occupation layers and the later decay of most of the finds. The slope effect and erosion are multiplied by ploughing (Ammenman 1985) to the point when a total displacement of finds can be expected. A combination of these factors may explain, for example, why there are very few Mesolithic sites within the traditional settlement area of Central Bohemia (with a tradition of intensive arable agriculture for centuries, if not millennia),
Fig. 4. Section "Úvaly" of the Central transect with the distribution of sampling polygons. 1: random points generated by a computer programme; 2: polygons walked upon an "availability scheme"; 3: polygons selected on the "random points" scheme (walked during the spring 1992 campaign); 4: polygons selected in the same way but not yet walked; 5: unaccessible areas (villages, woodland).

Fig. 5. A: Locating polygons on a field map 1:25000 (SE part of the Úvaly section). B: Archival map 1:10000.
## Table 1: Comparison of various sorts of evidence on the multi-cultural prehistoric site at Dřevčice-Popovice (10 hectares in extent). These sorts of evidence are compared: Grab surface collections (cca 17 man-hours); “total” collection of finds within 286 randomly selected circles (total area 107 m²), 5 man-hours, not the whole site was covered; evidence of earlier occasionally recovered features (1930s – 1980s); results of a systematic trenching (830 m trenches in total, cutting the whole site); ALRN standard survey (I) and ALRN survey covering the empty strips between the traverse bunches (II).

<table>
<thead>
<tr>
<th>Period</th>
<th>Grab survey (shards)</th>
<th>&quot;Surface cleaning&quot; (shards)</th>
<th>Earlier finds (pits and graves)</th>
<th>Trenching (830 m)</th>
<th>ALRN (sherd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATE NEOL.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EARLY NEOL.</td>
<td>3</td>
<td>17</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MIDDLE NEOL.</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CORDED WARE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BELL BEAKER C.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBA-ČEŠŤICE C.</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBA-JEDLEJOV C.</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBA-TUMULUS C.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBA - MBA</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBA-KNOVČÍ C.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBA-JÍTÍN C.</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EARLY IRON AGE</td>
<td>315</td>
<td>8</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LATE IRON AGE</td>
<td>26</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIGRATION PER</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREHIST. TOTAL</td>
<td>1284</td>
<td>60</td>
<td>43</td>
<td>390</td>
<td></td>
</tr>
<tr>
<td>FLINTS</td>
<td>49</td>
<td>1</td>
<td>+</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>STONE AXES</td>
<td>10</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

While there is an abundance of Mesolithic sites in marginal upland areas of Bohemia (Venci 1989, 1992b) where arable agriculture has only been applied more recently.

Taephonomic processes and lateral artefact displacements intervene between the original discarded assemblage, the artefacts in the ploughsoil and the artefact population brought to the surface. The geomorphology of the area, rate of erosion, colluviation and alluviation, and human activity, particularly the depth and length of ploughing play a major role in altering the original patterning of artefact deposition. Studies carried out to date (e.g. Allen 1991) indicate that processes of erosion and accumulation operate at different scales of resolution removing artefacts selectively from hilltops and upper slopes, shifting them downslope and burying the artefacts in low-lying locations. These patterns of selective removal and burial are related to artefact size, weight and shape, with smaller, lighter and less angular artefacts being removed at a greater rate (Allen 1991). Ploughing, also, tends to alter the original pattern of deposition by selectively bringing larger and heavier finds to the surface (Odell – Cowan 1987), although the amount of lateral displacement brought about by ploughing is still a matter of some debate (see Yorston et al. 1990 for a variable review). In general, a number of recent studies indicate that the artefacts at the surface (i.e. the sampled population in Fig. 2) represent less than 10% of the total ploughzone population (Leawarch – O’Brien 1981; Odell – Cowan 1987).

Other factors introducing specific but systematic bias to surface data have already been discussed in the literature. The variable character of subsequent contexts, reflecting specific past behaviour or norms of deposition deserves special mention. For example, deeper infiltation graves cannot be discovered by surface collections, in contrast to usually shallow cremation burials. Such a dichotomy is mirrored in other contexts: for example, in deep storage pits with finds at the bottom but not at the top. This would not be so important were it not for the possibility that such cases may be systematically related to particular behaviour of prehistoric communities, for example to a higher degree of settlement mobility (a case in point are the Eneolithic features from Jenštejn, Dreslerová pers. comm.). The original quantity of pots (the ratio between the pottery and wooden containers, for example) within a prehistoric household may also have an effect on the visibility of sites (cf. the early medieval period: Grojda 1989; Foad 1978). A further factor is the impact of the variable distinctive ness of pottery items, already mentioned previously (Neustupný 1982; Jirouch – Růf 1987).

In spite of these considerations, we do not fully share Neustupný’s (1982) and Venci’s (1992a) pessimism about the value of surface evidence. Venci’s own results have, in contrast to his own evaluation of them, demonstrated a good reliability for the surface data. As Tab. 2 shows (which we prepared ourselves on the basis of Venci’s article), the very fact that all the periods, represented mostly just by a single subterranean feature, were also recorded by surface collection, is an excellent result. The number of subterranean features was, indeed, extremely low in this case, contrasting with other sites where the density can reach up to 50 pits per hectare in a given period (Kuna 1991b). The surface collection and secondary intrusions into the fills of later pits have identified even those periods that were missed by excavation (Palaehrlich, LBK, Protoeneolithic, Bell Beakers, LBA, Late Iron Age). The only missing component in the surface evidence was apparently the Corded Ware graves which is hardly surprising. Similar results have been obtained by our own research at the site of Dřevčice/Popovice (Tab. 3). In both cases it is obvious that the plough zone data can be even richer in information than the excavation, for it can carry information that may already have been lost at the lower level. This shows the unique value of surface data collections: it is regrettable that the analyses of the kind carried out so precisely by Venci are so rarely done (and if so, rarely published).

The main problem is that all the biasing factors which are often studied separately, usually operate as a complex, interrelated system of variables. Their cumulative effects cannot be exactly modelled. It is true that knowledge obtained from surface scatters is always unsa-
satisfactory but the same can be said for all other sets of data (excavation, aerial photography, etc.) if taken separately. To avoid misreading the surface record, we reiterate the points made in our general discussion: first, the field walking survey data must be systematically matched with other sorts of information (earlier finds, recent rescue activities, aerial photography, etc.). Second, background information about the quantitative aspects of the surface scatters, field work intensity and environmental and taphonomic variables are urgently needed and, third, a selective repeated survey, designed on different levels of complexity and detail (multi-stage design) should be practiced, creating a feedback between the data and the theory of their formation (cf. Miller 1985).

We hope that by now the serious threat and permanent damage to which most archaeological sites are exposed by ploughing and the consequent processes have become apparent. The situation may be even worse than described by J. Hinrichs (1988) who suggested that the worst stage of damage to archaeological residues is the moment when just the lowermost parts of the buried contexts survive. We have enough reasons to believe that this is not the last stage because the ongoing erosion multiplied by the effects of ploughing moves the critical level still lower. This is also the reason, why the systematic field survey in Bohemia ambivalently belongs within the philosophy of rescue archaeology and should be evaluated as any other planned rescue project or cultural heritage management. It has been shown that the surface data can often encompass more and/or other information than the routine excavation of a prehistoric site, which, ironically, often begins by removing the top soil. Studying the plough zone by surface collections or test pitting (which is, however, more laborious and cannot be practiced on a regional scale) does not provide data of a marginal or subsidiary character, but it is a specific kind of information which can hardly be substituted in full by any other field technique, including excavation.

### 6. PATTERNS OF THE PAST ACTIVITY AREAS

Human behaviour was, as it is today, structured in space in a non-random pattern. We can expect that material remains, produced by this behaviour, will display the structure in a certain, identifiable way and, in particular, will show highly clustered patterns. Individual artefacts are usually discarded in clusters around an activity locus, a cluster of activity loci correspond to a short-term activity area (building complex, one-phase site), a concentration of building complexes usually form a long-term activity area (e.g. settlement site). Settlement sites usually appear in clusters again, which can be interpreted as a result of the long-term spatial stability of activities within a catchment territory (a community area). Community areas are usually arranged in a non-random pattern as well, distributed in lines along water streams, quite often in regular distances.

In spite of the patterned character of the past behaviour it is usually not easy to identify individual spatial and chronological components within the archaeological record. The surface evidence often represents an artefact continuum, spread over long strips of land, sometimes over tens or even hundreds of hectares. No clear, discrete units like "sites" are usually identifiable within such distributions, which are basically palimpsests of remains from various periods of the past. A dense "noise" of ubiquitous late medieval to modern pottery fragments, often inseparable from earlier material (until washed), does not make our orientation easier. Any method of survey, attempting just to "pick up the sites" must fail to understand the activity patterns properly, for it must, logically, concentrate just on the most visible scatterings, belonging usually just to several particular periods of prehistory. A proper identification of variable activity areas can be based only upon a careful chronological classification and quantitative evaluation of the find densities of individual periods, neither of which can be done directly in the field. That is why, instead of "looking for sites", a sort of systematic mapping of find densities, a "siteless survey" (Dunnell – Dancey 1983; Gaffney – Gaffney 1988; Gaffney – Tingle 1984) seems to be the only plausible approach.

At deposition, the character of the assemblage is a reflection of the past spatial organisation and of the behaviour of society under investigation. In order to design a field survey effectively, we have to have a model for the spatial structure of land use for each of the societies investigated. In the long-term landscape-oriented investigation, this can lead to conflicting demands on the field survey design. For example, mobile societies with a dispersed pattern of settlement, such as mobile hunter-gatherers or pastoral groups, are likely to generate discard patterns of even dispersion with small clusters of artefacts indicating key settlement areas. Such patterns of discard require intensive field survey to locate the artefact residues left by these societies. For example, a transect survey design superimposed over Agerod, a Mesolithic site excavated in Sweden, has shown that field survey at transect intervals greater than 15 metres could have missed the site completely, and that diagnostic artefacts may have been missed at intervals greater than 10 metres. The size of other Mesolithic settlement areas in Northern Europe (Zvelebil, n.d.) as well as in Bohemia (Vencel 1991) point to a similar conclusion.

On the other hand, artefact residues left by most of the post-Mesolithic, sedentary societies can be expected to display larger clusters of their activity remains. Consequently, wider transect intervals can be tolerated. Already at this stage, different land use patterns and period-specific settlement structures lead to conflicting demands on the survey design if the survey results are to be representative of all the periods covered.

Some basic ideas about the usual sizes of the activity areas of prehistoric farmers appear in Tab. 4. It must be noted that this data provides only minimal estimates and the most represented smallest category indicates, in fact, cases when just a small site fragment has been identified. The density of finds on the site surfaces is, of course, very variable and it has rarely been exactly measured. Using a method of randomly distributed circles over a site and collecting finds within them, we have estimated the artefact density on a larger and intensively occupied multicultural site (of Děvětice/Popovice: 10 hectares in
<table>
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<tr>
<th>SYSTEMS OF CROP ROTATION IN CENTRAL BOHEMIA</th>
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<tr>
<td>BEET *</td>
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<td>SPRING C.</td>
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<td>WINTER C.</td>
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Tab. 5. Typical systems of rotating crops in Central Bohemia. Years when the autumn field walking is impossible are marked by *; periods when the fields are unwalkable throughout the whole year are marked by **.

The calculated surface density of finds was 68.29 pottery fragments (30.7 kg) per 1 hectare; 36.8% of sherds were, however, smaller than 2 cm. These figures might probably represent the category of the intensively used, multi-period sites in Bohemia, which, as has been also tested by subsequent trenching in the particular case, are characterised by a high density of subterranean contexts. It is not only the larger size or the post-Mesolithic activity areas which makes the identification of the original behavioural patterns easier. Preposing a certain rational and predictable structure of the archaeological remains can also contribute to the understanding of the observed reality: a single find or a specific activity area need not be singled out as insufficient evidence, but can be used as a distinctive fragment of an comprehensible structure. This is, in fact, one of the important issues of the community areas theory mentioned above (Neustupný, 1986; 1991; Kuna, 1991).

Since all archaeological surveys in Bohemia which has been carried out to date, was previously oriented towards the recovery of "sites", very little is known about scatters which cannot be easily included into this category. We do not know much about smaller activity loci, masuring scatters and off-site activities. This has, of course, a severe impact upon the design of any sampling strategy, for many of the key variables (such as the size of smaller sites which can still be regularly identified, the average density of certain types of scatters) cannot be evaluated in advance of the survey. We are back to the "onerous sampling paradox" (Redman, 1975; Zvelebil et al., 1987). This is why the survey scheme detailed in the following sections is a compromise between several requirements.

7. TIMING OF SURVEY CAMPAIGNS AND FIELD AVAILABILITY

As in many other areas of Central Europe, effective fieldwalking can be best performed between the end of winter and the first spring harrowing which decreases the visibility of finds substantially. Such conditions are regularly met in just the second half of March and the beginning of April. Once agricultural activity begins, the field requires exposure to several heavy rainfalls before it can effectively be walked again, otherwise an inestimable bias is introduced into the results by the poor visibility of surface material. For this reason the conditions for later spring fieldwalking are very unpredictable, being dependent mainly on the amount of rainfall. The summer months are generally not suitable for walking, although occasionally heavy rain may allow any available ploughed field to become viable for survey work. Availability of fields during the autumn months differs due to the agricultural activities on a particular fields (e.g. fields cannot be walked if beet is present). Generally only a smaller amount of fields can be properly walked, mostly during October. The winter months (December—February) are not suitable for fieldwalking due to freezing temperatures, snow cover and sticky surfaces. There can be, however, many exceptions to the general rules, reflecting the specific treatment of individual fields as well as weather oscillations, but it would be very risky to plan a large field campaign employing people, equipment, etc. for terms other than those already mentioned. That is why, just two field campaigns of limited time range can generally be planned for each year of the project, situated between the end of March and beginning of April (2-4 weeks) and during the second half of October (2-3 weeks).

The availability of an area to be surveyed is basically dependent upon the sort of crop covering the particular field. The typical sequence of rotating crops within a 4-8 years cycle is shown in Tab. 5, illustrating the periods when access to the fields is complicated. This pattern is rather general within the territory of our study and does not probably create any systematic constraint regarding particular fields or areas.

8. SAMPLING FRACTION AND SURVEY INTENSITY

However tempting it would be to survey a region in its totality, the practical economic circumstances of modern archaeology rarely, if ever, allow unrestricted means to be available for large scale regional surveys. Any survey, therefore, is a compromise between the size of the area to be surveyed, the intensity of surveillance (depending on the expected characteristics of the "sites" that are to be identified), the time allotted for completion of the survey and the number of people available, the survey only being achieved by employing a strategy of sampling (cf. Struver, 1971; Plog - Plog - Wait, 1978; Schiffer - Sullivan - Klinger, 1978).

Recent studies concerned with the character of surface archaeological deposits (Shennan, 1985; Hazelgrove et al., 1985; Schofield, 1991; Rossignol - Wandsnider, 1992) emphasise the importance of detailed ground coverage in relation to obtaining a representative...
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>TOTAL AREA</th>
<th>SAMPL. FRACT.</th>
<th>SAMPL. UNITS</th>
<th>UNIT SELECTION</th>
<th>UNIT OF EVIDENCE</th>
<th>SURVEY INTENS.</th>
<th>SURVEY LITERATURE</th>
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<tr>
<td>Mabelle Farm (England)</td>
<td>113</td>
<td>16</td>
<td>transects</td>
<td>system</td>
<td>50 m-strips</td>
<td>25</td>
<td>20 Gaffney – Tingle 1989</td>
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<tr>
<td>East Hampshire (England)</td>
<td>150</td>
<td>20</td>
<td>transects</td>
<td>system</td>
<td>fields/lines</td>
<td>30</td>
<td>? Sherman 1985</td>
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<tr>
<td>Cuckemere valley (England)</td>
<td>200</td>
<td>2</td>
<td>transects</td>
<td>system</td>
<td>30 m-strips</td>
<td>30</td>
<td>? Garwood 1985</td>
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<tr>
<td>The Auvergne (France)</td>
<td>250</td>
<td>20</td>
<td>squares</td>
<td>random</td>
<td>100 m-strips</td>
<td>50</td>
<td>4–8 Mills 1985</td>
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<tr>
<td>East Brittany (France)</td>
<td>190</td>
<td>20</td>
<td>transects</td>
<td>system</td>
<td>100 m-strips</td>
<td>50</td>
<td>? Astill &amp; Davies 1985</td>
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<tr>
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<td>70</td>
<td>ca 10</td>
<td>fields</td>
<td>purposive</td>
<td>100 m-strips</td>
<td>10</td>
<td>? Jones et al. 1985</td>
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<tr>
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<td>ca 100</td>
<td>ca 20</td>
<td>squares</td>
<td>purposive</td>
<td>sites</td>
<td>4–5</td>
<td>Hayes 1985</td>
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<td>Metaponto (Italy)</td>
<td>40</td>
<td>100</td>
<td>total</td>
<td>–</td>
<td>sites</td>
<td>3–10</td>
<td>13 Carter &amp; D'Annaible 1985</td>
</tr>
<tr>
<td>Croton (Italy)</td>
<td>270</td>
<td>ca 20</td>
<td>squares</td>
<td>random</td>
<td>sites</td>
<td>?</td>
<td>? Carter &amp; D'Annaible 1985</td>
</tr>
<tr>
<td>Bocotia (Greece)</td>
<td>2500</td>
<td>ca 3</td>
<td>block</td>
<td>purposive</td>
<td>10–100 m-st.</td>
<td>7–15</td>
<td>&gt; 50 Bintliff &amp; Snodgrass 1985</td>
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<tr>
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<td>1500</td>
<td>&lt; 6</td>
<td>transects</td>
<td>purposive</td>
<td>sites</td>
<td>?</td>
<td>? Lloyd et al. 1985</td>
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<tr>
<td>Nemea Valley (Greece)</td>
<td>85</td>
<td>&gt; 50%</td>
<td>total?</td>
<td>–</td>
<td>100 m-strips</td>
<td>15</td>
<td>? Cherry et al. 1988</td>
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<tr>
<td>Neotherm.Dalmatia (Croat.)</td>
<td>2200</td>
<td>10</td>
<td>transects</td>
<td>system</td>
<td>sites</td>
<td>25–50</td>
<td>4–30 Batovčić &amp; Chapman 1985</td>
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<tr>
<td>ALLRB (Bohemia)</td>
<td>1000</td>
<td>ca 20</td>
<td>fields</td>
<td>random</td>
<td>100 m-strips</td>
<td>20/100</td>
<td>10</td>
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Tab. 6. Comparison of some objectives and selected methodological criteria of regional archaeological surveys in Europe.

sample. The general conclusion is that the accuracy of estimating artefact distributions decreases as the target population decreases in size or becomes more clustered (Wandsnider – Camilli 1992). This has negative implications for locating low-density, or highly clustered small clusters such as are likely to occur in the Mesolithic in Bohemia and possibly during some other periods of prehistory.

