

# Living on the lake in the Iron Age: new results from aerial photographs, geophysical survey and dendrochronology on sites of Biskupin type

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*The island site of Biskupin with its densely planned interior bears an uncanny resemblance to a prison camp. Is it typical of the Iron Age in Northern Europe? The authors here explore neighbouring sites around Poznań using aerial photographs, geophysical survey and dendrochronology – to stunning effect. These low impact methods have given high impact results: dated street plans, some similar and others different from Biskupin, but within the same time frame: almost a repertoire of early urbanism. The authors must also be congratulated on the identification of a new type of Iron Age feature, the ‘open area for spouse avoidance’ defined at Sobiejuchy.*

*Keywords:* Poland, Iron Age, Hallstatt C, Biskupin, settlement planning, dendrochronology, aerial photographs, magnetometer survey

## Introduction

The Early Iron Age stockade site of Biskupin in central Poland is one of the most famous prehistoric sites in Europe, well known to archaeologists since its discovery in 1933 and the early seasons of excavation from 1934 up until the Second World War. It is famous both for the detailed and virtually complete plan of a timber-built lakeside stockade of the period (Figure 1), and for the pioneering techniques which were used in its investigation, including balloon photography, the construction of a caisson to create suitably dry conditions for excavation, and for the reconstruction of the rampart, gateway and several internal buildings

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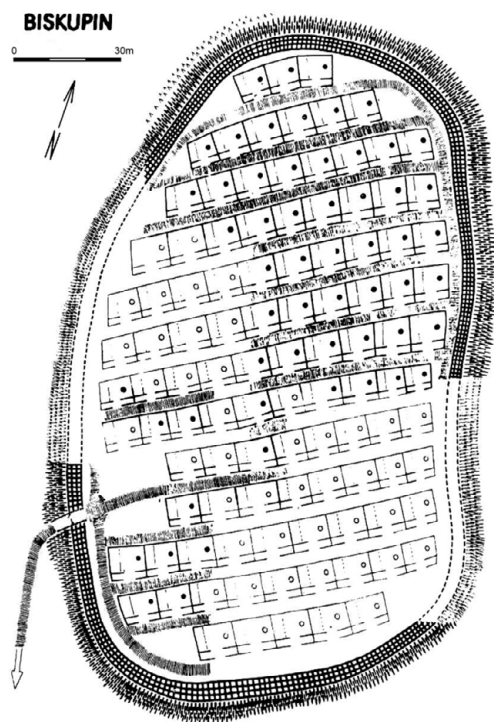


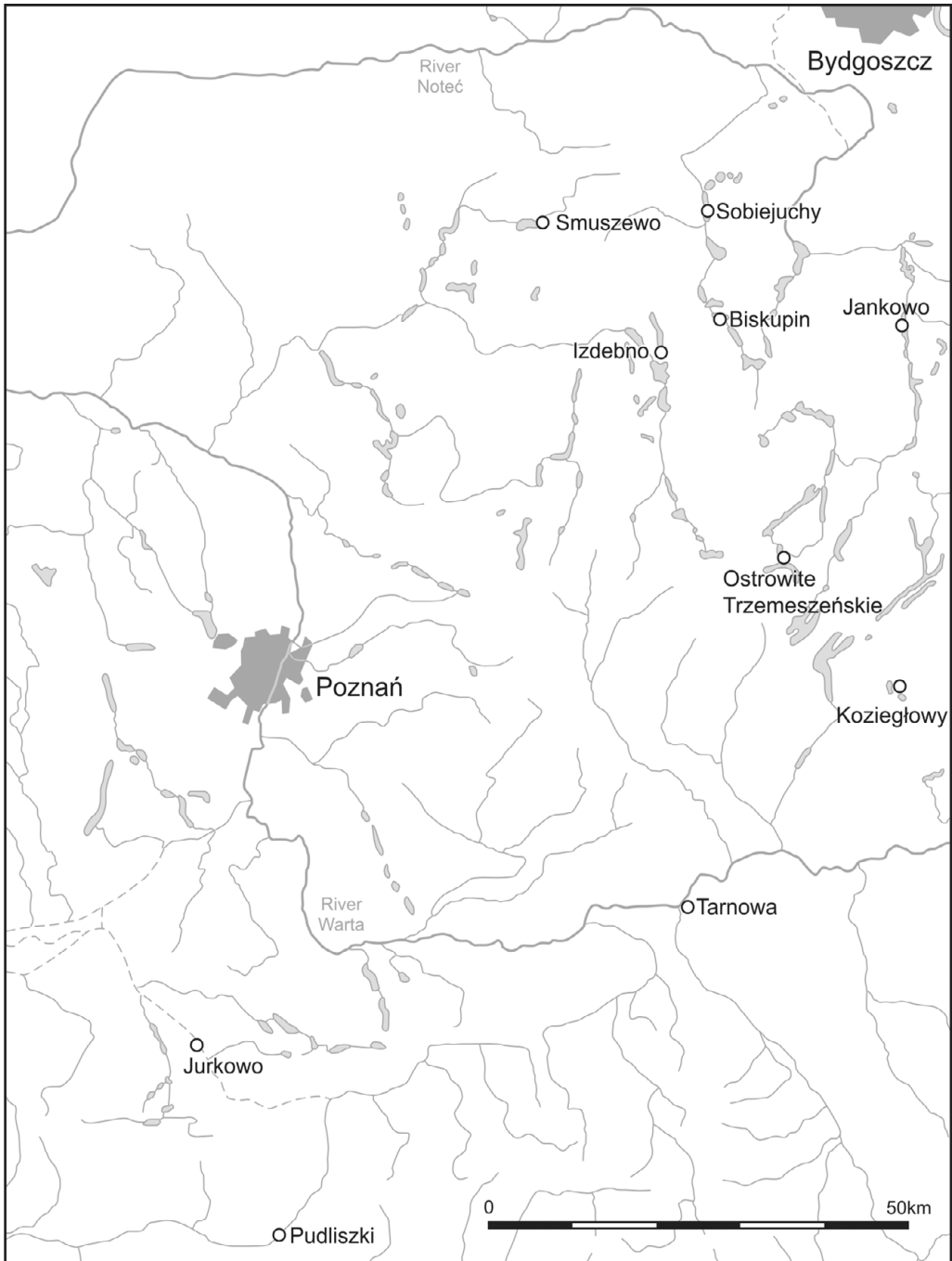
Figure 1. Biskupin, district Żnin: schematic plan of the older fortified settlement (source: Rajewski 1963, after Kostrzewski 1950).

