Influence of the Morphometrical Features on the Settlement Patterns from the Neolithic to the Middle Ages in the Middle Obra Region

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Introduction

Question concerning the archaeological sites arrangement in the prehistoric landscape, is not a new one in the archaeological research (Willey/Gordon 1953; Williams 1956; Warren 1990; Kittel 2005). Factors that decide on the settlement preferences regarding the individual landscape elements have been pondered over. The dominant view in the literature states that the archaeological sites pattern in natural space is not random (Bauer et al. 2004). Both settlement studies and the geomorphologic ones show that the archaeological sites location depends on many natural determinants such as: elevation, slopes gradient or distance from water bodies. Before the introduction of GIS techniques (cf. Hunt 1992; Vanacker et al. 2001; Kvamme 2005) into the archaeological studies, conclusions about the influence of environmental preferences were intuitive and usually generalized. That problem was particularly noticeable on the areas of the European Plain, where the archaeological sites are common and the natural features are hardly diversified. GIS software made it possible to examine quantitative relations as well as to test statistically the meaning of differences between environmental characteristics and the archaeological sites pattern.

Main units of regional division on the studied area

Region of the middle Obra river is situated in the borderland of two physiographic units: Pojezierze Wielkopolskie (Greater Poland Lakeland) to the north and Pojezierze Leszczyńskie (Leszno Lakeland) to the south. These units are divided by the Pradolina Warciańsko-Odżańska (Warta-Odra Ice-Marginal Valley) (Kondracki 2002).

From another regional perspective the discussed area can be included in the Opalenica Kościana lowering. The part ice-marginal valley, which is the most lowered, is called the Łęgi Obrzańskie (Obra Marshy Meadows) on the examined area (Krygowski 1961, 1972; Bartkowski 1970).

On account of geomorphologic regionalization, Równina Opalenicka (Opalenica Plain) can be singled out to the north. To the south the plain is enclosed by a part of the Pradolina Warszawsko-Berlińska (Warsaw-Berlin Ice-Marginal Valley). Within this area waters are channelled both to Obra and Warta rivers. The Równina Kościańska (Kościan Plain), which in the south borders on the ice-marginal valley, is the most extensive geomorphologic unit of the investigated area. This unit in turn is enclosed by the Wysoczyna Śmigielsko-Lipnowska (Śmigiel-Lipno Plateau) in the south. From the Kościan Plain the plateau is separated with the postglacial valley of the Samica river (Bartkowski 1970).
Geomorphologic characteristics of the research area

Flat morainic plateau is a dominant morphological element on the studied area. It consists of the Kościan Plain and a part of the Opalenica Plain. The elevation differences all over the described form stay within 0–3 m, hardly ever exceeding 5 m. Absolute elevations within this form reach up to 70–80 m a.s.l. Whole area has slope not exceeding 1° towards the northern west. The plateau are cut by the network of postglacial channels what morphometrically constitutes a specific element of such areas. These channels drain huge amounts of meltwater in the marginal zone of Leszno (Brandenburg) Phase of the Vistulian glaciation.

Undulated morainic plateau is the second characteristic form, to be found mostly in the south-western part of the area. Absolute elevations on the plateau reach up to 110 m a.s.l. Varied relief, with the elevation differences between 3 and 10 metres, is typical of this form. The whole plateau, including its edge zone, is severely washed out. The edge zone is cut by parallel troughs and hummocks stretching at the base of the plateau.

Among other forms, outwash moraines should be mentioned. On the analysed area they occur as the relict landforms, often in the shape of patches covering the top parts of the plateau remnants. Eskers, stretching along trough valleys, are more noticeable in the landscape. These forms are composed of sands, gravels and silts, and are sheathed in glacial till (Krzysztofka 1993).

In the edge zones kame terraces are occasionally adjacent to plateaux. They mark the former flow paths in postglacial channels. The edge zones, with relative elevation over 30 metres, are cut by erosional-denudational forms. They are located in the southern zone of ice-marginal valley as well as in the Samica river valley.

In the area of ice-marginal valley, on the terrace, sands were subjected to aeolian processes. Hence, in places, they occur in the form of dunes or aeolian cover sands.

Summing up, it should be stated that, from the morphometrical point of view, this area is flat and hardly varied; in the postglacial period almost no relief changes have occurred.