In a significant study, Wandsnider and Camilli have collected by field survey experimentally planted pottery scatters of different characteristics and dispersal patterns (Wandsnider – Camilli 1992), using an intensive transect interval of 5 m. Dramatically more clustered (82%) than isolated (66%) artefacts were recovered. The rates of recovery also favoured large artefacts, whereas smaller artefacts were mostly found upon closer inspection of the surface. The bias against smaller finds was compounded if there was a lack of contrast with the background surface. The conclusions arising from this study indicate that (1) the number of artefacts found through field survey may not reflect the distribution on the surface, (2) surveys using wide-spaced transects (15 metres and above) will selectively pick up large artefact clusters (30 metres and above in diameter) reinforcing the traditional notions of settlement– based structure of the archaeological record, (3) the initial survey results will tend to yield a document which will distort the true density (towards large clusters) and assemblage composition (towards larger artefacts) (Wandsnider – Camilli 1992; see also Seaman et al. 1988).

Again, the implications are that archaeological cultures are defined by small artefacts (i.e. the Mesolithic) or by residence mobility will not have an equal chance of representation with cultures of more sedentary character or those leaving behind larger artefact fragments.

One solution to this problem is the application of intensive surveys (transects of 5–10 meters apart) and/or of repeated surveys on the same locations. Experimental studies have shown that the pick up rate (the field survey sample of the surface assemblage) is related to the intensity of survey (e.g. Shiffer – Wells 1982; Cowgill 1990), ranging from 66% by transect survey 5 metres apart (Wandsnider – Camilli 1992) to 5–6 % for less intensive surveys (Odell – Cowman 1987).

From this discussion, a number of general points emerge. First, it is clear that the original sampling universe – the size and the structure of the assemblage at deposition – is unknown. The practical way to deal with this problem is to secure a high number of cluster samples (Cowgill 1975; Redman 1975). From a statistical point of view, it is unclear whether random or systematic cluster sampling provides more reliable estimates (Redman 1975; Judge et al. 1975), although a systematic sample is simpler and more efficient to perform in most situations (Redman 1975; Zvelebil et al. 1997). The random sampling strategy which we decided to follow in our project is, however, logistically much more advantageous as we argue further on in this paper.

Second, the simplest solution for the problem of uniform representation of different cultures is to design surveys of high intensity where most or all of the ground is covered by the survey. Such a goal, however, is in direct conflict with the requirements of a regional survey, where the objective is to cover large areas of the landscape. Bearing in mind the need for a balance between the quantity of information, quality of information and the costs involved, this conflict can only be resolved by developing a stratified research design and by integrating field survey with other methods of landscape investigation.

The development of a stratified survey design will reduce the sampling bias arising from the uneven representation of cultural residues in time and space. In reference to our project, the initial coarse sampling of both the North and Central Transsects will provide general but systematic information about the settlement patterns from the Mesolithic through to the Middle Ages. This will be followed by a series of stratified sampling procedures, designed to test for potentially biasing factors in the first survey. Such procedures will include more intensive sampling of small ecoczones within the transects (e.g. the floodplains of the Obre and Labe rivers) or of key ecotonal zones (e.g. terraces/rockstrata alluvium boundaries), where concentrations of settlement can be expected.

Third, the general discussion presented here indicates firmly that within the framework of landscape archaeology, field survey is merely one element of a larger research programme. The role of the field survey is to generate a record of variation in archaeological find densities over space which can be further analysed and manipulated through the application of modern geographical technologies such as GIS (Allen et al. 1990). Sub-surface testing, (by coring or test pitting), geomorphological studies of soil depth, erosion and accumulation, analysis of cartographic sources and aerial photography can be combined to establish vertical control over the archaeological record gained by the systematic field survey.
A sampling procedure designed for the first phase of our survey could be articulated in many different ways, but there are some factors which cannot be freely modified. In this project we can expect to be able to spend about 30 days in the field in each of the transects each year. Assuming a group of 10 people on average take part in the field work, and 2.5 km of traversing per day is achieved (this corresponds well with the figures given by Farhman et al. [1980] and with our direct field experience), the capacities of the project as a whole can be estimated to about 2500 km of traverses per each of the project transects in total, to be walked within the first 3 – 3.5 years of the project duration (this time schedule is recommended in order to leave the remaining part of the project duration for the next stages of field work, including more intensive study of particular areas). This would represent a ca. 1.0% fraction of the area assuming that a walker visually controls a strip about 2 metres wide. Referring, however, not to isolated finds but to larger spatial units (sites, activity loci), a much higher sampling fraction is, in fact, possible, because each of the traversing pedestrians effectively "controls" a strip which is about as wide as the expected size of the object to be found (assuming sites of 50 metres in diameter a 52 metres spacing between surveying persons still means, theoretically, a 100% coverage of the area).

This theoretical assumption does not, however, take into account the aspect of variable find density within a cluster, the variable personal error of each walking person (probability of missing a find) and, in general, the three methodological tasks of the survey; locating any activity remains within a broader area, identifying a spatial pattern ("a site" or activity area within a "background noise") and the precise dating of this. These tasks, in fact, need different levels of survey intensity in particular cases (cf. Foley 1978) and any applied scheme must compromise between them.

The 1% sampling fraction (achieved if the surveyed areas are covered "totally", that is by traverses 2 metres apart), is obviously insufficient, taking into account the scale of the settlement patterns and their expected distribution. The 20 metres interval, which has been finally chosen, increases the surveyable sampling fraction to 10%, at the cost, however, of the identification of the smallest and least distinctive activity loci. These must probably be neglected in the first research phase of the project; their identification will be addressed by stratification of the sample in the later stages (see above).

To further increase on the surveyed part of the transects we have decided to walk the chosen fields in parallel bunches of five lines (traverses 100 metres wide) and to leave out another 100 metres wide strip next to each of the traverses surveyed. This automatically doubles the sampling fraction, which means that the fraction of 20% can be reached under the supposed project capacities. It is expected that most of the activity areas cannot be missed even within the gaps between the line bunches (traverses) and a reasonable sample of smaller activity loci will also be opportunisticall located. If just the areas which are available for survey (not covered by woodland, pastures or buildings) are considered (c. 360 sq. kilometres in the Central transect) the fraction of the territory that can be surveyed by the available capacity automatically increases to about 28%. The suggested sampling fraction does not represent any firm limit which has to be reached in all the ecozones at any costs. Due to the proposed sampling scheme (random or pseudorandom selection of sampling polygons) a sampling fraction at any level forms a representative sample of the area. In practice, great care must be taken to ensure that random sampling is not biased by practical considerations of field availability and convenience of access.

9. SAMPLING POLYGONS: SIZE AND SHAPE

Landscape to be surveyed by sampling must inevitably be divided into analytical units (samples) within which the actual survey is performed. In the ALRB project these analytical units are called sampling polygons, their size and shape is, in several respects, influenced by the recent history of the landuse patterns in modern Bohemia.

The collective farming of the last forty years has changed the traditional landuse pattern of small private fields into large field blocks. Many of the fields today may reach an extent of 50–100 hectares. This, of course, does not make the existing fields ideal sampling units, because the larger the (average) size of sampling units, the smaller can be the total number of polygons surveyed (sample size). Besides that, existing fields vary largely in size which will make them less reliable in terms of statistical evaluation of the results. To cope with this properly would mean to employ geodetic measuring equipment to divide the land into smaller units of standard or similar size. This has been tried and found to be too labour intensive. Instead, natural geographic or landuse units are used as polygons to be sampled. The degree of statistical bias that can be introduced by larger sampling units of variable size will have to be tested. Larger sampling units will probably have one advantage: on their base it is possible not only to make inferences about the presence or absence of a past activity on a location but also to describe more of the specific patterning associated with it.

The size of sampling units is closely connected to the question of their shape. Using standard, arbitrary units (e.g. squares, transects; Mills 1985) is a good solution in theory and was tested during the first campaign of the project. It soon has become clear, however, that this approach has serious practical logistic problems. Most of such arbitrary units, wherever they are placed, fall across boundaries of different fields or crops, woodland or villages and can be surveyed only at different periods of time (if at all). It is not possible to keep a scheme with a regular sampling grid without substituting the permanently unaccessible parts of the sampling units and waiting for those that cannot be walked at that moment, which immediately incurs a substantial increase in time costs for the survey.

To compound the problems there are nearly no field boundaries marked on current maps issued since the change to collective farming and the reorganisation of the arable landscape. Within these large open fields annually rotating crops create sub-divisions that may have no permanent boundary markers. Any attempt to prepare a formal scheme of the selection of sampling units, including the calculation of their size etc., would necessarily entail spending a considerable time either in the air obtaining aerial photographs or in the field plotting the analytical unit before every fieldwalking campaign.

On the basis of these practical experiences in the Bohemian landscape, we decided to use the existing landuse units (fields) as sampling units, a sampling framework commonly used in Ireland (Zvelebil et al. 1987; 1992) and Britain (Schofield 1994). Instead of a uniform systematic sampling, used for instance by Zvelebil in Ireland (Zvelebil et al. 1992), a method of random selection of sampling units has been developed (here we are obliged to E. Neustupný for his useful ideas) taking into account the practical constraints and opportunities dictated by modern landuse. This method is detailed in the next section.

10. SELECTION OF FIELD WALKING POLYGONS

The selection of the polygons can be defined within several basic schemes. The first of them, having been applied at the beginning of our project, was pretty simple, and represented surveying any field in the area which was walkable at the time. The pattern, obtained in this way, may form a pseudorandom sample of the area. The necessary condition of such an approach is, however, that the number of walkable fields in the area is so low that all of them can be surveyed during the same campaign. Any subjective choice of what should be walked and what is to be left creates a bias and changes a random sampling into a purposive one which is to be avoided.
This is why, the simple strategy of walking all available fields cannot be practiced in situations such as the spring campaigns when nearly all the fields are weathered and ready to be surveyed. For such cases a procedure of random selection of polygons has been developed. Several series of 25 random co-ordinates for each of the transect parts (map sections of 95 sq. km) are prepared. All the fields, assigned by one of these randomly chosen points, will be walked, if their surface visibility is good. If not, their survey will be delayed or the field is substituted by the closest field available. Co-ordinates falling into permanently unworkable areas (villages or water ponds) are also substituted by the nearest available other polygon. Co-ordinates directing into woodland should be both substituted by a polygon on the nearest edge of the woodland and some visual survey combined with test pitting is planned for the wooded areas themselves (cf. Fig. 4).

It is supposed that at least two series of randomly chosen polygons will be surveyed within each of the transect sections, representing about 200 polygons within a transect altogether. Smaller fields should be walked in total, if a large field (over 50 hectares) is chosen, just a part of it should be walked creating a polygon of ca. 25 sectors (50 hectares) walked around the appointed co-ordinates. Estimating the average size of the polygons to ca. 12.5 sectors (1 hectare square), covering 25 hectares the survey of 200 polygons would represent a ca. 10% fraction of the transect. It is supposed that this will be further increased (up to the proclaimed sampling fraction of 20–28 %) by repeating the same procedure or by adopting a modified scheme in further survey (e.g. by stratifying the area).

The adopted sampling scheme inevitably involves several problems regarding sampling theory. One of them is, whether the unworkable polygons may be substituted by their closest neighbours or not. Substituting of permanently unworkable polygons (villages, woodland) by the closest available field is obviously quite necessary for in both cases these areas represent important territorial strata with a higher, non-random probability of past activity distribution. As we have observed the distribution of medieval/modern villages probably quite closely correlates with the distribution of prehistoric settlement sites (Kuna 1991b). Substituting of a polygon falling into a village by another polygon randomly chosen anywhere else could therefore systematically diminish the probability of a prehistoric (and medieval, of course) site being discovered. In the case of the larger blocks of woodland the situation is just the opposite. Although we mostly do not know how far back in history the occurrence of particular woodland blocks may reach we may generally presume that they have survived in areas which were less suitable for agricultural use and therefore less intensively covered by occupation activities.

Another problem is apparently introduced by the large average size of the sampling polygons (usually 10–25 sectors or 20–50 hectares) and, as a result, the small number of them. That is why, we may expect that certain specific environments smaller in extent (narrow valley bottoms, for example) will be missed totally by this sampling procedure. This would mean, that although the variability between different larger units (ecozones) might be truly reflected, the distribution pattern within their boundaries could be missed. Being aware of this problem we shall try to solve it in future, probably by some type of sampling stratification.

Randomizing of the polygon selection does not fully exclude the possibility of surveying polygons (fields) purposively. It is quite legitimate to add several polygons in each area to the random sample of the fields to provide more information about those places which seem to be important for some reason. In recording the field work it should be, however, clearly mentioned which polygons were chosen in a purposive way and what was the reason for it.

### II. FIELD WALKING METHOD

Organizing field work within teams consisting of five members (a number convenient to personal car carrying capacity) has emerged as the most appropriate strategy. Each crew organizes its own particular programme within a given territory (usually a map section 1:25000, with a 95 sq.km part of a transect). Sampling polygons correspond to the particular land use boundaries at the moment of survey which are fixed in the map. Whole fields or their substantial, logical parts are to be walked. Only weathered fields with good surface visibility may be walked, the risk of missing important information due to lower visibility (e.g. if the field has been freshly harrowed) is avoided.

The survey of the selected polygons is performed upon a grid of N–S parallel lines, derived from the S42–coordinates kilometre grid of the standard military maps 1:25000. The lines are drawn onto the maps in advance, spaced 200 metres apart and represent the axes of the allowed survey traverses (traverse bunches; cf. Fig. 5: A). Each of
these bunches consists of 5 traversing lines spaced at 20 metre intervals. The central line (line C) is identical with the pre-drawn line on the map. It is usually walked by the leader of the team controlling the activity of the group. The resulting pattern are regular N-S strips 100 metres wide, each second of which is walked (cf. Chapter 8 and Fig. 6). The use of a fixed grid for the survey has two important assets; it reduces the fixing of survey traverses within the huge field units to a simple, routine procedure and it avoids subjective decisions about the particular parts of fields which should be walked.

Once it is decided to walk a particular field, the starting point is defined, being normally the southern or the northern end of one of the pre-drawn lines intersecting the field. The starting point at the intersection of a traverse with the edge of the field can be easily located by pacing from any point of orientation and the direction of the traverse (North or South) is easily obtained by compass. The exactness of such measurement has been tested and the results were quite satisfactory (any error in orienting lines can normally represent just about 20 metres at the other side of the field, several hundreds metres away). Any mistake, made in the compass measurements, is, however, not cumulative within measuring the next traverses, since each traverse should be marked out separately using a different point of orientation.

After defining the starting point and the direction of the first traverse, one of the team starts pacing 100 metres stints (sectors), marking them with ranging poles. The rest of the team can start walking immediately the second stint is marked (pacing the third and further stints the pacing person does not need any help to remain on line, being able to see at least two other poles in line backwards). Four remaining persons walk their lines, whereas the person walking in the middle collects the poles (sets of eight, light, one metre aluminium ranging poles in leather bags are used). The pacing person joins the rest of walkers after finishing the job, numbers of sectors which were walked with only four people are entered on the form.

Each traverse is, thus, divided into sectors of approximately 100 metres long. Each sector is walked in five lines, marked A-E (A is always the western line, E the eastern one). Finds of each line within each sector are bagged separately (Fig. 6).

When a traverse bunch is walked to the end, the next one, situated 200 m to the East or West, can be measured in the same way and walked in the opposite direction. Pacing of sectors starts always from the starting points on the edge of the field, no attention is paid to any crosswise alignment of sectors (this makes the procedure quite time-effective). Individual length bias of the pacing person usually causes that the length of sector varies between 90–110 metres. The real length of sectors is calculated when redrawing polygons into the archival maps and digitizing the computed densities of finds will take it into account.

The filling of a polygon description form, giving details about weather, soil, land use, number of sectors within individual traverses, the length of the non-standard (end) sectors and number of sectors in which the crew was not complete is done in the field. No field sketch is necessary since the boundaries of the polygons can be drawn straight onto the field map. Redrawing of the polygons and sectors into an archival set of maps 1:10000 immediately after coming back from the field is, however, compulsory (Fig. 5: B).

12. ANALYSIS OF FINDS AND THEIR DISTRIBUTION

Specific questions concerning the obtained data treatment and evaluation are not detailed in this paper, although their basic lines have been already established. A computer programme for the evidence of polygons and finds has been already created (database system FWalk, designed by M. Kuna and D. Adelsbergerová). This programme makes it possible to record the data, sort it according to various aspects, quantify the densities of specific finds within individual sectors and display them graphically on a computer screen or a printer (Fig. 7: A). Since the names of persons who walked individual sectors and lines are also recorded, it is also possible to evaluate the personal abilities of individual walkers and to use this information for evaluating the reliability of the results achieved.

Classification of finds according to a detailed chronological scheme represents a specific problem. All the finds are classified by three persons or teams (one for prehistoric pottery, medieval to modern pottery, and flints) and special items are consulted with other specialists. To obtain the maximal level of objectivity (or at least to have estimation of the classification bias), attempts have been made to compare classifications made by different specialists on the same find sets. Since the evaluation of these results goes beyond the goals of this paper it is omitted here but it will be detailed later, together with the analysis of some of the first results of our field work.

13. GENERAL RESULTS

Since the analysis of the collected information is quite laborious and makes sense only in the context of other data, an evaluation of particular field data is not given here. The aim of this paper has been mainly methodological, some general ideas about the effectiveness and reliability of our field survey design can already be made already at this stage.

The main goal of the survey, namely to define the settlement zone as whole and to monitor its changes in extent and inner population density through time, appears to be fairly realistic. The number of prehistoric and medieval sites which have been newly discovered by the project survey so far is quite high, negatively proportional, however, with the intensity of the preceding archaeological activities in particular parts of the transects. Our survey is providing key materials for comparing the intensity and character of the use of individual ecozones of Central Bohemia in the past, as well as data for a general quantification of the density of archaeological remains within the country. These evaluations and considerations of specific taphonomic questions of the surface record are bringing us closer to the estimation of the threat to which the archaeological record is generally being exposed. It has been also stated that, for many various reasons, the surface collection survey can bring reliable results only if systematically matched with other sets of field data.

The total amount of finds collected during the first two years of the project is about 50,000, mostly pottery fragments: The general picture obtained by a systematic and spatially controlled survey challenges, as expected, the traditional notion of the archaeological record as a set of points ("sites"), situated within an empty space. In contrast to this, archaeological remains appear to create a more or less continuous distribution over space, suggesting a complex use of landscape by different activities in various periods of the past (Fig. 7: A).

The suggested survey intensity has proved adequate not only to monitor the general distribution of surface scatters (activity areas) but it is also sensitive enough to distinguish many individual scatters of the period–specific areas within larger sites. Comparing the results obtained by intensive grab sampling, test trenching of the same sites and walking them by the standard ALRNB method has shown quite satisfactory results. Comparative research at the Děvěčice site has shown, on the one hand, that the chosen sampling intensity is able to identify most chronological components and smaller activity areas which were known from other kinds of evidence (the only larger but missing component on the particular site is EBA–MBA materials: in this case we cannot be, however, too certain with the previous classification of the finds, see Tab. 5). On the other hand, it is obvious that the suggested survey scheme can provide a quite reliable but a more or less general picture of settlement history. A more intensive survey will be necessary within particular smaller areas to detect some of the rare components and/or to prove expected patterns on a local
Fig. 7. A: Map sheet 12–22–19 (1:10000; cf. Fig. 3A) with the polygons walked up to 1992. Shading displays the various densities of prehistoric pottery fragments within individual sectors (stints). B: Map sheet 12–22–19, a: sectors with lithic finds of the (probably) Neo- and Eneolithic periods; b: sectors with Neo- and Eneolithic pottery; c: occasional earlier finds of Neo- and Eneolithic periods; d: extent of the lowest sand-and-gravel terrace ("Würm"); e: extent of the flood plain; f: current water streams; g: palaeochannels identified on recent aerial photographs; h: Lake palaeomeanders; i: edge of the transect.
level. This should be the aim of the next phase of the multi-stage sampling procedure within the project. The already mentioned concept of community areas (Neustupný 1986; Kuna 1991) and the presumed rules of distribution and co-occurrences of certain phenomena allow us to make generalisations even from fragmentary data. The next stages of the project will be to both test some of our assumptions and to furnish them with data for local level patterns.

The results obtained so far enable us to expect that the method described here enables us to monitor such activity areas which cannot be recovered during any "site-oriented" survey. In this way it has, for example, been possible to distinguish differences between the Early Iron Age and Late Iron Age settlement patterns, identifying smaller dispersed pottery scatter sites of the latter period, in contrast to the nucleated settlement sites of the former one (Fig. 8). Another example could be the patterns of dispersed flint finds, showing possibly specific activity areas of the Neolithic or Eneolithic periods (Fig. 7: B). The third example could be manuring scatters around medieval villages which have not been specifically mapped in this country so far.

One of the most important results of our efforts has been the fact that the suggested survey zones have proven to be time-effective enough to cope with the large size of the transects to be studied. While preserving the basic criteria of survey reliability and control of space it was possible to survey about 26 sq. km in the Central Bohemian transect (cca 2500 sections of about one hectare each, which is about 10% of the total area of the transect) during the first two years of the project. The survey efficiency (25 sectors, meaning 50 hectares of polygons) per one team per day is quite high when compared with other published projects of similar character. That is why, we believe that this methodology, responding to the specific demands of the Bohemian landscape, the specific character of its archaeological record and the general goals of a regional project, can contribute to the development of landscape archaeology in this country.

SOUHRN

Archaeological fieldwork and systematic surveys have proven to be time-effective enough to cope with the large size of the transects to be studied. While preserving the basic criteria of survey reliability and control of space it was possible to survey about 26 sq. km in the Central Bohemian transect (cca 2500 sections of about one hectare each, which is about 10% of the total area of the transect) during the first two years of the project. The survey efficiency (25 sectors, meaning 50 hectares of polygons) per one team per day is quite high when compared with other published projects of similar character. That is why, we believe that this methodology, responding to the specific demands of the Bohemian landscape, the specific character of its archaeological record and the general goals of a regional project, can contribute to the development of landscape archaeology in this country.
Vlastní povrchový průzkum (explicitně definovaný jako vzorkování sledovaného území) je členěn do tzv. polygonů. Každý polygon odpovídá zpravidla jednomu pojiš nebo jeho části (u polí větších než 50 ha). Výběr polygonů pro průzkum je náhodný, pomocí náhodných bodů, jejichž souřadnice jsou generovány počítačem. Malá pole jsou zkoumána celá, u velkých polí jsou zkoumány pouze části zhruba do velikosti 50ha umístěné v okolí vybraného bodu. Trvale neprůstupné polygony (vesnice, les) jsou narázovány stablem na nejblížích do-

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Fig. 8. Change in the Iron Age settlement pattern as displayed by surface finds. Distribution of prehistoric pottery around the Dřevčice site. A: prehistoric pottery (total); B: Early Iron Age; C: Late Iron Age (LT B–D). Shades show distinctive sherd counts per one sector.

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Hlavním cílem tohoto příspěvku je představit metodiku povrchového průzkumu v rámci projektu krajinné archeologie. Domníváme se, že hlavní cíl průzkumu, definování zdielenců oblasti a postižení změny v jejím rozsahu a hustotě obyvatelstva, je realistické. Počet nově objevovaných pravěkých a středověkých lokalit je vysoký. Průzkum nesporně přispíval důležitým materiálem pro srovnání intenzity a charakteru využívání jednotlivých ekosystémů i podklady pro obecnou kvantifikaci povrchových nálezů a pro obecné zhotovování jejich vypovídacích možností a zvýsíma.

Během prvních dvou let projektu bylo prozkoumáno zhruba 2500 sektoru (5000 ha, tj. 10% slepovadla území). Shromážděno bylo přes 50000 nálezů, většinou fragmentů keramiky. Obraz, získaný na základě systematického průzkumu podle náležitě behnoutí popřípadě tradiční chápání archeologických pramenů jako souboru diskretních bodů (nalezišť), situovaných v právě zmiňovaném prostoru. Místo toho se zdá, že archeologické pozůstatky jsou na mnoha místech v prostoru rozšířeny více než jednou souvislostí; jejich hustota a rozptyl svědčí o komplexním využití krajiny (obr. 7: A).

Povrchové sbírky mohou přispět spolehlivé výsledky použít v soustavné konfrontaci s ostatními druhy terénních dat. Porovnání výsledků intenzivního sbírání, rýhování a výsledků dosáhnutých standardní metodou užívání v rámci projektu je ujistitelné (Tab. 5). Zvolená intenzita povrchového průzkumu se ukázala jako dostatečná nejen k zachycení obecné struktury rozložení artefaktů na povrchu, ale i dosažitelně citlivá vůči rozdílům článkových chronologických komponent v rámci velmi velkých lokalit. Nicméně je zjevné, že předkládaná metoda povrchového sbírání je schopna poskytnout jen rámcovou představu o vývoji osídlení, přičemž k nalezení méně výrazných komponent lidské činnosti nebo upínače její struktury na lokální úrovni bude třeba v některých částech transektního průzkumu na místním úrovni. Ten by měl být zahrnut do následující fáze výzkumu, jestliže v rámci vlastního projektu.

Dosavadní výsledky naznačují, že zvolená metoda povrchových sbírů umožňuje (přestože v mnoha ohledech přitahující v diskusi relativně nízkou intenzitu průzkumu, dosáhnuše 20% metově rozsypů, jen rámovou zjištění) rozpoznat v terénu i takové komponenty, které nelze zachytit průzkumem tradičního rázu, orientovaným na "vyhledávání lokalit". Plošné mapování terénu popisovanou metodou indukuje i příklovo malému počtu nálezů např. rozdíl mezi prostorovým uspořádáním areálů (sídlišť) v laténském období, reprezentovaným malou sestavou nálezů leváčů a kladí, ukazující běžně na možné areály mimočlánovitých aktivit nečlánkového a clánočlánkového období, nebo na areály sítí bez zohlednění oblastí (obr. 7: B). Těžší přístup tvoří určení poli kolem některých středověkých vesnic na základě velkoplošního rozpočtu keramiky s nízkou hustotou.

Efektivita sběrů provedených navrhovanou metodou AL.RNB je v porovnání s jinými podobnými projekty v zahraničí dosud vysoká. Proto věříme, že její aplikace je realne zkoumat vývoj osídlení i v tak velkém rámci, jaký představuje projekt AL.RNB - Krajina a sídla. Dosáhnete tak, že posouvá metodu a strategie jejího uplatnění, odpočínající specifickým problémům české krajiny a považovaným archeologickým pramenů, může přispět k dalšímu rozvoji krajinů i zdielenci archeologie v Čechách.

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AERIAL PHOTOGRAPHY
IN THE CENTRAL BOHEMIAN TRANSECT OF THE ALRNB-
LANDSCAPE & SETTLEMENT PROGRAMME 1992

VYUŽITÍ LETECKÉHO PRŮZKUMU VE STŘEDOČESKÉM TRANSEKTU PROJEKTU
ALRNB – KRAJINA A SÍDLA V ROCE 1992

Martin Gojda

In most archaeologically advanced countries aerial reconnaissance is included within complex landscape history projects forming an integral and irreplaceable role. It serves as a means of detection and identification of archaeological structures – features, sites, roads, field systems, etc. – and under favourable conditions it may make a valuable contribution towards our analysis and interpretation of the buried landscape.

Approximately 40% of the central Bohemian transect of the Ancient Landscape Reconstruction in North Bohemia (ALRNB) and Landscape & Settlement co-operating projects is situated within territory which, in terms of archaeological detection, is considered to be favourable: this is the territory of the Labe terraces and their environs, situated between the towns of Mělník and Brandýs n.Labem, an area known as the Mělník Hollow, which is characterised by light soils (gravels and sands as the principal subsoil element). Such soil conditions are usually favourable for the creation of crop marks and since this part of Central Bohemia has been densely settled since the Neolithic period it is to be expected that many traces of human activity should be detected from the air. For these reasons this area was the focus of attention during the first aerial-photography campaign.

Initially a study was made of ordnance survey photographs from the central military air photograph archive that related to the relevant transect territory. Unfortunately they are not ideal for archaeological purposes due to their smallness of scale and consequent low resolution, and most of them were taken outside the best seasons for aerial reconnaissance. On the other hand, a set of pre-war photographs provided very useful information about pre-collectivisation land-use, the patterns of which may date, in some cases, to as early as the late Middle Ages. Some of the photographs also contain valuable evidence documenting the former patterns of the course of the river Labe and local streams.

The first major aerial reconnaissance was carried out in June and July 1992. These first steps of aerial archaeology in Bohemia were watched by R. Featherstone of the Air Photography Unit of RCHME (Swindon, U.K.) and O. Braasch (Schwabisch Gmünd, Germany) who kindly came to Prague and assisted as advisers during the flights. In the territory of about 220 square kilometers of the Central Bohemian

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Fig. 1. The survey of sites detected within the studied territory of the central Bohemian transect of ALRNB from the air in the summer of 1992 as compared with the data hitherto collected by systematic field walking. M-macula, 1-linear feature, RMDEM-rectilinear multiple-ditched enclosure with macula placed in its centre, RSDE-rectilinear single-ditched enclosure, Ph-s-Prehistory non-specified, N-Neolithic, LN-Late Neolithic (Eneolithic), BA-Bronze Age, H-Hallstatt period, LT-La Tène period, RP-Roman period, EMA-Early Middle Ages, HMA-High Middle Ages. + yes, no, hna—hitherto not analyzed. Index of sites = Sklenf¹ 1982; (administrative villages of the transect indexed by Sklenf²).
transect a total of 18 sites have been identified within the cadastral areas of 13 villages and country towns (the numbers in brackets correspond to those on Fig. 2): Tišice (1), Chrást (2), Vletaty (3), Nedomic (4), Dřisy (5), Čečelice (6,7,8), Jiřice (9,10), Mraín (11), Šaší (12), Dřevčice (13), Brandýs n.L.—Hnězov (14), Jenštejn (15,16,17), Veleň (18). Of them cca 30% are new sites hitherto unknown.

From the viewpoint of site classification we can distinguish three groups of sites within the studied territory: 1. those identified as clusters (irregular rather than regular) of different amounts of features (mostly tens to hundreds of simple features – pits, sunken-floored buildings, graves, etc. – named in terms of morphology, maculae), 2. those identified as sites composed of linear features (enclosures, linear–ditches, linear systems), 3. those which combine both maculae and linear features.

Apart from morphology it is the interpretation and dating of detected sites that forms the complete classification of air–photographed features. The macula sites may in all cases be classified as settlements, none of them appear to be a cemetery. Of the linear features only the recumbent multiple–ditched enclosure with a centrally placed macula in Jiřice 10 can be interpreted as a burial which is indicated by the macula placed in its centre and by its size (10 metres in order). This type of feature (small rectangular enclosures, with macula) has been dated to the Iron Age in Britain and to the Hallstatt – early La Tène period in Bavaria, but the Jiřice example is unique in that it is composed of a three–ditched enclosure.

The other two linear–feature sites (Dřisy 5, Jenštejn 16) are characterised by their larger size and may be interpreted as settlement enclosures. However it is worth noting that the identification of both

Fig. 2. The distribution of sites within the central Bohemian transect of ALRNB (the territory of the Labe basin) detected by aerial reconnaissance in the summer of 1992: a–maculae, b–rectangular enclosure, c–rectangular enclosure with a macula in its centre, d–linear feature, e–uncertain site, f–limits of the Labe gravels (the border of the Holocene flood-plains within them is not marked).

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of these features as being of prehistoric/historic date is not completely certain.

Evaluation of the data shows that about two thirds of the sites detected from the air were field-walked and in one case has no evidence of finding which, together with similar results from other central Bohemian territories (cf. Goeja, 1993), confirms that the air-photographed features (especially those of the macula type) are actually archaeological structures rather than natural features or the consequence of modern cultivation and land-use practices.

Evaluating the introduction of aerial archaeology into the ALRB project we can see that it has contributed to the completion of the list of sites of the studied territory since a few completely new sites (neither listed in the latest index by Sklenář 1982 for the district of Mělník, nor discovered by field walking) have been detected. Of some importance are also photographs which provide evidence about the natural environment (paleoarchannels of the ancient Labe river). It is evident that it is worth continuing the program of aerial archaeology in future seasons. We also plan to complement this method of site and landscape pattern survey by special intensive field walking and geophysical methods in order to test the comparability of different methods of site detection.

SOUHRN

Příspěvek podává stručný přehled o dosavadních výsledcích letecího průzkumu kombinovaného se sběry na lokalitách objevených ze vzdálení v severní polovině středoevropského transektu projektu ALRB. Z celkového množství 18 lokalit byl na třetině z nich proveden povrchový průzkum, který až na jeden případ doložil na nalezenéch sídelní aktivitě v pravěku či raném středověku. Údaje o jednotlivých lokalitách a typických objektech na nich náběžných letecím průzkumem jsou uvedeny v tabulce.

References


GEOPHYSICS WITHIN THE ALRB - LANDSCAPE & SETTLEMENT PROGRAMME: A NEOLITHIC CIRCULAR ENCLOSURE AT VINOŘ

GEOFYZIKA V PROJEKTU ALRB - KRAJINA A SÍDLA: NEOLITICKÝ KRUHOVÝ PRÍKOP VE VINOŘI

Roman Křivánek – Martin Kuna

The geophysical survey at Vinča in 1992 was carried out in 1992 after two rescue excavations during the construction of two gas pipe-lines (1981, 1988). Magnetometry indicated a neolithic circular enclosure (ditch) cut by two gas pipe-line trenches.

Geophysics ranks foremost in the non-destructive methods of modern field archaeology. The observation and analysis of changes within the physical parameters of the upper soil levels can not only provide useful information for creating effective procedures in structuring archaeological activities, but can also be employed for recovering new data rarely obtainable by other field methods. For archaeological purposes the most frequently applied method of geophysics is magneto-

metrics. This is probably due to its efficiency in surveying large areas in a relatively short time span. For this reason it was decided to apply magneto-

metry within the ALRB – Landscape & Settlement programme involving the systematic geophysical survey of chosen sites within the frames of a regionally based research project.

The geophysical survey at Vinča in 1992 was planned mainly as an attempt to evaluate the operating parameters of the available equipment and the time-costs of the field work, from which a reliable research programme could be developed. The first geophysical operation within the project brought not only the required methodological results, but the discovery of an archaeological feature morphologically identifiable as prehistoric in date and interesting enough to be published separately.