Specific hydrographical conditions of the area

The middle Obra region is the biggest mire complex in Greater Poland. It resulted from peat-covering of a bottom part of the Warsaw-Berlin Pradolina (i.e. Obra Marshy Meadows). The answer to the question, why the peat bog originated in that section of the ice-marginal valley, can be found in the western part of the area, in the Kotlina Kargowska (Kargowa Basin). It was caused for example by a large dune field, covering the valley bottom and blocking the outflow of waters. The second answer is the Odra alluvial fan. The river flows into the flat-bottomed Kargowa Basin, depositing there the material it carries. This is the place of the Obra bifurcation. Part of waters flows into the Kotlina Gorzowska (Gorzów Basin) in the north whilst the rest flows westwards into the Odra as the Obryca river, passing the mentioned Odra alluvial fan (Bartkowski 1970).

The mires occur also in the postglacial channels. Flat channel reservoirs, as well as small overdeepenings, were first to turn into the peat bogs (in the Samica or Obra Kościańska troughs the peat thickness may exceed even 5 m) (Krzysztofka 1993).

The substantial bogginess of the area was the cause for initiating the reclamation — one of the earliest in Greater Poland. First attempts to stop the pradolina flooding by removing the watermills dams in the upper sections of the local rivers were made in 1775. After this region had been taken over by Prussian authorities, the first land improvement works began, which were being continued until 1806. Four main drainage channels were constructed at that time: the Kościan Channel (from Kościan to Bonikowo), the Mosina Channel, the Southern Channel and the Northern Channel (Palach 2006).

The analysis of the 17th- and 18th-century cartographic material, carried out by Hilczerówna (1967), proves that the Obra waters used to flood on vast areas, creating
small shallow lakes overgrown with reeds. Many times the Obra river lost its course in the mire, within the ice-marginal valley.

The river network formed during the postglacial period has changed to a slight extent. The water level in postglacial troughs and in pradolina was the only element to vary. It used to rise or drop, depending on the changes in climate conditions, and it influenced level of bogginess or water table in shallow water bodies. With the passing of time the water level was lowered because of land improvement that is of channeling unregulated streams.

Described changes in hydrological conditions were undoubtedly important for the settlement processes in the northern part of the area, within the large ice-marginal valley. Lowering of the groundwater level enabled the settlement and human agricultural activities, also the prehistoric ones, on these areas. Whereas narrow postglacial troughs could have served as pastures during dry periods.

Spatial statistics analysis — a theoretical background

Site locations encountered in any areas often manifest themselves in the form of point patterns in two-dimensional space. Data observed in respect of such phenomena consist of the objects of study — archaeological remnants of different scale. In most cases the manner in which these points are arranged contain useful information of the settlement process and its dynamics during the time as well as information about external factors affecting settlement process. This information is subtle as well as difficult to detect, to extract and to quantify.

Archaeological traces are mapped usually in sparse form. Statistical methods used to investigate the settlement pattern transform a sparse data into the continuous surface. Three spatial statistic methods have been used to investigate the settlement changes on Lower Obra region in prehistory and the Middle Ages:

- trend analysis to investigate more generalised process of settlement pattern formation (Fig. 1, 2);
- kernel density estimation to find existing clusters of settlements (Fig. 3, 4);
- multivariate analysis to investigate relationships between natural landscape properties and settlement preferences. (Fig. 5, 6, 7).

At the beginning of the analysis process, the sites were tested, in k-estimate Monte Carlo test, if their pattern is not random (CRESSIE 1993; BADDELEY/TURNER 2006; JASIEWCZ / HILDEBRANDT-RADKE 2007).

Trend analysis of spatial point pattern is relatively new method of analysing archaeological data. If archaeological data are random it can be said that spatial point pattern is stationary i.e. it does not change when shifted in space and its parameters, such as the mean and variance, also do not change over position. Such situation takes place when the settlement process is not affected by any (or affected by multiple but contrary) external factors both natural and socio-economic. Spatial point process which parameters change over the position is referred to as non-stationary. If point proceeds is non-stationary it usually assumes that point pattern is affected by some external factors. Trend analyses have been made with spatstat package (BADDELEY/TURNER 2006). For all data it has been fitted to third order polynomial trend. Apart from its multiple applications in numerous sciences trend surface analysis allows to detect the settlement pattern easily if:

- sites tend to concentrate (trend surface is convex on the investigated area);
- sites do not show visible concentration (trend surface is almost flat without distinct maximum);
- sites tend to scatter all over area (trend surface is concave).