The cadastral area of Vinča is situated NE of the centre of Prague (now being included administratively into its 9th district). The site itself is situated 200 metres WSW of the village (local place-name "Na dolůchách", co-ordinates of the site are W – 375 mm and S – 317 mm within the 12 – 24 – 14 Basic Map 1:10000). The terrain of the surveyed area is flat (declination of the slope is below 1 degree). The whole area is composed of magnetically non-active sandstones and claystones of the Bohemian Cretaceous Plateau. The top part of it is formed by a mixed stone-clayey layer of weathered bedrock, covered by loess and chernozyem soil.

Attention was focused on a plot of land across which two parallel gas pipe-lines had been constructed during 1981 and 1988 in which a group of Neolithic features (site II on Fig. 1) were discovered and recorded by rescue excavations conducted by M. Fratinová (Prague City Museum, 1981) and M. Kuna (1988, cf. Kuna 1990; here: Fig. 3 A). Further prehistoric features were recorded in other parts of the same pipe-line trenches within a few hundreds metres (Early Iron Age settlement site: site I on Fig. 1; Neolithic deposit, a rich Early Iron Age burial and an Early Medieval grave: site IV on Fig. 1). Other Neolithic structures have been discovered during the building of new block of flats at Vinča in 1988 (site III on Fig. 1), but it was only possible to record and sample them.

Five features (plis) were found in the pipe-line trench within site II in 1988. A few indistinct pottery fragments from the features, probably belonging to the Late Neolithic Stroke Pottery culture, were the only finds (now in the City Museum of Prague). Subsequent fieldwalking recovered scattered surface finds of a similar date range (Brandýs n.l.Museum No. 94/89). Besides three indistinct Neolithic pits two other features of a nearly identical, triangular shape were found (15 A and 15 B, Fig. 2). Their width in the upper part was 320–330 cm and their depth, measured from the present surface was 190–220 cm. Their clay and soil fill was also identical, the lower deposit being a light clayey soil, indicating that they may have stood open for a period, and the upper deposits consisting of dark brown soil.
comparable to the top soil above. Since both the features were observed on both sides of the trench (cca 1.3 metres apart) at a distance of about 55 metres from each other and their size, shape and fillings were quite distinctively similar, an assumption was made that these two features belonged to a Late Neolithic circular enclosure. Examples of this monument type have been discovered at several sites in Bohemia (Zapotočká 1983) and many more of them have been found elsewhere in Central Europe, especially by aerial photography (e.g. Lensis 1983). In Bohemia a magnetometric survey of such a feature has been carried out at the site of Bylany (Futárová – Macek 1983). The goal of our geophysical survey was, besides the testing of our equipment, to confirm such an assumption and to determine accurately the complete shape and scale of the feature accurately.

The necessary condition for any application of magnetometry is the presence of a magnetically distinctive structure or deposit in a subterranean archaeological feature. Such magnetic variability can be identified as changes in the relative values of the geomagnetic field $\Delta T/\mu T$ resulting from the buried items (iron artefacts, slag etc.), different character of the filling or the presence of burnt clay (ovens, fire places). The survey at Vinohrady was carried out by a fluxgate gradiometer FM36 (Geoscan Research Company product), being a gradient modification of a basic flux-gate magnetometer. A flux-gate magnetometer consists of two narrow permalloy cores of high permeability within a system of primary and secondary field coils. The measurement is based upon the indication of change in alternating voltages on the secondary field coil if any break of balance between the magnetic flows on the two permalloy cores, oriented in the opposite way, occurs. Such a change is usually induced by any motion in the external environment which is, as regards magnetic properties, never perfectly homogeneous. In the case of a gradiometer like the FM36, two measuring coils, placed in a constant vertical distance of 0.5 m, are employed and the vertical gradient of the magnetic field is displayed. A certain advantage of such a system is the high speed of measuring, a fast procedure providing preliminary results by computer analysis, and also the possibility of carrying out a survey in industrial areas without being obliged to record variances. Its only disadvantage, in contrast to proton magnetometers, is a slightly lower accuracy of results due to the instrument drift.

The survey covered an area of 5.200 square metres. The distance between profiles and between individual readings was 1 metre (a one-metre grid was established). The accuracy of measurement was $\pm 1$ nT. The analysis of the survey results was done in two phases. Firstly, a preliminary image of the pattern of the magnetic field was constructed by means of computer analysis by the Geoplot–IBM programme (Fig. 3 B). Secondly, the data have been compiled into a more detailed map of isonanotes $\Delta T$ (Fig. 3 C) and into an interpretative scheme of the most significant anomalies (Fig. 3 D).

Since the two cross pipe-line trenches cut through the surveyed area we had to expect a relatively high break of magnetic field in their close surroundings. Indeed, the survey displayed two distinct lines of high anomalies running in two parallel streams in a NNW–SSE direction and spaced 5 metres apart from each other. The anomalies belonging to them are extremely high (tens to hundreds of nT) and extensive in plan (I). This meant that in the vicinity of the pipe-lines (up to 5 metres in each direction) it was not possible to detect any patterning of a less distinctive character. Outside of this area, some concentrations of relatively very low values (units of nT) could be, however, identified, belonging to several types of anomalies. First of all, a disconnected circular anomaly (maximum 10 nT) corresponding to a circular feature (55 metres in diameter), probably a ditch of minimum 2 metres width (II) could be observed. The circular ditch was broken by an artificial step in the terrain of cca 2–3 metres in its E part. This represents the field edge relating probably to recent land use and/or clay pitting, recorded in this locality at the beginning of the century. Two entrance gaps of about 4 and 5 metres width, orientated to the SLS and SW respectively, are clearly visible on the plan of the
Fig. 2. Neolithic features 15 A and 15 B (circular ditch) cut by the pipe-line trench.
preserved part of the enclosure. These are accompanied by two out-turned wings, directed towards the SE and SW respectively, evidenced by linear anomalies within the order of units of nT (IIa, IIb).

Apart from the linear features the magnetic field pattern displayed many local anomalies. The most distinctive of them, the point anomalies of values up to tens of nT, are probably caused by non-archaeological iron objects or stones of magnetically active rocks laying on the modern surface. Larger isometric anomalies in the N fringes of the area, overlying partly the ditch and showing the values of between units and tens of nT, may be related to the gas pipe-line building or some other recent activities (IIa, IIb). A few other more extensive anomalies of a specific shape and the first-rank nT-values (three inside the circle and one outside it) can probably be labelled as prehistoric settlement features (IVa, IVb, IVc, IVd). It is not possible to interpret the rest of the observed anomalies reliably, especially in cases where just smaller values are in question (units of nT). We cannot, however, exclude their relationship with the past occupation activities.

The magnetometric survey at Vinča has confirmed the presence of an enclosure, possibly of late Neolithic date, being cut by a double gas pipe-line and an artificial field edge of recent origin. An anthropogenic impact upon the site in general may also explain the fact that all our attempts to prove the monument’s existence by aerial photography have failed up to now (first attempts were made by M. Kuna in 1988, followed by M. Gojda in 1992). This, in fact, enhances the results of the geophysical survey. From the geophysical point of view the measured data offered a wide range of anomalies and their amplitudes which can be explained as several distinctive types of subterranean structures. The degree of time-effectiveness has also been most promising: the complete measurement were accomplished by two

Fig. 3: A: The area of the magnetometric survey with the distribution of Neolithic features discovered in 1988. B: A computer analysis of the magnetometric data by the Geoplot-IBM software. C: Map of the magnetometric isolines T (1: 0–2 nT; 2: above 2 nT; the area of the pipe-lines not displayed). D: Interpretative scheme of the most distinctive magnetic anomalies (I: pipe-lines; II: Neolithic enclosure; IIIa, IIIb: out-turned entrances; IIIa, IIIb: recent activities; IVa–IVd: prehistoric features).
people within just two days, including the computer analysis and printing of the first results. The geophysical survey of the Vizoví brook microregion as a part of the ARLN bộ Landscape and Settlement project will continue in 1993 when some other sites of archaeological potential will be surveyed.

SOUHRN


References


ARCHAEOZOOLOGY AND ARCHAEOBOTANY
ITS ROLE IN THE ARLN Böl PROJECT

ARCHEOZOOLOGIE A ARCHEOBOTANIKA V RÁMCI PROJEKTU ARLNB

Mark Beech

This paper describes the methodology being employed for archaeological and archeobotanical analyses within the ARLN Böl project, and presents some preliminary results of the work carried out to date. Archeozoological samples were studied from the multi-period site of Jenďav Újezd (Neolithic–Early Medieval), Radovesice (Bell Beaker) and Jenďav (Eneolithic – Hallstatt). Archeobotanical samples were studied from Šdirice (Eneolithic) and Roztoky (Roman).

1. INTRODUCTION

The aim of archeozoological and archeobotanical analyses within the ARLN Böl project is to contribute towards the modelling of the palaeo-economic and palaeo-environmental development of the longterm, regional landscape history of the ARLN Böl research transects, situated in Central and North-West Bohemia. The aim of this contribution is to discuss the methodological background to such work, as well as to present some preliminary details of the initial data collected.

2. METHODOLOGY

Both archeozoological and archeobotanical analyses are strongly connected with archaeological research, being principally concerned, in our case, with the analysis of existing collections of material collected from old excavations within the transect area and its immediate vicinity. An attempt has also been made to visit new archeological excavations taking place within the transect areas in order to take bulk samples of the deposits for archeobotanical material, bones, molluscs, etc.

2.1. Archeozoology

A major problem has been actually finding sufficient quantities of material to analyse from within the project area. Many assemblages are simply too small to say anything of great interest (e.g. especially in the acidic chernozem soil areas), or the archaeological post-exca

vation process has not reached a suitable level whereby the animal bones may be analysed, i.e. all dating and stratigraphic information being prepared. The strategy that has been followed to date has been based on the selection of the most recently excavated, best dated material. An important factor that has to be also considered is the nature of the archeological deposits sampled. An attempt has been made wherever possible to compare similar types of deposits, i.e. "settlement debris", from different sites. The comparison of different sites, of course, is still problematic unless the original analyst included some mention of the taphonomic problems of the assemblage within his/her original report, which is seldom the case. The general differences recorded between sites may of course reflect several factors: differences in the role of animals in the economy, the nature of site occupation (duration, intensity, etc.), but equally may simply reflect the impact of different disposal patterns between different periods. In comparing different data sets there still, of course, also remains the possibility that the variability in taphonomic richness is simply a result of the differences in sample sizes between different assemblages. Understanding the kinds of variability in faunal and botanical assemblages and comparing these types of data over large areas is of course somewhat problematic. The aim of the current work is to utilise a diachronic perspective permitting the evaluation of major patterns which may then be related to social/economic/environmental models derived from other archeological/environmental data gathered within the transects, e.g. field walking data, existing archeological excavations, off-site environmental data, etc. The advantage of undertaking archeozoological and archeobotanical analyses within a particular geographical location is the fact that there is a distinct cultural sequen

ce and spatial reference points against which to compare it. The starting point for this work has been the collection of data by under-
taking a survey of the existing literature. One of the immediate problems encountered is the comparability of identifications which have been carried out by a variety of specialists. Fortunately in the case of the Czech Republic there is a reasonable uniformity in data collection as most analyses were carried out by the same specialist, or by a restricted number of specialists, all sharing a similar tradition in their practice. In terms of comparing data between different sites, the only consistently recorded feature for all assemblages within the research area is the number of identifiable fragments of each species (NISP). This quantification technique naturally has some associated problems, which have been much discussed elsewhere in the literature, but in the absence of other information it is the only principal means available of comparing sites. The method being utilised to compare these data is that of the analysis of taxonomic diversity, examining the patterns of species dominance. How do samples from different time periods differ? Can these differences be related to an intensification of animal use? Is there any indication of the selective manipulation of a narrow portion of the faunal spectrum which might suggest economic specialisation? It is planned that the collection of this data will contribute to the integration of all the ALRN8 environmental data in the GIS system currently being developed for the research project in the Institute of Archaeology, Prague.

2.2. Archaeobotany

The present author has developed an effective system for the environmental processing of samples, primarily in order to recover archaeobotanical remains. The retrieval system established is an adaptation of the continuous washover system (Radim — Jones, 1985). This system is operated as follows: the volume of the soil sample is first recorded in litres, the sample is then washed in water and stirred by hand in a large plastic dustbin. The contents are then repeatedly poured over a 500 micron sieve, until only sand and gravel remain in the dustbin. The residues from the dustbin are then sieved, again using a 500 micron sieve, for continuity in recovery. Both floats and residues are then allowed to dry. Residues are then sorted in the laboratory with the aid of low power magnification, all flots being sorted by microscope. All archaeobotanical material recovered to date has been analy-

sed by Dr. Eva Hajnalová of the Institute of Archaeology, Nitra, Slovak Academy of Sciences (Hajnalová — Mihályová, 1992 a+b). Similarly to the archaeozoological data the general method being utilised to compare these various archaeobotanical data is that of the analysis of taxonomic diversity. It is hoped that the examination of the patterns of species dominance between different time periods can be related to periods of intensification in plant use, indicated by the selective manipulation of a narrow portion of the botanical spectrum, perhaps suggesting economic specialisation.

3. RESULTS

3.1. Archaeozoological results

During the past year I have carried out the analysis of several faunal assemblages within both Northern and Central transects (Bech, 1992a,b; forthcoming) (see tables 1 and 3). It is not within the scope of this present paper to discuss all the details of this data, instead I would like to summarise the most significant points to emerge. None of the samples, with the possible exception of the La Tène material from Jenštejn and the Eneolithic and late-Hallstatt/early La Tène from Jenštejn, was of sufficient sample size to put forward any concrete interpretations. Wild species generally formed only a small percentage in comparison to domestic species, although the lack of wild species in some samples may be partly a reflection of sample size. The only exception to this was the Eneolithic material from Jenštejn, where wild species formed 37.2% of the total, largely represented by wild boar bones. Of particular interest also within this material was the presence of Emyrs orbicularis or the European pond terrapin. The distribution of this species at the present day is largely confined to the Mediterranean and south-east Europe (Arnold — Burton 1978), however its northern limit of breeding does extend into Northern Germany and Poland, its northern breeding range being apparently limited by the 18 degrees C July isotherm (Stuart 1979). This species has traditionally been used as one of the typical 'indicator species' to infer climatic change, its spatial occurrence during earlier periods north of its present day range, in e.g. Britain and southern Sweden, inferring the presence of a warmer, milder climate. It is worth noting that its

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Table 1. List of archaeozoological localities studied.

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Table 2. List of archaeobotanical localities studied.
modern distribution in the Czech and Slovak Republics is largely concentrated in the climatically mildest southern Moravia and southeast Slovakia (Lubosl PeRe, pers. comm.). One should be somewhat cautious, however, in interpreting its occurrence here as introductions of this species beyond its normal range are fairly normal.

With regard to the larger samples of bones from the La Tène period at Jenštejn and the late-Hallstatt/early La Tène material from Jenštejn, the following points were of interest: (a) there appeared to be a change in the faunal spectrum at Jenštejn between the La Tène A to La Tène B–D periods. The La Tène A period appeared to be dominated by cattle and sheep/goat, followed by pig, whereas La Tène B–D had slightly more pig and broadly similar amounts of cattle and sheep/goat. This perhaps may indicate some change in economic emphasis within the settlement during the later La Tène period. It is worth noting that a similar trend has also recently been observed by the author for the site of Mlécké Žehrovice, with increased pig keeping occurring during the later La Tène period. (b) several examples of severe pathological specimens were identified at Jenštejn and Jenštejní. These ranged from quite serious fractures to typical traces of osteoarthritic associated diseases. These were of some interest as they suggest that the inhabitants of both settlements have taken considerable care of their animals, permitting their recovery from quite dramatic traumas. All the specimens concerned also bore traces of butchery marks, indicating that they had been subsequently consumed even though the animals concerned would have been somewhat disfigured or old. (c) several horse and dog bones at Jenštejn and Jenštejní have traces of butchery marks, indicating that they also perhaps contributed an occasional role within the daily diet of the inhabitants. These last two points indicate an interesting insight into man-animal relations at this time. Animals at both these settlements undoubtedly were valuable resources which were not to be wasted, even if by modern standards we might not consider them immediately edible! (d) a detailed investigation of the spatial distribution of the Jenštejn animal bones revealed the possibility of different activity zones within the settlement area. There appeared to be a contrast between the ratios of the main species within the huts and building features. Huts, have a relatively high percentage of sheep/goat followed by pig, then cattle, whereas, buildings, have a high percentage of cattle, followed by sheep/goat and pig (see Fig 1). This difference is confirmed by an examination of the type of fragments in the unidentified bone fragment category, where there are nearly twice as many sheep/goat-sized unidentifiable fragments as cattle-sized fragments in the huts, but a similar amount of cattle and sheep/goat-sized fragments in the buildings. One possible explanation for this pattern might be that the deposition of more sheep/goat-sized fragments in the huts represents waste originating from domestic, cooking activities rather than primary butchery and slaughter waste, i.e. the larger amounts of cattle-sized bone fragments.

3.2. Archaeobotanical results

As mentioned above, a reliable procedure has been successfully established for the retrieval of archaeobotanical remains from archaeological investigations currently underway in the two areas. This was important for two reasons: firstly, to prove to archaeologists that it really was possible to obtain archaeobotanical and indeed other environmental information using relatively simple and inexpensive equipment, and secondly, to try to balance our knowledge of sampled localities (previously, most samples were only taken by archaeologists...

Spatial Distribution of Jenstejn bones
Major species and fragment categories

![Spatial Distribution of Jenstejn bones](image)

- Cow
- Pig
- Sh/Gt
- Lar
- Med
- Sma

% identified fragments

- Huts
- 'Buildings'
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**Table 3. Archaeozoological data from studied localities.**

**KEY TO TABLE:**

All figures in tables indicate counts of numbers of basic fragments identifiable to species (NISP).