Kernel density estimation can be applied if point process is not random. This method enables to count sites in an area, centred at the location where the estimation is made. The area is defined by kernel size (or more precise: bandwidth). The kernel bandwidth strongly affects the density surface. All analyses were made with 1200 m kernel. In the course of the analysis sites are being partitioned into a number of different clusters and sparse data are being transformed into a density surface. This method is very good for analysing the point patterns as well as to discover the hotspots or concentration centres.
The third method applied to spatial data was the multivariate analysis described previously by Jasiewicz and Hildebrandt-Radke (2009a, b). That complex method used multivariate (mostly hydro-geomorphological) set of variables to detect spatial dependence between site location and natural features.

Main stages of the settlement

The archaeological research resulted in the reconnaissance of the prehistoric and medieval settlement of the area. The research consists of the surface survey, conducted within the framework of Polish Archaeological Record Project (received by courtesy of Regional Chief Inspector of Ancient Monuments and Historical Buildings) as well as of publications from archaeological excavation fieldwork carried out on this area especially after the Second World War. Unfavourable climate conditions discouraged the Palaeolithic settlement. Not more than individual findings of Late Palaeolithic flint cores occur on the analysed area (eg. in Białcz Stary) (Szydłowski 2003).

Also only few archaeological sites originating in the next period — the Mesolithic — have been recorded on the studied area. Moreover, low number of the settlement points preserved from these two periods is caused by economy and settlement of the hunters-gatherers, who lived in relatively mobile groups and exploited rather temporary settlement forms.

Only beginning with the Neolithic did this area start to be settled intensively. The cultures of Linear Band Pottery appeared. Their presence on the examined land was connected with the overpopulation of the Kujawy (Kuyavian) centre. The oldest settlement with long houses in shape of trapezium was uncovered in Białcz Stary and dated to 4850–3700 BC.

About 4300 BC the settlers of the Funnel Beaker Culture appeared with the height of their development in phase III. The culture spread all over the Kościan Plain.

After the period of intense settlement in this area, a kind of decline was noticed in the number of artifacts of the Globular Amphora Culture settlement. This has been recorded particularly for younger phase of the settlement — 2900–2000 BC).

Subsequent societies of the Corded Ware Culture are well represented on the discussed area. The settlement indicators are considerably higher than in the regions surrounding the Kościan Plain. The material traces typical of the Corded Ware Culture are known both from the settlements and graves. In case of settlements their concentration is observed along the southern bank of the middle Odra river, around Kokorzyn, Racot, on the Pojezierze Krzywińskie (Krzywiń Lakeland) as well as to the north of Kościan (in Kielczewo).

Noticeably higher settlement density relative to the neighbouring areas is characteristic of both the Corded Ware Culture and the preceding ones. Remnants of the former, including the pottery and the boat-shaped stone axes, show that this society had very extensive area of contacts reaching the cultures living on the Solawa and Łaba (Elbe) rivers as well as the Nordic world (Szydłowski 2003).

The described area was important during the Bronze Age too. There are numerous findings of the Únìtice Culture Kościan group. In the initial period of its development the culture is regarded as the Late Neolithic one with lack of metal artifacts. However, in the course of its development, the Únìtice culture mattered first of all in the metal goods trade among the Solawa-Elbe, Wrocław and Kuyavia centres.

The Early Bronze Age is a period of intensified farming. Wheat, millet, oats, barley, broad bean, pea and lentil were the prevailing cultivated plants. Agricultural character of that times settlements was certified by excavation work in Bruszczewo and findings of hoes, querns and pounders. Bones of livestock unclosed in Bruszczewo (cattle, pigs, sheep and goats) outnumbered other findings of that kind (Szydłowski 2003).

The Bruszczewo settlement boasted textile, pottery and flint-knapping workshops as well as a metallurgical one. Making metal objects and weaving resulted in the large-scale trade contacts of the Bruszczewo community. In some regions, the
density of the Early Bronze relics, in the form of settlements, accompanying hoards of artifacts and individual findings, is high enough to single out two microregions within the investigated area: west of Kościan — around Kokorzyn as well as Bruszczewo situated 9 km to the south of Kokorzyn (Szydłowski 2003).