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<td>3 = Pig (Sus scrofa f.domestica)</td>
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</tr>
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<td>4 = Sheep/Goat (Ovis/Capra)</td>
<td>BB = Bell Beaker</td>
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<td>5 = Dog (Canis lupus f.familiaris)</td>
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<td>8 = Wild boar (Sus scrofa)</td>
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<tr>
<td>9 = Brown bear (Ursus arctos)</td>
<td>LTA = La Tène A</td>
</tr>
<tr>
<td>10 = Hare (Lepus europaeus)</td>
<td>LTB-D = La Tène B-D</td>
</tr>
<tr>
<td>11 = Beaver (Castor fiber)</td>
<td>RIA = Roman Iron Age</td>
</tr>
<tr>
<td>12 = European pond terrapin (Emys orbicularis)</td>
<td>EMD = Early Medieval</td>
</tr>
</tbody>
</table>

where there was visibly botanical remains present, e.g. hearth areas, our samples being therefore biased towards particular assemblages often which were dominated by one particular species. To date three archaeobotanical samples have been analysed by Hajnalová and Mehegyvölgyi (1992 a+b). These samples came from two localities: Ždálic and Rostoky. The site of Ždálic, Prague S, lies at the north-east edge of the Prague basin on the loess plain. An excavation carried out in 1988 by Jan Turek for the Prague City Museum, identified an early Eneolithic (Funnel Beaker period) sunken house with storage pit, cut by the trench of a pipeline. Two samples were taken from the base of this storage pit. Both samples taken contained mostly: Triticum dicoccon, with lesser amounts of Triticum monococcum, Triticum c.f. aestivum, Triticum c.f. spelta, Bromus arvensis, Bromus sterilis, Galium aparine, Fallopia convulvulosa, Poaceae and ?Asperula arven
dia. If one compares this data with that of the recent summary carried out by Hajnalová (1991) of the Czech and Slovak archaeobotanical data, then one observes that the presence of Triticum dicoccon in considerable quantities within the Eneolithic samples at Ždálic would seem to be fairly typical. Hajnalová reported 14 out of a total of 18 (55%) Eneolithic botanical assemblages in Bohemia and Moravia containing Triticum dicoccon. The site of Rostoky, Prague-West, is situated adjacent to the Vltava river on the northern edge of Prague, on a loess soil step above the river. Excavations carried out by Martin Kuna between 1980-83 revealed the presence of a multi-period settlement, which included an early Roman period (cca 1st century AD) vaulted oven, made of burnt clay (feature 568/A). The sample was taken from grey-black layers, containing lots of charcoal and seeds, on the floor inside the oven. The sample consisted almost entirely of Hordeum distichon var. nudum, but also included the presence of Triticum aestivum, Lens esculentum, Avena sp., Chenopodi
dium album, Chenopodium hybridum, Asperula arvensis, Galium aparine, Fallopia convulvulosa, Poaceae and ?Asperula arven
dia. If one compares this data with that of the recent summary carried out by Hajnalová (1991) of the Czech and Slovak archaeobotanical data, then one observes that the presence of Triticum dicoccon in considerable quantities within the Eneolithic samples at Ždálic would seem to be fairly typical. Hajnalová reported 14 out of a total of 18 (55%) Eneolithic botanical assemblages in Bohemia and Moravia containing Triticum dicoccon. The site of Rostoky, Prague-West, is situated adjacent to the Vltava river on the northern edge of Prague,
CONCLUSION

My work has only just begun, but already the analysis of archaeozoological and archaeobotanical material is beginning to provide a valuable insight into the nature of man-animal/man-plant relations throughout different periods within the landscape history of North-west and Central Bohemia. The work of collection of both archaeozoological and archaeobotanical data from both North-western and Central Bohemia is currently under way, and it is planned that this data will be synthesised in a forthcoming paper, and will be also utilised as a contribution in the development of the ALRNB G.I.S. system.

SOUHRN

Autor podává zprávu o metodě a předběhlých výsledcích archeozoologických a archeobotanických analýz, které pomáhají modelovat paleoekonomický a paleoekologický vývoj krajin v rámci projektu ALRNB. Dopostrud byl analýzován archeozoologický materiál z polykulturní lokality v Jenštejně Újezdě (neolit–československé středověká, Radovesic (kultura zvoncovitých pohářů) a Jenštejna (časová eneolit, starší doba železná (HaD–1. TA). Kosti divokých zvířat jsou všeobecně zastoupeny pouze malým procentem. Výjimečný je eneolitický soubor z Jenštejna, kde divoké druhy tvořily 37,2 % z celko-

<table>
<thead>
<tr>
<th>NAME OF LOCALITY</th>
<th>Štíbelce</th>
<th>Roztoky</th>
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</thead>
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<tr>
<td>DATE / CULTURAL PERIOD</td>
<td>Early Eneolithic</td>
<td>c. 1st cent AD</td>
</tr>
<tr>
<td></td>
<td>Funnel Beaker</td>
<td>Early Roman</td>
</tr>
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Cereals:

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<tr>
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<td>328</td>
<td>–</td>
</tr>
<tr>
<td>grains</td>
<td>336</td>
<td>792</td>
<td>–</td>
</tr>
<tr>
<td>rachis internodes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triticum dicoccon</td>
<td>4074</td>
<td>2976</td>
<td>–</td>
</tr>
<tr>
<td>grains</td>
<td>7322</td>
<td>4432</td>
<td>–</td>
</tr>
<tr>
<td>fragments</td>
<td>714</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>Triticum aestivum</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Triticum c.f. aestivum</td>
<td>31</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Triticum spelta</td>
<td>46</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>glume bases</td>
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<td>96</td>
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<td>–</td>
<td>–</td>
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<tr>
<td>grains</td>
<td>2935</td>
<td>3032</td>
<td>–</td>
</tr>
<tr>
<td>rachis internodes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hordeum distichon</td>
<td>–</td>
<td>–</td>
<td>65</td>
</tr>
<tr>
<td>var. nudum</td>
<td>–</td>
<td>–</td>
<td>231</td>
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<td>c.f. Hordeum distichon</td>
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<td>–</td>
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<tr>
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<tr>
<td>Avena sp.</td>
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Pulses:

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<tr>
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Wild:

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<td>Chenopodium hybridum</td>
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<td>–</td>
<td>2</td>
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<tr>
<td>Chenopodium album</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Galium aparine</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Galium/Asperula sp.</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Asperula arvensis</td>
<td>–</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>c.f. Asperula arvensis</td>
<td>–</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Bromus arvensis</td>
<td>4</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Bromus sterilis</td>
<td>1</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Bromus sp.</td>
<td>36</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Fallotia convolvulus</td>
<td>1</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Poaceae</td>
<td>–</td>
<td>2</td>
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</tr>
</tbody>
</table>

Table 4. Archaeobotanical data from studied localities.
The Changing Landscape of North-west Bohemia During the Last Two Centuries

Změny Krajiny Severozápadních Čech za Poslední Dvě Století

Jaromír Beneš - Vladimír Brůna - Roman Krivánek

For understanding the broad development of the historical landscape it is necessary to take into account the situation during the two last centuries. During this analysis we have concentrated on three questions: which are the dynamic changes in the landscape, which elements of the landscape mosaic are dynamic and which are static and why, and finally, which changes are typical for particular ecozones. The three sources of information which have been analyzed are: the military mapping of Joseph II in the second half of the 1780’s, aerial photographs from the 1930’s, recent photographs and maps. The results are incorporated within a numeric matrix. The most important change when making comparisons with the end of the 18th century is the dramatic decrease in water and wetland areas. There was only a small increase in the settlement network and the forested area largely remained stable. The area around the town of Most was irreversibly changed on account of the open cast mining taking place there.

Before commencing the analytical and interpretational phases of the ALRB, it is necessary to understand the broad development of the historical landscape. Our questions have concentrated on which were the earliest changes in the landscape for the previous two centuries. Particular study was carried out over the direct observation of changes in scale between 1:25,000 – 1:40,000. The direct observation included the analysis of Joseph II maps from the 1780’s, aerial photographs from the 1930’s, current military topographical maps at the scale 1:25,000 (Fig. 1): Most – M-33-52-A-d Libčev – M-33-52-D-a Libochovice – M-33-53-C-c

References


A. Black and white copies of the first military mapping of Joseph II in the second half of the 1780’s (scale c. 1:29 000).
B. Black and white aerial photographs from the 1930’s scaled at c. 1:33,500, which were taken for the purpose of updating predating maps.
C. Military topographical maps scaled at 1:25,000, and recent black and white aerial photographs scaled between c. 1:28,000 - 1:34,500. These sources were verified by our own field observations.

Information obtained from these different sources although of a similar nature is not entirely the same. The details of each source can be manipulated by historical perspectives, it was therefore necessary to choose those elements of the landscape mosaic that transgressed the three time slices.

Those elements of the artificial and natural landscape mosaic that were chosen consist of:

a) settlements (towns, villages, farmsteads, mills, castles, churches, railway embankments and industrial areas).
b) forest (non-determined structure, plantation, secondary forested areas and parks).
c) marginal woodland (riverside, roadside and marginal areas).
d) orchards and gardens (not including cultivated areas such as vineyards and hop fields).
e) areas of water and wetlands (rivers, flood plains, ponds, reservoirs and water catchment areas).
f) quarries (open cast mines, spoil heaps, recultivated areas, sand and clay quarries).

Description of chosen areas

1. Most

This section (Fig. 3 - 5 are examples from this section) consists largely of the lowland ecotope Pánev Bílina, and the higher slopes of the southern ecotope České Středohoří on neovolcanic hills. The area north of the Bílá river was shaped by irreversible changes within the environment. From basic observations of the Josephian maps and more recent material, 40% of the landscape has been determined as being irreversibly destroyed through the extraction of brown coal by open cast mining.

The destruction of the landscape can be considered through qualitative and quantitative values. In terms of quantity, the changes to settlements, forest and wetlands between the end of the 18th century and recent times have not been extensive, but qualitatively the changes have been large. The majority of small settlements in the Bílá basin concentrated along the rivers and tributaries were all completely destroyed in the period following the second world war, especially during the decades of the 1960’s and 70’s. In contrast we have direct evidence of a dramatic growth and concentration of a new settlement structure (the new town of Most). Systems of former ponds have been substituted by artificial reservoirs and other industrial water systems in close proximity to industrial plants, where natural water courses have been redirected into artificial channels. The existence of vegetation alongside watercourses, although not shown on the Josephian maps, is assumed to have existed in the period before the 18th century. At the beginning of the 20th century, areas of recultivation were planted with “unnatural” vegetation.

Fig. 1. The general situation and distribution of the three studied sections at a scale of 1:300,000. (1=Map section A: M-33-52-A-a, B: M-33-52-D-a, C: M-33-53-C-c, 2=Chosen examples of map sections, 3=The situation of villages or towns giving its’ name to the section a: Most, b: Liběřice c: Libochovice, 4=District boundaries MO: Most, TP: Teplice, LN: Loučy, LT: Litoměřice, KL: Kladno).
landscape element /loc.map. 1930 1990 (Fig. 6
settlements 1.95 6.08 8.42
forests 0.98 3.30 5.07 /3 artificial/
woodland 1.43 2.80 0.49 /1/2 artificial/
orchards, gardens 1.65 2.20 0.77
water and wet areas 7.35 4.85 7.49 /3/4 artificial/
quarries 0.00 4.93 37.39 //

2. Liběřec

This section (Fig. 4: A-C are examples from this section) consists largely of the forested region České středohoří (ecozones České středohoří and Hradčany) determined by the neovolcanic hills, which on the north, south and west comprise sandy clay and chalk sediments. The southern part of the section has moderate open slopes on chalk bedrock (ecozone Újezd). This area in comparison with that of Most retains a settlement density similar to that at the end of the 18th century. Only a small degree of forested areas are evident, as relatively large areas of slopes were cleared for orchard cultivation. A clear decrease of 50% in water bodies and wetland areas can be noted from the end of the 18th century. The regulation of water courses and "cultivation" (ploughing wet areas during the communist regime in the 1950's) and the growth of marginal woodland along roadsides has been observed.

ecozone is defined by forested steep slopes continuing within a moderately undulating limestone and sandstone landscape without forest cover.

The most important change when making comparisons with the end of the 18th century is the dramatic decrease in water and wetland areas, a 75% reduction being clearly seen especially in the ecoszones Újezd and Niva Obře. This reduction is a direct resultant of the expansion of field size on the alluvial flood plains. It is interesting to note the positive correlation in growth between settlements and orchards as well as the evidence for the stability of woodland and marginal wooded areas.

landscape element /loc.map. 1930 1990
settlements 1.74 4.45 /3x increase/
forests 7.96 6.66 /stability/
woodlands 0.71 1.00 /stability/
orchards, gardens 0.30 1.45 /5x increase/
water and wet areas 8.12 2.33 /4x decrease/
quarries 0.00 0.07

Interpretation

Comparing the chosen examples of close geographical landscape units we know that the development of the environment during the last two centuries has varied to a great extent. Two factors largely respon

![Pie chart showing the time scale perspective.](Image)

Fig. 2. Pie chart showing the time scale perspective.

landscape element /loc.map. 1930 1990 (Fig. 7
settlements 2.21 2.33 2.96 /stability/
forests 9.99 9.23 8.75 /stability/
woodlands 0.81 3.37 2.09 /roadside trees/
orchards 0.36 2.25 3.72 /10x increase/
water and wet areas 5.95 3.51 2.78 /2x decrease/
quarries 0.00 0.15 0.30

3. Libochovice

This section consists of three landscape types (Fig. 5: A-B are examples from this section.) The area north of the Obře river (ecozone Újezd) is a moderately sloping lowland with a deficit of higher vegetation. The ecoszone Niva Obře to the south of the section, is an intensively populated flood plain. The southern boundary of this

sible for variations noted in the landscape are relief and the behaviour of humans. The Blína basin is a sad example of the capacity of human destructivity. The destruction of natural water areas, streams and settlement structures are only a limited number of examples upon which the actions of humans impact. It is possible to see that many changes inflected upon the landscape are irreversible.

The České středohoří region within the Liběřec section can be observed as an example of landscape stability, with only a local degree of modification to water and wetlands. This is possibly due to the relatively small increase in population. Compared to the 18th century increase in settlement size has increased three times, this increase has been supported by the gradual improvement of agricultural techniques. This resulted with the dramatic decrease of water and wet areas. We also have evidence of a rapid decrease in marginal riveride woodland and field headlands with increasing field sizes, but it appears that woodland was substituted alongside roadways.
Fig. 3. 3. Detail of map section A. Land use pattern at the end of the 18th century. Area between Libkovec and Braňany. 4. Detail of map section A. Land use pattern at the end of the 1930s. Area between Libkovec and Braňany. 5. Detail of map section A. Land use pattern at present. Area between Libkovec and Braňany. Legend: 1 – settlements, 2 – forests, 3 – woodlands, 4 – orchards and gardens, 5 – water and wet areas, 6 – quarries and destroyed areas connected with open cast mining.
Fig. 4.6. Detail of map section B. Land use pattern at the end of the 18th century. Area around Libčeves. 7. Detail of map section B. Land use pattern at the end of the 1930's. Area around Libčeves. 8. Detail of map section B. Land use pattern at present. Area around Libčeves. Legend: 1 - settlements, 2 - forests, 3 - woodlands, 4 - orchards and gardens, 5 - water and wet areas, 6 - quarries and destroyed areas connected with open cast mining.
Returning to the original question: The most dynamic element of the landscape mosaic (excluding specific destructive change connected with open cast mining activities) are the areas of water and wetland. The characteristic of modern day settlement patterns is fully understood, as in the case of Most, the previous settlement having been destroyed by mining activities. The changes to the landscape within the area of Most are particular and unique and it is therefore impossible to draw upon analogies from other situations in relation to the reconstruction of such devastated archaeological landscapes. The other sections of Liblice and Libochovice do however present useful aspects of information and it is therefore necessary to unlock the doors into these landscapes so that we may pass through and enter the corridors of prehistory from which ancient landscapes may be reconstructed. The area of extended human settlements in Libochovice section has undergone large changes in contrast to the area of České středohoří which has remained stable. If the evidence for settlement site change is objective or not, it is possible to determine site extension as an element of local variability.

The potentially static element of the landscape mosaic is that of forest, which since the Josephian period has changed very little in relation to quantity in the landscape, yet has substantially shifted in relation to those areas originally covered. Is this an homeostatic static developed in the agricultural landscape?

Water and wetlands can be seen as being very dynamic elements of the landscape mosaic. These dynamic elements can be used as good examples of what we are not able to read within the vast scale of prehistoric time. At present particular aspects of the ALRB project have only been possible to study over very small portions of time, therefore the consideration of variable dynamic landscape elements have been paramount to the success of this study.

**SOUHRN**

Krajinně archeologické studium se musí vyrovnat s otázkou, jak velké a jakého typu byly změny v krajině v jejích posledních předpolo- myslových fázích a v industriální epohe. Jen tak si lze teprve učinit alespoň dobu představu o "normální" krajině předindustriální doby. Časový rozestav dvou posledních stáří je dáno zejména možností využití "přímoň" pozorování změn v měřítku štědrosti 1: 25 000 až 1: 40 000, což je již nabízi 1 výslově 1. vojenské mapování, tzv. josefínské (vyhotovené za cíle Josefa II. v osmdesátých letech 18. století). K poznání prvého prvé-publikové krajinně třicátých let bylo využito panchromatických leteckých měříček snímků (tedy nejstaršího souvislého snímkování našeho území). Současný stav země byl sledován na vojenských topografických mapách, kontrolován studiem panchromatických LMŠ a přízkumném současného terénu.

Předložená práce si položila otázku, k jakým konkrétním změ- nám v krajině mozaice severozápadních Čech v daném období došlo. To se za cenu jisté schematizace podařilo zodpovědět. Byla zvolena metoda vzájemného porovnávání tři plochy rovnoměrných území, vzájemné se lišících jak krajinými typy tak i příčinami a důsledky jejich současných změn.

K hodnocení byla vybrána sídla, zahrnující města, vsi, samoty, mlýny, zámky, kostely, plochy železničních náspů a průmyslové areály, dale lesy bez rozlišení povahy, doprovodná zednice, což jsou nezivyné, převážně krovinaté porosty podél vodních toků, vodních ploch a cest, sady a zahrady, ale také vodní a podmáčené plochy, zahrnující vodní toky, jejich podmáčené okolí, rybníky, nádrže, nivy, prameně páne, mokřiny, a zápalovaná území. Poslední klasifikovanou účelem pak byly doly a lomy, včetně hald, nepřirozených ploch rekultivací. Do kategorie lomy jsme končně počítali i cíhelné a pískovny.

Nejvýraznější změny probíhala oblast severně od toku Bíliny. Z protého porovnání stavu na mapách josifinského mapování a zeměpisného stavu vyplývá, že v rámci zvolené plochy je téměř 40% nevratně zničeno povrchovými uhelnými dolami. Procentuálně méně výrazné změny sídli, lesů, vodních a podmáčených ploch mezi koncem 13. stol. a současností je do kvantitativní kvalitativně obtížné. Většina drobných sídel v přesně oblasti zanikla zcela, rovněž i jejich původní struktura podél vodních toků, naopak prudce vzrostla koncentrace osídlení (nový Most). Systémy dřívějších rybníků jsou dnes suplovány umělými nádržemi a odkaliště v předpolí velkoobchod a chemických závodů, přirozené vodní toky byly svedeny a usměrňeny umělými kanály. Již za josifinského mapování řídil vegetace kolem potoků významu, založen byl druh nepřirozené vegetace nové v podobě zalesněných výšinek.

Z porovnání s doma přesně zmiňovanými oblastmi severozápadních Čech, které byly v něm projektu doma vyhodnoceny, je patrné, že

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**Fig. 6. Diagram showing the relative percentage change of landscape types throughout the three time series. Map section A. Series 1 = the end of the 18th century, series 2 = the end of the 1930's, series 3 = at present.**

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**Fig. 7. Diagram showing the relative percentage change of landscape types throughout the three time series. Map section B. Series 1 = the end of the 18th century, series 2 = the end of the 1930's, series 3 = at present.**
vývoj přírodního prostředí za posledních 200 let i v tak poměrně blízkých regionech může být velmi odlišný. Pánev oblast severně od toku Blíny na mapovém listu Most je výjimečným příkladem kam až je schopna destruktivní aktivity člověka dojít. Zákaz plochých vodních ploch, toků a sídelních struktur, to jsou ještě z mnoha takvých příkladů negativního jednání mnoha i současných gene-
raci. Dnes již lze, bohužel, jednoznačně říci, že zásahy do přírodního prostředí v této oblasti i jejími bezprostředními okolí jsou nevratné, irreversible.

Jako příklad dospěl poměrně harmonické oblasti, kterou lze s krajinnou nižinnou Mostecka srovnávat, je blízké České středohoří. Ta se dnes jevi napak z hlediska sledovaných prvků krajiny jako nejvýznamnější, pouze se lokálním útrylem vod a mokřin, zcela již také zásadní pevnost zemědělských osidlení. Ale i zde lze sledovat některé

negativní jevy. Vede o číšnění rozšíření vodních a podmáčených ploch to je také úbytek doprovodně zeleně kolem vodních toků a polních cest na úkor polí. Za pozitivní jevy pak lze považovat nárůst doprovodné zeleně kolem rozšiřující se stálých silnic.

Přestože jsou naše pozorování zásadně důležité charakter, zda se, že již dnes lze nastavit již obecnější principy chování jednotlivých prvků krajinného mozaiky, zejména z hlediska jejich dynamiky nebo konzervativnosti. Bez náplav závěrů, že dynamika moderní sídelní struktury je značně závislá na určitém typu krajin. Na druhou stranu lze za prvek vyložit konzervativní označit lesní porost, jehož přirozený rozrůst se od profesionálních dob změnil pouze nepatrně, i když se konkrétně utváření lesních ploch v průběhu dvou století značně změnilo.

Comments - Komentáře

Preliminary Comments
ON THE ALRNB PROJECT

Jan Klápště

In the discussions which took place within the Prague Institute of Archaeology during the winter of 1989/90 many ideas concerning the priorities for Bohemian archaeology as well as future conceptions for the Institute were pronounced. Apart from the concurrence of ideas a set of contradictory opinions and arguments also emerged. Unfortunately, there was not sufficient time to analyse these approaches at that particular time. It was inevitable that eventually it would be necessary for us to directly confront some of the issues. Three years are a common term for scientific projects and after such a period we should be closer to exchanging opinions based more upon a factual level. The persuasiveness of general proclamations disappears and it is only real results which can persuade people about the value of particular approaches. As for an evaluation of project aims, which are being solved in cooperation with Sheffield University, information is only available concerning the general focus of the project. This is because the project is only in its half way stage. We therefore have no possibility of submitting a more detailed critique of all aspects of the project. The number of concrete results and their analysis is perhaps less than one might have expected. In spite of this statement, it is reasonable to submit partial and preliminary ideas concerning some questions.

For some time it has been clear that one of the principal faults within Bohemian archaeology is its inability to search for settlement processes within wide spatial and time scales. Since the 1970’s studies on landscape transacts of some few tens of square kilometres have started to be published. These were usually focused on a specific period of prehistory or the Middle Ages. The investigation of these so-called microregions was undoubtedly a progressive contribution to this country’s archaeology and it was a pity that it was not pursued in a more systematic manner. In addition to the search for the potential of microregions to provide detailed historical evidence, an understanding was also developed of their limitations. The detailed conception of the discussed approach was simply disproportionate to the efforts to solve questions dealing with the settlement pattern within the scale of the whole of Bohemia. It is just this point which offers one of the principal opportunities, as well as obligations, to current Bohemian archaeology. It is exactly this concern which has brought to life the idea of a system of sample regions, of an order of hundreds of square

kilometres, which should in the course of time cover the whole of Bohemia in the form of representative landscape transacts. The only available possibility was to create suitable conditions for the initiation of such a project. Considering the endless and vague discussions which previously took place, we must evaluate this new beginning.

Questions and methodology

The authors of the project start with a set of nine questions. They have established two transacts (each being five hundred square kilometres in size) and predominantly use archaeological evidence obtained by means of field walking. Questions have been formulated in a general way and as such they are certainly acceptable. The selection of transacts was carefully made, most probably with respect to the expected quality of results (they include the so-called old settlement territory of Bohemia, situated between the towns of Most and Kolín). The wide chronological span is necessary, as the subject of the study are long-term historical tendencies. Field walking is, within the given concept, the only method applicable for the whole scale.

Allow me to begin with a question: What can the field activities carried out within the project actually provide? In our country, as in others, field walking (plough walking, surface survey) has become a common method of survey. Its advantages and limitations are well known. I believe that a general discussion on the value of the application of this method has already taken place and is therefore redundant. Relating to this matter we may trace a shadow of the way of thinking of the 1960’s when “regularities”, “laws” and “rules” were being stressed. The authors provide a number of good reasons for the benefits of field walking, however equally we could offer a list of its disadvantages and examples of its failure. The core of the problem can be expressed by means of a question: what possibilities and limitations apply to the selected methods within our particular conditions. In other words, what method can/cannot provide the solution to explicit questions here and now? I am afraid that in the case of the ALRNB project we have to continue to wait for such an analysis.

The authors do not intend to examine the whole territory of both selected transacts. They prefer to evaluate a definite sample. At the same time they mention the theoretical assumption that the landscape has been settled and used coherently throughout its whole area. In the case when this assumption is true then a considerable amount of possibilities to use the collected data emerges. However, such a consideration can only be proved once we have quantified the single components of prehistoric and medieval activity. This is not valid in the case of short chronological terms. Another level of analysis is the
study of landscape as a whole, either by means of an overall view or of a defined sample. The utilisation of prehistoric and medieval landscape was not only incoherent, but was of an irregular structure, being conditioned by both natural and cultural factors. The ALRNB project thus attempts to provide a balanced view of an uneven reality.

Consequently, the project offers the possibility to evaluate and compare relatively large landscape units. Thus, it is expected that the chosen sampling strategy will enable us to obtain a picture of settlement density within selected tracts and their parts and of the basic changes taking place to the settlement pattern. How, and at which scale, this will be identified remains an open question. If we concentrate on the published figures, for example, the distribution of evidence around the Hallstatt-period hillfort of Břeží (Prague-East district) one may ask the following question: how can this method of sampling contribute to our understanding of the real structure of that site’s hinterland? In relation to micromegalstones studies the problem has been altered. The ALRNB project will probably be involved with the understanding of the whole, but at the same time it is important to take into account the possibility of an equally shared and holistic approach to detail. This certainly will be carefully monitored as the conception of the project includes the study of microregions. Their study will undoubtedly help decipher the relationship between the results achieved by means of sampling with that of the real settlement structure.

One of the important components of the selected strategy is the establishment of ecozones. Consequently, these will be compared with the distribution of archaeological information. The method of determination of these ecozones is problematic. I have doubts, for instance, about whether the boundaries of the Krems-berg (Ore Mountains) submountainous plateau, or of the region around the town of Kostelec nad Černými Lesy, were correctly established. The different interpretative approaches utilised, and particularly their inherent logic, may be disputed. A major problem may be the suitability of using an analytical concept based upon the comparison of distribution of archaeological information within single aspects of natural components (conditions). I think that for archaeological purposes the proposed ecozones are a form of premature synthesis and may simply be illusory simplification.

The study of ecofacts within the project is an activity whose results are eagerly awaited. In our country, the value of particularly polynatography has been deeply underestimated. The majority of previous work has concentrated on the analysis of samples, not linked to questions concerning settlement history or archaeology. These samples were mostly connected with sediments situated in upland areas and for this reason they are mostly unsuitable for our aims. With respect to the destruction of the Bohemian landscape (caused by the collectivisation of agriculture since the second World War) there are no other available means other than to search for ways of utilising "non-traditional" sediments. The report on fifteen samples taken from alluvium deposits is accompanied by questions on the post-deposition influences affecting them, and also by the problem of their absolute chronology. This will be more accurately answered once radiocarbon dates are available, but the distortion caused by the depositional evolution of the environment of streams and rivers will very obviously be a more difficult task to solve.

The ALRNB project represents an important research programme. As such it is so considered should enhance the image of the Institute of Archaeology of the Czech Academy of Sciences, representing an important contribution within Bohemian archaeology. It is only this institution which, at the present time, can and consequently should be involved in the study of Bohemia as a whole. These summaries of the concepts, methods and hitherto achieved results of the ALRNB project are to be welcomed. They are accompanied, however, by queries which await more comprehensive form of publication and further discussion.

### SOME FIELD WALKING THEORY

**Evžen Neustupný**

Few archaeological field projects carried out in Bohemia have been theoretically prepared to the degree exemplified in the preceding papers by archaeological practitioners participating in the two intertwined projects currently realised in NW and Central Bohemia. What follows was meant as a few remarks on the validity of the method of field walking and it should not be interpreted as a disagreement with Kuna, Zvelebil and their colleagues.

Archaeologists approach their record in a number of ways. Some of them are destructive (such as traditional excavations), some are non-destructive. The latter category comprises geophysical and geochemical survey, aerial photography, and field walking to enumerate those currently used. There has always been a tendency in archaeology to select a particular field method proclaiming it to be the best, or at least to assume its supremacy tacitly. In the past this applied to traditional excavations, then (at least in some countries) to aerial photography. It is field walking which is now becoming "one of the very best archaeological methods". In my view this entails some danger.

Let me state at the beginning of this paper that I do not question the value of field walking as a scientific tool indispensable to contemporary archaeology. There is no alternative way how sufficient material could be assembled for the tasks chosen by the project, as the results of excavations, rescue or other, would hardly yield a representative sample. In consequence of this Zvelebil, Kuna and their colleagues have to rely on field walking as their principal field method. At the same time I would like to stress that field walking is just one of the research methods which archaeologists have at their disposal, and that it can be proved to distort the picture of the past similarly as, or even more than, any one of the remaining methods taken separately. (This is not to say, however, that using all the available field methods at the same time can by itself bring us nearer to the past.)

I am going to approach the validity of field walking by comparing its results as achieved in the district of Chrudim (East Bohemia) with the results of traditional excavations and other kinds of field activities in the same region.

<table>
<thead>
<tr>
<th>Area</th>
<th>Field find units</th>
<th>Field walked sites</th>
<th>Excavation find site units</th>
<th>'Other' find units</th>
<th>Σ find units</th>
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</thead>
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<td>11.28</td>
<td>11.76</td>
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<td>9.77</td>
<td>7.35</td>
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<td>0.43</td>
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<td>2.95</td>
<td>0.64</td>
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<td>9.02</td>
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</tr>
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<td>8.27</td>
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</tr>
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</tr>
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</tr>
<tr>
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<td>12.54</td>
</tr>
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<td>Roman period</td>
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<td>7.69</td>
<td>1.50</td>
<td>2.94</td>
<td>11.25</td>
</tr>
</tbody>
</table>

*Table 1. Percentages of selected culture groups in the Chrudim district.*
members of the Prague Archaeological Institute in some localities, has also carried out most of the field work.

With the exception of a La Tène oppidum at Hradčice and a small prehistoric hill fort at Topol all the other excavations were rescue operations carried out according to the strategy of saving the maximum possible number of finds. However, some "interesting" sites of rarely appearing architectural cultures may have been given more attention than others subconsciously. There is no information on the methodology of field walking. The intention of the archaeologists apparently was to cover the area completely which, of course, was somewhat more successful only in the northernmost part of the district with dense prehistoric settlement. Very few fields were walked in more than one season. Yet, this field walking programme was the most intensive achievement of its type in Bohemia preceding the ALRN project.

The units of observation used in the field were sites considered to be parts of the terrain more or less homogeneous in respect to archaeological finds. Such sites did not usually surpass several hundred metres in diameter.

Table 2. Percentages of culture groups in the Chrudim district.

<table>
<thead>
<tr>
<th>Culture Group</th>
<th>Field Find Units</th>
<th>Field Walked Sites</th>
<th>Excavation Find Site Units</th>
<th>Other Find Units</th>
<th>Σ Find Units</th>
</tr>
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<td></td>
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</tr>
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<td>L. Palaeolithic</td>
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<td>0.00 0.00 0.00 0.00 0.00 0.31</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>0.00 0.00 0.00 0.00 0.00 0.41</td>
<td></td>
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<td>Mesolithic</td>
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<td>0.00 0.00 0.65 1.23 0.21 0.20</td>
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<td></td>
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</tr>
<tr>
<td>Stroke Pottery</td>
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<td>2.59 2.46 11.69 8.64 10.97 8.09</td>
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<td></td>
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</tr>
<tr>
<td>Lengyel</td>
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<td>2.01 2.15 8.44 6.17 2.53 3.28</td>
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<td></td>
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<tr>
<td>Jordanów</td>
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<td>0.29 0.31 3.90 2.47 0.42 0.92</td>
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<tr>
<td>TRB</td>
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<td>1.44 1.54 0.65 1.23 1.27 1.23</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>0.00 0.00 2.60 3.70 1.90 1.33</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Aeneolithic</td>
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<td>0.86 0.92 5.84 6.17 6.54 4.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Únětice</td>
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<td>1.72 1.54 7.79 6.17 2.53 3.07</td>
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<td></td>
</tr>
<tr>
<td>Věteřov</td>
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<td>0.00 0.00 0.00 0.00 0.42 0.20</td>
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<tr>
<td>Middle Bronze Age</td>
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<td>0.00 0.00 0.00 0.00 0.42 0.20</td>
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<td>Bronze Age</td>
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<tr>
<td>Hallstatt/D. a Tène A</td>
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<tr>
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<td>1.15 1.23 1.95 3.70 0.63 1.02</td>
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<tr>
<td>La Tène</td>
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<td>17.53 17.54 14.29 8.64 8.23 12.50</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Roman period</td>
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<td>5.17 5.54 1.30 2.47 7.38 5.64</td>
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<tr>
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<td>16.38 17.23 1.30 1.23 6.12 9.02</td>
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</tbody>
</table>

Table 3. Absolute frequencies of selected culture groups in the Chrudim district.

<table>
<thead>
<tr>
<th>Field Find Units</th>
<th>Field Walked Sites</th>
<th>Excavation Find Site Units</th>
<th>Other Find Units</th>
<th>Σ Find Units</th>
</tr>
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<tbody>
<tr>
<td>Linear Pottery</td>
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<td></td>
</tr>
<tr>
<td>Stroke Pottery</td>
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<td>9 8 18 7 52 79</td>
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<tr>
<td>Lengyel</td>
<td>7 7 13 5 12 32</td>
<td>7 7 13 5 12 32</td>
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<td></td>
</tr>
<tr>
<td>Jordanów</td>
<td>1 1 6 2 2 9</td>
<td>1 1 6 2 2 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRB</td>
<td>5 5 1 1 6 12</td>
<td>5 5 1 1 6 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Beaker</td>
<td>0 0 4 3 9 13</td>
<td>0 0 4 3 9 13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Únětice</td>
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<td>0 0 12 5 12 30</td>
<td></td>
<td></td>
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<tr>
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<td>29 25 11 10 34 74</td>
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<td>6 6 0 0 1 7</td>
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<td></td>
</tr>
<tr>
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<td>76 69 26 15 86 188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hallstatt (late)</td>
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<td>4 4 3 3 3 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>La Tène</td>
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<td>61 57 22 7 39 122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman period</td>
<td>18 18 2 2 35 55</td>
<td>18 18 2 2 35 55</td>
<td></td>
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</tr>
<tr>
<td>sum</td>
<td>252 234 133 68 311 656</td>
<td>252 234 133 68 311 656</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Absolute frequencies of prehistoric find units and sites in the Chrudim district.