The mentioned microregions shared the important tumuli cemetery in Łęki Małe exploited c.a. 2000 BC. This round barrow is located to the north of the Obra valley, westward of Mogilnica (Szydłowski 2003).

In the Older Bronze Age (circa 1500–1200 BC) some noteworthy cultural transformations took place. The Odra river basin was at that time unified within so called Pre-Lusatian Culture. Burial customs involved cremation of bodies and placing ashes in urns buried in graves, and spread during that period (Wędzki 2005).

Middle Bronze Period brought further changes connected with the emergence of a new cultural system. The Lusatian Culture developed together with strangers coming from the south and from the west. It existed almost all over the today’s Poland and lasted for an exceptionally long time of about a thousand years (until c.a. 400 BC). The largest concentration of the Lusatian Culture settlement traces has been found on the middle Odra river. These are huge cremation cemeteries e.g. in Bruszczewo, Kotowo, Lubiechowo, Morawica, Parzęczew, Przysieka Stara (Szydłowski 2003). Lusatian early tribal communities were engaged both in farming and animal husbandry. Highly specialized handicraft developed as well. Numerous settlement traces are visible on the Samica and middle Odra rivers. They prove the consolidation and increase in number of population on the studied areas in the Late Bronze Age (Szydłowski 2003; Wędzki 2005).

It has become customary to begin the Iron Age with a year of 650 BC. The Lusatian Culture was still thriving on the examined area, nevertheless it slowly fell into its decline. Dynamic increase in the development of the Hallstatt Culture (from the middle Danube river up to the eastern France) and its far-reaching interchange of goods resulted in its influence on the areas situated near the important trade routes. Special cultural and economic development took place in Lower Silesia. The Kościan Land, located in close vicinity, was also involved in the development. Painted ceramics and huge amount of iron articles appeared on the area. The turn of Hallstatt and La Tène Cultures is a period of unfavorable climate conditions connected with the temperature lowering and the increase in groundwater level. Decline in population at that time is also noticeable (Szydłowski 2003; Wędzki 2005).

Toward the end of the 5th century BC, the south-western territories of Greater Poland became to welcome groups of the Pomeranian Culture representatives. They introduced different forms of economy with the particular significance of animal husbandry in forests and hunting. The settlements were no longer fortified but small and open. Burial customs also altered (Szydłowski 2003; Wędzki 2005).

The reincrease in population of the Greater Polish lands was associated with the existence of the Przeworsk Culture on the area. It was the time of tremendous changes in economy and culture. They were influenced by Celts who kept appearing in the south of Poland. The fortified centres lost their defensive character. Most often the kolonika was built i.e. the settlement in a circular form around an empty square also known as the Slavonic round village. Such settlements were located close to the watercourses, on elevations, and were often strengthened against the flood. All of that signifies the rising of water level at that time. Contacts with Celts resulted in the dissemination of iron extraction. Bog iron ores were mined for the limonite. Iron, purified to get rid of sulphur, was smelt in furnaces, then heated and hammered. The Przeworsk Culture abounded in arms, objects of everyday use and ornaments made of iron. Since the 3rd century potter’s wheel had been playing more and more important role in earthenware manufacture. Gradually, wheel-made pottery supplanted hand-built one (Szydłowski 2003).

The Roman Iron Age (since the beginning of CE till AD 400) was a period of significant economic progress. It was marked by two phenomena. First, the increase in crops caused by applying draught animals joined together by a yoke and improved ploughing implements. Second was the development of craftsmanship, particularly of
the ferrous metallurgy. Booming exchange of goods made it possible to establish closer contacts with the Roman Empire (Wędki 2005).

The fall of the Roman Empire and the Migration Period between 350 and 550 is noticeable in the area of Greater Poland because of enormous depopulations as the result of many invasions. The Przeworsk Culture declined in the middle of this period. The Slavonic settlement was initiated in the East-Central Europe by the Sarmatian tribes, arriving from the east (Szydłowski 2003; Ostoja-Zagórski 2005).