When I transformed the card files into a database, I preferred to work in terms of find units: concrete manifestations of individual components (finds of the same archaeological period clustering in a limited area and reflecting one single activity – cf. Neustupný 1993, 27) found in one year. Thus, a cemetery and a settlement site of the same period found at the same place in the course of a single excavation season form two find units. Similarly, a cemetery excavated in two consecutive seasons has also been divided into two find units. The
rationale behind this was to create units with maximum homogeneity which were clearly distinguishable by observation. I am not going to
discuss the problems connected with such units here.

I considered it useful to retain the traditional sites understood as
spatial clusters of archaeological finds irrespective of their chronology
and function, and not respecting the time schedule of their observation.
I found it possible to use the concept of site mainly because the sites
chosen by archaeologists in the Chrudim region were of an acceptable
size and did not create any great problems. Ideally, higher units of the
record such as components or settlement areas should be constructed
from find units stating clearly formulated reasons for the respective
archaeological decisions; they should not be established by purely
subjective delimitation.

The main types of archaeological activity chosen for the analysis
was field walking, excavations, and the category 'other' (mainly finds
given to museums by non-archaeologists).

There were some 2000 find units within the territory of Chrudim
district, of which some 1000 were prehistoric. The number of prehis-
toric sites was 765, of which 665 could be spatially determined more
accurately than within the territories of modern villages. Table 4 and
2 present an analysis of the find units and sites as related to culture
groups representing periods of time.

It can be discerned at first sight that only a small number of
culture groups (or their groupings) are represented (26 out of some 37,
not counting summary groupings) and even so the frequencies of some
of them are very low (all pre-neolithic culture groups, Michelberg,
middle bronze age). Summary groupings such as 'prehistoric' or 'neolithic'
(carlying mainly of isolated finds of polished stone axes) etc., are
characterised by very high frequencies. 'Neolithic' and 'cucuteniic' are
typical of the category 'other', while 'prehistoric' (which means 'not medieval') is most frequently identified during
field walking.

If these two cases (i.e. the low frequencies and the summary
categories) are left out, we get Tables 1 and 3. It is obvious from these
tables, especially from No. 4, that the distribution of individual culture
groups among the field walking, excavations and the category 'other'
is very uneven. A G-test of independence (cf. Sokal - Rohlf 1981, 744)
shows that the difference between field walking and excavation is
statistically significant both for find units and sites.

Some of the culture groups (Linear Pottery, TRB, Laussitz, Sile-
sia–Pilańzow group, possibly late Hallstatt period) seem to be more or
less comparably represented in both field walking and excavations.
Stoke Pottery, Lengyel, Bell Beakers and Únětice, however, clearly
predominate in excavations while La Tène and the Roman period
groups are more frequently met among the results of field walking.

My point is that such differences deeply influence the informa-
tion supplied by field walking. To reconstruct a map of prehistoric
settlement of any region on the basis of raw data obtained by field
walking is as hazardous an undertaking as to make judgements, on
the same basis, on the density of settlement in particular periods of
prehistory. I am not going to analyse here the factors which influence
any picture of the settlement structure as observed by field walking
(cf. Neustupný 1982, 180–181) or any other field method (Neustupný
1989, 82). In general, they consist of various transformations which
the archaeological record has undergone while leaving the live prehis-
toric culture and while being transformed by both later natural and

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NOTES ON THE SERIES OF ARTICLES
CONCERNING THE ALRN8 AND L&S
PROJECTS

Jan Rulf

As far as Bohemian archaeology is concerned there are but few
conceptual international research projects. For obvious reasons these
deserve our special attention. A group of Czech and English authors
has submitted here a summary of their efforts and bitherto achieved
results of their joint work which began some 18 months ago. I would
like here not to make a detailed critique of each of these reports but to
focus my attention on some key points within both projects.

1. Objectives

The development of a cultural landscape and, consequently, of
social transformations, is the principal idea detectable in both projects.
Some other aims (for instance the investigation of the transition from
the Mesolithic to the Neolithic) can be viewed from the global point
of view as being subsidiary. The division of the principal topic into
a set of minor questions is included especially in the parts dealing with
field–walking and I will return to this later. It is surprising, however,
that in the introductory text we cannot find the list of principal
objectives of the ALRN8 project as they were published in 1992
(Bened – Kuna – Petke – Zvelebil 1992). In that article the reconstruc-
tion of the basic characteristic features of the landscape in single
periods from the Mesolithic through to the modern period was first
presented. This objective was followed by two other aims: the recon-
struction of the settlement network as a part of cultural landscape, and
the creation of a strategy aimed at the preservation and utilisation of
historic relics within the modern cultural landscape. The latter is, I am
afraid, an impressive proclamation rather than a realistic expectation
capable of fulfillment. This is a mixture of ecological and historical
views, the former prevailing. In apparent contrast, the material pub-
lished here suggests that the authors tend to stress the historical view.
This means they emphasise the study of human history within specific
environments. Such a shift, in case it is not just my misunderstanding
of what they expressed, is to be welcome. This is because I believe
that archaeology as a historical discipline must be involved not in the
study of landscape, but of people (individuals, societies) living within
it. There is no doubt that landscape is not a passive subject influenced
by Man, and that landscape has influenced the evolution of human
societies in a dynamic way (is it then necessary to stress such a
triviality by giving a reference to a future work of one of the project’s
authors?).

Let me now turn to other objectives of the project as they were
defined in the part concerning the surface survey (field–walking).
There are nine of them and they show that the authors are overly
optimistic. In contrast to them I do not think that it is possible, by
means of the archaeological survey used by them, to establish and
define the population density of Bohemia and to follow its changes
chronologically, to identify and explain the hierarchy of settlement
sites, to describe the internal structure of settlement areas and of the
relations of their individual components. It will be also difficult to
determine the general and culturally specific economic, social, and
symbolic factors, which, in the course of the whole of agricultural
prehistory and the Middle Ages, were responsible for site locations
within the landscape. Consequently this would mean that most of the
2. Methodology

At the beginning we must state with sorrow that the question of the overall methodology applied was not presented as a whole and that its partial aspects are spread throughout individual contributions leaving the reader to discern them.

The project is based on the methodology of English landscape archaeology. This is focused on space and the spatial arrangement of archaeological evidence, along with the adoption of a multi-disciplinary approach (let me note that within such a discipline the presence of a detailed chronology is very often underestimated). It is a pity that almost exclusively the authors are orientated towards Anglo-American literature (and this is obvious with most contributions) and do not consider the central European roots of similar methodological approaches, which are even older than the English ones (as early as the beginning of this century, in 1901, the pioneering work of R. Gradmann was published; cf. also the German Siedlungsgеographie und Siedlungskаrхеologie as in Jahкnk 1935 and 1977, the founding works by Wislansky 1969, Siebmаnn 1971 and Kruck 1973; apart from these, no important Dutch and Scandinavian contributions were mentioned in any of the ALRNB project’s contributions).

The multidisciplinary approach itself as a conditio sine qua non cannot be a guarantee of results which should be adequate to the expended effort. The common methodological attachment of approaches and the ability to integrate different results into an entire picture is necessary. At this moment we are not able to make a critical opinion concerning the latter statement as it seems that a lot of work must be carried out in the matter of bringing the approaches of various disciplines into harmony and balance. The archaeobotanical and (especially) archaeozoological sampling can, in the quantities presented here and in the context of the proposed objectives, only provide a mosaic of partial results which can only contribute with difficulty towards the overall picture. As for palynology, it is the same problem. Although this is a very important discipline, if one expects its greater contribution towards solving the project questions it will be inevitable to have many more available analyses. Moreover, these must comprise whole Holocene sequences and not only short samples which are datable with difficulties (and which cannot be easily interpreted). These tend to represent mere illustrations of landscape conditions but not proper evidence for its evolution. In brief one may comment that the connection between aerial archaeology and geophysics could be labelled as a traditional one. The investigation carried out by Beneš, Brůna and Křivánek into the development of landscape during the past two centuries is obviously interesting, but it is almost impossible to use it for other interpretations because of difficulties with spatial and chronological generalisation.

The principal contribution of natural science to the ALRNB project is the division of studied landscape transects into 13 ecozones, as published here by Pelke and Sádlo. Obviously, the division of these ecozones is (according to the criteria distinguishing one from the other) relatively stable within the time scale. From the viewpoint of future analyses they offer a certain (but obviously approximate) landscape division. It is possible to make simple predictions of the settlement patterns within each of the ecozones. From the methodological perspective it is important that Pelke and Sádlo present a critique of some elements of the Mikyňka geobotanical reconstruction maps, which have been tacitly accepted by many archaeologists. One can also agree with their opinion that the cultural landscape of central Bohemia can be viewed as representing an artefact. From such a viewpoint Bohemian landscape archaeology can be considered as artefactual archaeology, although I do not believe that the distinction of archaeology into artefactual and other is proper.

With no doubt it is field-walking that will form the main source of evidence during the five-year course of the project. For this reason it is not surprising that this subject constitutes the core of most of the submitted contributions. The authors are aware of the weak points of this approach and of the objections expressed especially by E. Neustupný and S. Vencel (a further objection can also be added: the danger of pseudo-sites caused by the relocation of soil containing pottery fragments and other evidence from archaeological sites to new localities). The authors provide arguments supporting the valid opinion that, as a prospection method, field-walking should not be omitted. They convincingly argue against the objections of their opponents concerning the overestimation of quality of data collected by means of field-walking and then they go on to explain the methods of field-walking as developed for the project. These are presented in a competent manner and in some cases perhaps even in too much detail (for instance, there is no reason why to doubt that it is advantageous to practice surface collection in April and not in January). The methodology is really excellent and it is difficult to find something which one could criticise. The authors suppose that by means of field-walking they will be able to cover cca 20% of the area of the studied transects (I would like to point out that in Beneš - Kuna - Pelke – Zvelebil 1992, 341, the authors stated that they hoped to enlarge the visual range of field-walking from a planned 2% to 5%; but no information is presented on how long this would take and only from the data presented in this series of articles it is obvious that this should be carried out within one year. For many readers it will probably be surprising that the authors consider that surface collection (field-walking) represents a form of archaeological rescue excavation. I would disagree with this opinion.

3. Results

It is understandable that now when the project has not even reached its mid-duration that all results are preliminary. For this reason the authors stress the formulation of objectives and the continued search for proper methods. Consequently, it is not possible to make an appropriate evaluation at this moment, but it must be stressed that the set of results obtained, especially those concerning the methods of field-walking and environmental sampling, are promising from the point of view of the significance of results and interpretations which are expected in the future. The importance of the study of river flood plains, both from the perspective of archaeological and environmental studies, has been rightly stressed.

The quality of future results and historical interpretations will be highly dependent on how the authors will manage to chronologically select a picture of the studied territory, which up to now (at least in some ecozones) seemingly covered by archaeological evidence in a continuous way (from a chronological perspective). I think that the general statement, namely that the more detailed chronological scale utilised, the more discontinuous the spatial distribution of finds will be, will be valid even in this case. The balancing of chronological and spatial dimensions, of course, forms one of the corner stones of modern archaeology.

I hope that the whole team of scholars involved within both projects continue to have ideal conditions for the continuation of their work, and that they manage to bring this ambitious project to a successful conclusion.

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COMMENTS ABOUT THE ALRNB LANDSCAPE AND SETTLEMENT PROJECTS

Slavomír Vencel

Field survey currently represents an independent and fast developing discipline within the field of archaeology. For this reason projects aiming at the application of this discipline within our country are welcome. The importance of the inclusion of such types of projects within Czech archaeology is paramount since the results achieved by methods of field archaeology elsewhere in the world remained almost unnoticed in Bohemia and Moravia. The set of contributions being discussed is composed of preliminary reports and information concerning the parameters of the field component of the project. Consequently, it is impossible to initiate a discussion upon the project’s results whilst at the same time the submission of comments on its methodology is too late: the project has started and field work is currently in progress. I will therefore confine my comments to a few notes, as I have already expressed my opinions on the credibility of field-survey data elsewhere (Vencel, in press).

I fully agree with the project authors that the cognition of structures of prehistoric settlement is conditioned by the use of systematic methods which permit the examination of the entire territory and allow for the comparability of data. Such a complex approach has to examine the connection between both archaeological and natural data (e.g. paleontology should be carried out extensively). This is why the authors repeatedly stress a number of useful terms, some of which have been advocated earlier (due to my self-indulgence I am citing just examples from my own work: the term – off-site activities, cf. Vencel 1967, 184; the concept of the archaeological settlement of Bohemia as a find continuity, cf. Vencel 1982, 569; the informative value of arable soil as demonstrated by the production of Neolithic lithic industries, cf. Vencel 1986, 1990; daub, cf. Vencel 1991; the identifiability of Mesolithic settlements, cf. Vencel 1992; and, notes on Corded Ware culture settlements, cf. Vencel 1994). The project of M. Kuna et al. has no parallel within Bohemian archaeology but a high quantity of available empirical data, which can be easily used, collected by hitherto performed non-systematic excavations and other activities are available. For instance, the results achieved by F. Hammer, J. Fröhlich, J. Zadák, D. Kolbing and many others suggests that the level of understanding a region is conditioned by many factors, such as the intensity of work carried out and the efficiency of collectors, as well as changes to land surfaces. As a consequence of the well known variability of densities of data spread on surfaces, the cognition of archaeological settlement patterns is of a cumulative character and it is impossible to avoid this fact by any sophisticated methods. A short-term or even single survey of a particular surface may potentially provide different quantitative, and consequently qualitative, results, but not objective information concerning the character and intensity of settlement. For example, J. Fröhlich, between 1977–1983 surveyed a lithic industry site at Borečná II and Malenovice II. He field-walked the former site 11 times and collected 70 artefact fragments, and the latter 10 times which resulted in a collection of 106 lithic fragments. The number of finds ranged, in the case of the first site, between 1 and 19 artefacts per walk, and, in the case of the other site, between 2 and 21. The first walk at Borečná II resulted in the collection of only one artefact, whilst at Malenovice II the results of the first visit to the site were more successful (21 artefacts). Consequently, evaluation of the first season provides a completely different idea about the character of these two sites, which differs from reality as was proved during subsequent field–walking across the sites. A similar example of the role of time factors can be seen in the difference between the present settlement activity in the basin of the Říčany stream, close to the villages of Říčany and Dubeč. On the former site, only a fragment of the settlement activity was identified from a long-term survey in the close vicinity of the later village – cf. Kuna – Waldhauser – Zvelebil 1989, 28, Fig. H, and Vencel – Venclová – Zadák 1976. It hard-working field workers such as D. Kolbing and (manuscript, personal communication 1993) repeatedly find new sites in macroregions during their field surveys (which last for several decades), then the concept of short-term or even single surface collection is doubtful. Projects of this kind will obviously provide, on the basis of comparable parameters, a better picture of the archaeological settlement of territories being examined. In future, it will be interesting to investigate the differences in results obtained as achieved by the project under discussion and subsequent reality. The credibility of the surface survey as expressed in the contributions of M. Kuna et al. will have to confront the missing surface evidence from buried sites within whole regions (cf. Vokolek – Sigl 1982) (It is well known, that in contrast to properly excavated assemblages which contain relatively well preserved objects which can be controlled by their contextual position, finds from surface surveys are isolated items which, due to weather conditions, ploughing, etc. have lost a number of their qualitative attributes. Consequently the reliability of the chronological interpretation of material collected by means of surface survey is markedly depreciated.). The quality of the project will be evaluated by its results. Both the quantity of finds (per square kilometre) and the type of variability within the archaeological data, particularly in the case of less apparent sources, will be decisive in this respect (e.g. Mesolithic camps – cf. Vencel, in press, list of references included).

Finally let me make a small comment on the interpretation of results from the rescue excavation at Dolní Počernice (Vencel 1992b; cf. Kuna – Zvelebil – Foster – Dreslerová, Tab. 2). Between 1972 – 1982 the above-mentioned field survey resulted in the collection of a lithic industry (Upper Palaeolithic, late Neolithic) as well as poorly preserved pottery fragments (the best preserved being the large, heavy fragments of Červená culture pots, termed area lunata). Before the arable layer (4 hectares area) of this site was stripped, I expected that rescue excavations would reveal evidence of settlement activities dating to both periods. On the surface of the stripped area, as well as on the mound of stripped soil, we have repeatedly performed, since April 1982, intensive monitoring and collection activities. Apart from the fact that we were not successful in identifying the Upper Palaeolithic site, this effort resulted in the discovery of stray artefacts dating to few prehistoric periods. Tab. 2 as interpreted by M. Kuna et al. unfortunately combines (in the second column) data from the collection carried out on the surface of the arable soil (actual land surface) with that gathered from the surface of the stripped area. Both were
COMMENTs ABOUT THE PROBLEM OF SPATIAL ARChEOLOGY

Jan Fridrich

We are now starting to publish in this section of our journal a series of information which aims to reflect actual trends and opinions concerning both domestic and foreign archaeology. In addition, recent results (no matter whether final or preliminary) of projects which are currently in progress are welcomed, as well as the original ideas of individual authors. We believe that such efforts will widen the discussion, as it was suggested in the introduction of this volume.

The series of articles published in this volume are concerned with a project which aims to reconstruct the historical development of two selected regions within Bohemia. A preliminary introduction to this project has been recently published (Benet – Kuna – Peltek – Zvolebník 1992). The fact that an insufficient general discussion about the project has taken place means that the principles and ideas of the project remain largely open. Its objectives and basic methodology have been repeatedly formulated (Kuna – Zvolebník – Foster – Drewery). The project itself is so ambitious in its aims that it encompasses many of the basic principles of archaeology, especially in the particular case of the strategy and practical performance of field survey.

Bohemian archaeology, particularly regional field survey, has a more than one hundred year old tradition. Every experienced archaeologist, both professional and amateur, has considerable personal experience of this type of field activity. It represents a significant empirical stage within the evolution of archaeology and, in spite of its imperfections, represents an irreplaceable part of archaeological methods. We currently find ourselves in a stage of archological theorisation and this creates new needs and problems. One of the problems is the completion of archological data, its generalisation and management. Different natural science disciplines had to face similar problems and this always resulted in the solution of important theoretical problems, either anticipated or discussed. In this particular case, within our country, the problem we are concerned with is the reliability of data acquired by surface survey. During the course of history massive human impact has taken place upon soils which undoubtedly has dramatically affected the distribution of archological evidence. Particularly in recent times, the large-scale transfers of upper soil levels, as a consequence of extensive building activities, has caused the severe displacement of archological evidence. A recent example was announced by the archaeologists from Prague City Museum. At the edge of the basin, forming the source of the Cervenomłyntý stream, in Prague 8 (Ďáblice area), a detailed surface survey was performed upon an area of 23.45 hectares. This territory is bisected by a trackway into two parts, the former representing approximately 2/3 of the whole field, the latter consequently about 1/3. The survey was carried out three times in the larger of the two parts (15.5 hectares). Altogether 143 prehistoric and early historic pottery fragments were collected. The archaeologists were able to classify, from a chronological point of view, only about 10% of the entire collection. Most pottery was identified to the late Iller period and Roman periods, a few sherds perhaps dating to the late Bronze-Age Knovíz culture and late Neolithic Jordanov culture. After the arable layer of the field was stripped no archological features or artefacts were detected. During the field-walking carried out on the surface of the other (smaller) part of the field, no archological artefacts were found. After the arable layer was stripped a single feature, a Funnel Beaker culture pit, was identified. The find of this particular context excludes the explanation that all archological features may have been destroyed by ploughing.

The archaeologists concerned explain the situation in the following way: the site is actually a false (or pseudo-) site which originated as a consequence of transfers of arable soil (from a brick-field?) onto a certain area within the field. This is an excellent example of a false archological site, which could not have been detected in case when plough-walking was not performed in advance to stripping the soil. Moreover, a further (second) false site may have been created by the transfer of material from this site to another one. This therefore complicates any evaluation of settlement patterns within a studied region and generally indicates the limitations of surface surveys. Not only new sites (false/pseudo-sites) may occur, but also some archological localities may be lost for ever when being covered by transferred soil.

This particular example is obviously not an isolated one. Every experienced archaeologist or surface collector could provide a set of similar examples. We may then suggest that artefacts (especially medieval examples) collected by field-walking may firstly be seen as evidence that such a soil is an anthropogenic sediment. Its character may have been re-created or even artificially produced, as it came into past contact with human artefacts (as a consequence of arable soil formation, the transfer of garbage and manure), originating from both nearby or even remote sites. Generally speaking in more recent periods the volume of this occurrence may have been greater, as may have been the distance (or re-depositional area). Consequently, surface collection data is of secondary value and its presence must be confirmed by the detection of intact archological contexts.

The project published in this volume, being highly sophisticated, is based upon a certain volume of complementary data which helps to achieve the principal objectives, but which, at the same time, is limited.
The authors stress the unified method of data collection within the whole studied region and this results in the call for a rapid and large-scale collection. For this reason the archaeologists are forced to walk across sites in a limited time schedule and in standard spatial intervals. Although this is all organized in a rational way it is no wonder that experienced archaeologists may have some objections. It is obvious that a sophisticated programme should operate with sophisticated data: this is probably the point at which an essential contradiction occurs between the traditional concept of field survey (as a source of information concerning the existence or non-existence of primary sites) and that which is not complementary to proper excavations. In other words, such a concept does not aim to confirm information obtained from the surfaces of possible sites with that obtained from positive results excavated on site. It is therefore necessary to apply each of these methods independently as they both serve different aims.

The ways that archaeological data have been collected to date differ in many respects. They mostly come from empirical research and their collection is casual rather than systematic. This is brought about by a number of facts (e.g. the character of institutions and individuals involved in such practices). Such an accidental collection of archaeological evidence will not result in "the concept of landscape as an empty space with a certain number of sites", since we know very well that even amateur archaeologists—collectors are able, within their territories, to correctly understand the landscape in its entirety. This enables them to base general conclusions upon landscapes on their experience which may often result in the discovery of many new archaeological sites. In this respect I must express a criticism regarding the project authors’ inconsistency in the following matter: if they consider their revolutionary idea that landscape can be understood as a continuity of areas of different date and functions in which archaeological sources are regularly spread, then one may consider the selected size of the surveyed area (1/5 of the whole studied territory) as a strict limitation for such ideas. Originally even a limit of 5% was discussed. I am not sure whether the final enlargement was not achieved to the detriment of the quantity and quality of information.

The topics discussed here evoke a number of opinions and I consider it important to publish them. With respect to the extent of this contribution I will focus on a general consideration of the relationship between archaeology and the natural sciences. Archaeology is linked with many human and natural sciences. This is often a spontaneous cooperation and as such is not based on the proper education of archaeologists within the respective disciplines. This may often result in elementary misunderstandings. Such a fusion of disciplines creates difficulties in establishing within which field we are actually proceeding. Usually it is the individual’s discipline which is decisive in this respect. The use of highly specialized computer software will probably accelerate this tendency. In the case of spatial archaeology one can see it as a subdiscipline of geography or historical (and also human) geography. Historical geography started to develop in our country 30 years ago and since the 1970’s has become a widely studied and employed discipline, based on the application of statistical procedures and the recognition of behavioural/humanistic approaches. The latest definition of geography as pronounced by our scholars provides a true picture of the intentions of modern geographers: "...a group of disciplines involved in the sphere of landscape, in the relations between the system of environment and that of human societies in time and space, in their components and geosystems. It decipher regularities and laws of the distribution of different quality phenomena and is aimed at a mutual interaction between society and environment. Geography is a complex discipline on the Earth placed in the boundary territory of humanities, natural science and technological disciplines...actual geography tries to determine the laws of spatial arrangement of different geographical phenomena, their complexes and evolutionary changes in distribution. With respect to the intention of the authors to study diachronic changes from prehistory to the present time, we are entitled to label such a discipline, regional historical geography.

Translated by Martin Gojda, corrected by M. Beech

NOTES
1) I am obliged to my colleagues Dr. D. Baštová, Dr. M. Fridrichová and Mr. M. Kostka of the Museum of Prague who enabled me to publish this information.

REPLY TO COMMENTS

M. Kuna, S. Butler, D. Dreslerová, M. Zvelebil

We are grateful to Fridrich, Klápště, Neustupný, Rulf and Vencík for their thoughtful comments on the achievements and future direction of the ALRNB “Landscape & Settlement” projects. We agree with most of the critical remarks made by the authors, in particular regarding the difficulty of integrating the palaeoenvironmental and archaeological data and various problems of the archaeological survey. In our reply we would just like to comment upon a few points for which further explanation may be useful.

J. Rulf notes that the focus of the project’s objectives has changed since its first publication in Archeologické rozhledy. He is right that we have now adopted a more historically orientated perspective. This shift was the result of permanent discussions carried out during the first two years of the project’s duration. The change does not mark a substantial break with the previous goals but rather an attempt to make them more compact and explicit. It is true that the goals of the survey as summarised in the discussed paper by Kuna et al. are rather wide but we still hope that most of them can be achieved (e.g. an estimation of changing population density, modelling site location preferences or identifying patterns of settlement distributions). Our attempt will certainly not rely upon field walking evidence alone but will include all available archaeological information.

J. Klápště suggests that a general discussion about the validity of field walking data has already become redundant. This is a surprising opinion since we consider that there is a noticeable lack of any published discussions on this topic within Czech archaeology. Klápště’s opinion is not shared by the other authors of the comments since at least three of them (Fridrich, Neustupný, Vencík) made just this point the key problem of their contributions. According to our opinion, even more attention should be paid to the theory and methods of field walking survey in future, as this particular field method is increasingly more often employed by many research projects and its tasks are becoming more and more complex.

E. Neustupný shows that field walking data represents a biased reflection of the archaeological record. This is exactly what we attempted to show in our paper (Kuna et al., Tab. 1) and our own results coincide with Neustupný’s tables. It seems that the greater part of the bias is not incidental but systematic and thus partly predictable. We
are aware of this fact and, as we have explicitly stated in our paper (Kuna et al.), we are not going to generalise about past settlement patterns until surface data are complemented by information obtained from other sources (facial photography, previous finds and excavations).

Most of Fridrich's and Vencel's comments concentrate on the validity of surface data in respect to the original (sub) surface situations (sites). We fully agree with their points but it seems to us that they missed a substantial difference between the goals of our survey and the survey described by themselves. The difference of the two approaches is mainly a difference in the scale of the entities forming the target of study. Whereas Fridrich and Vencel consider field walking as a method of collecting particular information about particular sites, we are attempting to learn about entities of a larger size. Working at a regional scale we obviously have to accept that our data cannot be precise in detail as well as being balanced on the level of the whole. If a more intensive survey is applied, either by repeating visits to the same fields (as suggested by Vencel) or test pitting (mentioned by Fridrich) we would by necessity either have to reduce the project area drastically or to abandon our idea of obtaining a spatially balanced landscape sample. Besides that we do not believe that any archaeological evidence can ever be complete (this also applies to the evidence obtained by repeated field walking or excavation), so that the decision what level of relative completeness can be considered to be sufficient is always arbitrary and can be evaluated only in relation to the project goals.

"Sites" themselves, both as individual entities and as a particular category of the archaeological record, do not provide sufficient data for many questions raised by contemporary landscape and settlement archaeology. We cannot explain the observed settlement patterns within a particular landscape unit unless the "sites" are considered within their wider context: off-site remains, surrounding empty areas, natural environment, etc. What we need to obtain by survey is a balanced, quantitative representation of the archaeological record over territories by far exceeding the extent of individual sites. That is why, we do not agree with Vencel's statement that the number of sites discovered in a territory (or their relative proportion when compared to the real situation) is the main criterion for an effective survey. We would also oppose his opinion that the discovery of more sites within an intensively surveyed region can invalidate the existing survey results. What we are aiming at is not discovering all sites within a region (this can never be achieved in any case) but to obtain a reasonable representative sample enabling us to analyse their spatial and other types of patterning. From this point of view the bias caused by variable agricultural treatment of the fields and other factors is of secondary importance (on condition, of course, that this bias is randomly spread over the territory).

The same comments apply to Fridrich's opinion that field walking data generally have a secondary value and must be evaluated by test pitting, excavations, etc. This general statement may not be defendable even if considering individual sites. We attempted to show that the surface evidence often provides complementary (not just partial) information about a site. Surface and plough zone assemblages can for example contain finds of specific periods of times which have already disappeared from subsurface contexts. Fridrich's statement is even less correct if we consider the study of a region as a whole. At a regional scale, field walking data represents a primary source of information which can be only selectively controlled by other types of field research. This presupposition is not substantially affected by the fact that surface data are biased (which is the case of any data) and must be controlled against alternative, independent information (as for any other data).

Surveying a region by field walking is, probably more than any other archaeological activity, a sampling procedure and its results can be effectively approached only keeping this in mind. The inevitable bias seems fatal only if the surface evidence is taken at its face value and in terms of a site-oriented archaeology. Within a "landscape approach" various distorting factors, such as erosion, accumulation and the anthropogenic transfer of soils, can be considered as variables which themselves should be studied and included with archaeological interpretations. It would be, of course, a very difficult task to reconstruct the patterns of past activity if most of the soil deposits e.g. occurred in secondary contexts as suggested by Fridrich. The fact that most fields could have been affected by secondary processes unrecongnisable on the field surface should not be interpreted as evidence for all of them really having been affected. The general possibility of misreading surface data in particular cases is much less important if larger areas are considered. A statistical inference about a region can either remove the particular bias or help to explain it. In our preference for general, statistical data, in comparison to particular, local information sets, and seeking for regularities (structures) within the archaeological record, we may be accused of standing within "the conceptual shadow of the 1960's" (J. Klápar's comments). If we were so labelled for this reason, then we do not mind it since we would prefer such an evaluation to retrieving particularistic archaeology of even earlier periods.

Fridrich does not agree with our remark that traditional archaeology approached landscape as an empty space with a certain number of (isolated) sites. Wanting to prove the opposite he is, in fact, restating the same when he says that even amateur archaeologists of the past understood landscape as a "totality" discovering a large number of sites within it. This is exactly what we understand by the traditional approach. In our view, there is a difference between a notion of landscape as a set of sites (that is a set of the most obtrusive, discrete and mutually isolated entities) and the notion of landscape as a continuously used space consisting of areas of variable functions and with a variable density of archeological remains. We also do not see any contradiction between the latter approach and a research strategy based on sampling (as suggested by Fridrich). To study continuous phenomena does not necessarily imply covering them by continuous, 'total' investigations.

Fridrich and Rulf stress the particular danger of the possible occurrence of pseudo-sites which have their origin in the re-deposition of soil containing archaeological finds. We are aware of this problem and we did pay special attention to it (not mentioned in our main papers). Special maps of recultivation and other anthropogenic activities have been prepared which indicate this influence upon the character of the fields. Mapping of these factors is a time-consuming matter, because almost no written documents concerning such activities are available. In many cases, the only suitable method is to ask local specialists in the neighbouring cooperative farms. The majority of recultivation activities have taken place relatively recently, hence the information obtained is fairly complete. It is also partly possible to predict locations with recultivation, reclamation of soil or other activities. It is, for example, unusual to find recultivation in fields with good quality agricultural soil. One usually finds re-deposited soil in areas with poor soils, as well as in old palaeoamendments, gullies, drains or ditches, as a means of enlargening cooperative fields. We admit that we are not able to identify all previous modifications made to fields, however we hope that such an approach may at least diminish the probability of mistakes being made in the interpretation of landscape development.

We would like to emphasise some differences between landscape archaeology, which we aim to practice by our project and settlement archaeology within the Central European tradition. We are concerned here with discussion of a different conception of space as well as a different conception of the meaning of artifact distributions in space, and therefore different research strategies as well as results. One of the essential elements of landscape archaeology is the active role played by landscape - a cultural construct - on the decision-making of human communities, and the concepts of landscape antecedent and successor.
Confusion about the suggested sampling fraction (5% in our previous article, eca 20% here; mentioned by Ruf and Fridrich) was probably caused by ourselves. There is, of course, no contradiction between both figures. Whereas the lower estimate characterizes the area supposed to be covered by direct visual control, the higher figure concerns the total extent of fields to be sampled. In other words, surveying one half of a territory by traversing it in 20 m intervals would create a 5% sample if the visually controlled area itself is considered (each walker controls a strip of about 2 m wide). However, it would be a 50% sample, if the extent of the whole surveyed fields is calculated.

J. Klápště, questioning our concept of ecozones, has obviously touched upon a serious problem. We admit that the ecozones within the studied territory, both as a particular set of natural entities and as a theoretical approach, might be questioned. The reasons why we decided to use the concept have been explained by L. Peše and J. Sádlo. We should only add that we do not suggest this concept to become a universal tool for analysing our results. In agreement with J. Klápště we would like to combine it with, or perhaps even substitute it by, an analytical approach. In spite of this, the present definition of ecozones is, in our view, quite important since it has provided us with an independent (done by non-archaeologists) description of the area under study and has helped us to structure our research strategy in various ways.

Kláště is justifiably concerned with the special problems of dating and analysis in alluvial sediments. Floodplain environments do create complex depositional sequences with a high potential for redeposition. This is why it is so important to undertake comprehensive lithostratigraphic surveys as a basis for the selection and interpretation of palaeoenvironmental and dating samples from such deposits. Lithostratigraphic mapping and selective preliminary sampling provide a basis for evaluating depositional contexts and identifying the most reliable and informative sampling sites. Our methodology recognizes the importance of this geoarchaeological approach to alluvial sediments.

Rulf's point is concerned with the question of scale. This is the most serious problem faced by the project and Butler's paper attempted to reflect this. Butler attempted to illustrate the difficulties involved by pointing to the large discrepancy between an idealised sampling strategy aimed at meeting the overall research aims, and the actual field characteristics of the study area which determine the real nature and fragmented availability of sampling sites. The types of sampling to which Ruf refers (i.e. complete Holocene sequences with large pollen catchment areas) simply do not exist within the study area. Despite these difficulties, our survey has identified what potential does exist within the study area, and has indicated the methodology required to deal with that potential. It is clear that the very large spatial scale and temporal scope defined in the overall project aims call for considerably more financial and human resources than are currently available to the project.

We apologise for our misreading of some parts of Vencs' article about Dolni Počernice missing the fact that some of his "surface collections" were, in fact, performed only after the top soil had been removed. It does not change, however, much of our ideas since even these finds belong to the plough zone data, principally "visible" on the field surface.

We agree with Fridrich's idea that some parts of our activities may seem quite similar to "regional historic geography". We would like only to stress that geography is generally understood as a (natural) science whereas archaeology is a social science or humanity. Although some questions, methods and theories within both disciplines may be identical, the disciplines differ in their general background. Both disciplines have a different context in which research questions are laid down and different reasons why the questions are asked. In geography, man is just a variable within the physical world (landscape). In archaeology it is the other way round, and landscapes becomes one of the variables within the world of social phenomena. Although terminology is certainly not the key problem of this debate we are not inclined to rename the discipline in which we are active and we do not see any reasons for being excluded from archaeology as a whole.

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**ERRATUM**

We apologize for the error made during the process of editing of Tables 1 to 4 on p. 150 and 151. The text provided below is the correct one.

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