Next stage of the settlement in this area is connected with the Early Middle Ages. People used to settle mainly near the river valleys, in open settlements. The example of such in Bruszczewo was exceptionally large (10 ha). New settlement in Bruszczewo started already in the 6th century. Semi-dug-outs and earth lodges were the most popular form of dwellings. Strongholds appeared not earlier than in the second phase of Early Middle Ages. Most often they were constructed on swampy grounds, in places with natural defensive features, usually on the middle Obrar river. Such early medieval fortified centres were built for example in Bialcz Stary, Bruszczewo, Bonikowo, Drzeczkowo, Kamieniec i Łęki Wielkie. Undoubtedly the strongholds were associated with the beginnings of towns. In the course of the 10th century they were incorporated into the young state of the Polans together with the whole area adjacent to the Obrar river. New territories were captured during military activities. Proofs of that have been found in the forms of uncovered layers of burning as well as traces showing that the strongholds were abandoned in a hurry. In order to consolidate the state, the strongholds in Przemęt and Krzywiń were erected. Those served as administrative centres (Szydłowski 2003).

The human dwellings development depended on the trade routes to a large extent. At that time the routes run from Poznań via Kościan and Śmigiel towards Głogów as well as towards Wrocław via Krzywiń. River crossings were situated in Czacz and Kościan. With time a pathway leading through the river crossing in Śrem became the main route joining Poznań and Wrocław. The demographic research was done and it showed that the population density of the southern Greater Poland in the oldest phase of Middle Ages was considerably smaller than during the Roman Iron Age. Not earlier than about 750 did it reach the Roman Iron Age level. Quick demographic development, recorded later on the Kościan Land, might have been caused by the migration from Lower Silesia.

In the second half of the 10th century Polish lands were being intensively unified. The supra-tribal state of Mieszko I came into being and the gradual weakening of the former tribal centres occurred. The country was divided into provinces and strongholds (later turned into the castellanies). The analysed area became an integral part of the Piasts’ Poland what is proved by the castellans’ seats in Krzywiń (1070) and Przemęt (1210).

Beginning with the 11th and 12th centuries, concentrated settlement of peasantry, knighthood and monastic orders followed. Both secular and sacred architecture was built (e.g. the Benedictine monastery — at present an abbey again — in Lubiń, founded by Bolesław II the Generous, between 1072–1075 years).

With the passing of time the settled owners strove to be granted a town charter according to the Magdeburg law. Krzywiń — 1257, Poniec — 1270, Śmigiel — 1385, Kościan — 1400, Leszno — 1547 were the earliest towns to be chartered in that way.

Settlement changes in Obra region in view of spatial analysis

The Mesolithic and Early Neolithic

There are several sites and settlement points observed in the investigated area. Those sites are concentrated in the northern and northeastern part of the area, but due to their low frequency both spatial pattern and spatial dependence between natural and socio-economic condition cannot be determined.

The Late Neolithic

Trend analysis of the Late Neolithic shows very similar tendency in the settlement pattern formation in case of both perma-
nently and temporarily settled subsets of sites (Fig. 1A, 2A). Sites from both subsets tend to concentrate in the middle-northern part of the area, but temporary sites shift to the northwestern part of the area. In contrast to later epochs the similarity in both the Late Neolithic sites subsets can be explained by vague boundary between temporary and permanent sites of the Late Stone Age.

Density estimation presents similar but more precise view of the settlement pattern than the trend analysis. The temporarily settled sites show one major cluster in the northern part of the area with site concentration over 3 per km², and another, smaller, in the eastern part (Fig. 3A, 4A). On the rest of the area sites are scattered regularly, without special concentration, with lack of sites in the southwestern part of the area, around the Krzyckie Lake. The permanent sites form several clusters in the middle and northern part of the area with the site concentration below or near 0.5 sites per km², which is 6 times smaller than in the set of the temporary ones. Such settlement pattern indicates that in the Neolithic the foundations of the settlement network had not been developed yet.

The analysis of landscape preferences shows that the temporarily settled sites concentrate near the plateau edges, on valley scarps (Fig. 5A, 6A). Valleys bottoms were absolutely avoided. The permanent sites concentrate more towards the centre of plateau, without visible concentration on the valley scarps. Valleys bottoms were also avoided. The settlement preferences for the subset of permanent sites may be slightly uncertain due to relatively small number of archaeological sites of that type.

The settlement pattern of the Late Neolithic shows, that settling near river/stream valleys was preferred while the valleys bottoms were conspicuously avoided. This can be explained by the higher flood probability and generally widely humid climate in the fall of the Neolithic (Atlantic) period (Rotnicki 1991). The settlement clusters concentrate generally on the lower plateau areas where distance to valleys is not large. Temporarily settled sites partially overlay, but partially complement permanent sites locations. It can be caused both by inadequacy of the PARP (Polish Archaeological Record Project) methods in distinguishing the temporarily and permanently settled sites in the Neolithic as well as by
Fig. 2. Settlement trend analysis on the temporarily settled site set
A) Neolithic;
B) Eneolithic/Early Bronze;
C) Late Bronze/Early Iron;
D) Late Roman Iron;
E) Early Medieval;
F) Late Medieval

Fig. 3. Kernel density estimation on the permanently settled site set
A) Neolithic;
B) Eneolithic/Early Bronze;
C) Late Bronze/Early Iron;
D) Late Roman Iron;
E) Early Medieval;
F) Late Medieval
Fig. 4. Kernel density estimation on the temporarily settled site set
A) Neolithic; B) Eneolithic/Early Bronze; C) Late Bronze/Early Iron; D) Late Roman Iron; E) Early Medieval; F) Late Medieval

Fig. 5. Settlement intensity on the permanently settled sites: Legend description: value lesser than 1 denotes avoided areas, value greater than 1 denotes higher preferences, value equal to 1 denotes areas with no preferences
A) Neolithic; B) Eneolithic/Early Bronze; C) Late Bronze/Early Iron; D) Late Roman Iron; E) Early Medieval; F) Late Medieval
Fig. 6. Settlement intensity on the temporarily settled sites: Legend description: value lesser than 1 denotes avoided areas, value greater than 1 denotes higher preferences, value equal to 1 denotes areas with no preferences
A) Neolithic;
B) Eneolithic/Early Bronze;
C) Late Bronze/Early Iron;
D) Late Roman Iron;
E) Early Medieval;
F) Late Medieval

Fig. 7. Settlement preferences differences
A) from Neolithic to Eneolithic/Early Bronze;
B) from Neolithic to Late Bronze/Early Iron;
C) from Eneolithic/Early Bronze to Late Bronze/Early Iron;
D) from Late Bronze/Early Iron to Late Roman Iron;
E) from Late Roman Iron to Early Medieval;
from Early Medieval to Late Medieval
real fluidity of these terms for that period of prehistory.

The Eneolithic/Early Bronze Age

Definitely scarce superficial material for the Eneolithic/Early Bronze period does not allow us to formulate more generalised criterion of the settlement pattern in these periods. Both trend analysis (Fig. 1B, 2B) and density estimation (Fig. 3B, 4B) show that permanent sites concentrate along east-west line in the middle of the area. The site concentration for that subset is similar to that of the Neolithic period but the area covered by archaeological remnants from the Eneolithic/Early Bronze Age is widely smaller. The temporarily settled sites tend to concentrate in the middle of the area with small number of sites in its northern and eastern part. In fact the settlement pattern of the temporarily settled sites of the Eneolithic/Early Bronze period is similar to that of permanent sites of the Late Neolithic. It amplifies the argument of rather indistinct division between permanent and temporarily settled sites in these periods of prehistory.

Because of the small number of remnants in permanent subset of sites, concluding about landscape preferences in that period is limited. The only conclusion to be drawn is that the Neolithic preferences for choosing mostly the valley scarps near plateau edges had been preserved (Fig. 5B, 6B).

The Late Bronze/Early Iron Age

The settlement pattern in that period significantly differs from the Neolithic pattern. The trend of permanent sites shows significant clustering process in the middle-northern area, while the temporarily settled sites show opposite process of dispersion throughout the area (Fig. 1C, 2C). In fact there is no visible trend in the temporarily settled sites distribution, and process seems to be stationary i.e. it is not influenced by any cross-regional factors. This suggestion is supported by kernel density analysis (Fig. 3C, 4C). The permanent sites are clustered in the northern and east-northern part of the area with some settlement centres of over 3 sites per km², while the temporarily settled sites are more or less regularly scattered over the area with the settlement density varying from 1.5 to 2.5 sites per km² without clearly distinguished centres. This situation is opposite to that of Neolithic period. It indicates that the Late Bronze/Early Iron was the period of more permanent settlement structures then the preceding intervals.

Landscape preferences of the Late Bronze/Early Iron Age also differ from the Neolithic period (Fig. 5C, 6C, 7B, 7C). The permanently settled sites concentrate on valleys scarps but on the plateau areas are also present. Settlements in valleys bottoms are visibly rarer than on surrounding areas, but not as significantly as during the Neolithic. The temporarily settled sites, as shown before by trend and density analyses, are scattered all over plateaus, without special preferences for landscape features. Only the lowest-lying areas of valleys bottoms were of slightly less interest to the settlers than plateaus.

Such settlement pattern is an result of palaeoclimatic conditions during the Late Bronze/Early Iron Age. Due to the significantly dryer climate during the Subboreal period, valley bottoms were much accessible than during the humid Atlantic period.

The Roman Iron Age

The settlement pattern of the Late Roman Iron Age is very similar to that of the Late Bronze/Early Iron period. Permanent sites concentrate on the same area with the same settlement centres as before (Fig. 1D, 2D, 3D, 4D). The temporarily settled sites tend to reveal more dispersed pattern, but with some distinct clusters on the whole area. The landscape preferences (Fig. 5E, 6E) are also very similar to that of the Late Bronze/Early Iron Age (Fig. 7D) but with more interest in plateau centre and less in valleys bottom.

The Early Medieval Period

The early medieval settlement pattern visibly differs from the one of previous and next ages. Trend analysis shows that the main centre of the permanently settled sites shifted much to the south-eastern part of the area (Fig.s 1E, 2E). In contrast to earlier periods, that area was highly settled for the first time in history. The temporarily settled
sites show scattered trend as well. Density analysis presents that there are four visible centres in the south. Site concentration in these places (up to 3.6 sites for km²) is the highest for all periods on that area (Fig. 3E, 4E). These centres are close to each others. Distance between them is not greater than 10 km. Similarly, the temporarily settled sites show great concentrations in the southern part of the area whilst areas of great concentration are shifted to these of the permanently settled sites where average distance is 2.5 km. There is also visible centre of the temporarily settled sites in the north-eastern part of the area without its counterpart in the permanently settled sites. Such pattern is difficult to explain at a base of natural features. It must have resulted from the social processes during the early Polish statehood.

The analysis of landscape preferences (Fig. 5E, 6E) in the Early Medieval Ages shows greater than in the Late Iron Age interest in valleys bottom, similar to that of the Late Bronze/Early Iron Age (Fig. 7E). That process can be explained with better climatic condition during so called early medieval climatic optimum which lasted to the end of the Early Medieval Age (DUNIN-WĄSOWICZ 1971).

The Late Medieval Age

Early medieval pattern is similar to all previous ones except for the Early Medieval and the Early Bronze ones. The main settlement centre migrates to the north, near Kościan, while the temporarily settled sites are evenly scattered all over the area, without any visible centre (Fig. 1F, 2F). Density analysis also shows the return to the same centres as during the Late Bronze and Iron Age, but the southern region is still visibly settled (Fig. 3F, 4F).

There are interesting shifts in landscape preferences between the Early and Late Medieval Ages (Fig. 5F, 6F, 7F) In the Late Medieval period there was visible decrease in the site concentration in valleys bottom and increase on the plateau, toward the centre. This process can be explained by the deterioration of climatic conditions at the break between the Early and Late Medieval Ages, manifested mainly by the decrease in temperatures and increase in precipitation (DUNIN-WĄSOWICZ 1971).

The settlement dynamics in prehistory and the Middle Ages in the Obra region

Results presented above show relatively stable settlement pattern along all archaeological periods. The sites tend to concentrate in the northern part of the area. Better settlement suitability of that region might have resulted from fertile soils and small landscape differences. The only exception of that rule is the Early Medieval Age, when the settlement centre shifts to the south of the area. That shift was probably caused by the early Polish statehood. The temporarily settled sites tend to scatter all over the area, except for the Neolithic period, when the settlement pattern for both the temporarily and permanently settled sites was almost the same.

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