chronology. Study of the pottery indicated that it should be contemporary with the periods known in Germany and Austria as Hallstatt C and D; traditionally the start of Ha C was placed at *c.* 700 BC and the start of Ha D at *c.* 630/620 BC, though it is now known that these dates need to be modified, as discussed below, with a start for Ha C as early as 800 BC.

The discovery of Biskupin was followed by a realisation that other sites in this part of Poland lay in similar situations, on small islands or peninsulæ in or on the shores of lakes, and (where excavation took place) dating to the Late Bronze and Early Iron Ages. Such sites included Sobiejuchy, Smuszewo, Izdebno and others (Figure 2). Although published results were few, the notion of a Biskupin ‘type’ arose, similar in date and function to other Early Iron Age forts in Central Europe, including those on hilltops, but characterised (so the belief went) by the parallel rows of houses, the wooden stockades, gateways and breakwaters, and the lakeside situation that were apparent at Biskupin. The problems of the sites, in terms of their function and relatively short lifespan, were addressed on a number of occasions (e.g. Rajewski 1963; Ostoja-Zagórski 1976, 1983; for more references see Piotrowska 2008), but fundamental issues such as those relating to the internal structure of the sites, how long they lasted, whether they were contemporary or not, remained unanswered. It is in this context that the work described here took place.

on the site. Although one part of the site interior remains unexcavated, the published plan shows 13 parallel rows of buildings that ran across the site, with an internal street running around the inside of the rampart, and breakwaters or defences of oblique pointed posts lying outside it (Kostrzewski 1938, 1950). Images of the reconstruction are found in many archaeological texts, and the site itself is a powerful symbol of Polish archaeology: the site is much visited, especially by school parties, and in the September festival season thousands of tourists from inside and outside Poland descend on Biskupin to take part in the huge range of activities that are on offer. The history of research on the site has been chronicled by several authors (e.g. Piotrowski 1991). 2009 marked the 75<sup>th</sup> anniversary of the start of excavations, and a celebratory conference was held in the site museum in June of that year.

From the early years of excavation it was evident that detailed information was available on craft activities, the functions of the different parts of the site, and



*Figure 2. The study area showing the sites surveyed.*

The dating of these sites has remained problematic, partly because the artefacts recovered are sufficiently different from those in the core Hallstatt areas to inhibit a tight local chronology, and partly because methods from the natural sciences were either not available or not helpful. Radiocarbon dating suffers from the problem that the calibration curve for the central part of the first millennium BC is almost flat, meaning that any date obtained will have a wide margin of error. Dendrochronology is the obvious method to adopt, and for Biskupin some results are available and more are in preparation; but for other sites nothing has hitherto been done.

As part of a collaborative programme of work between the British Academy and the Institute of Archaeology and Ethnology, Polish Academy of Sciences, a programme of survey and dating work on several of these sites was undertaken in the summers of 2004 and 2005. The work consisted of geophysical survey (by Harding and co-workers) and aerial survey (by Rączkowski), and the collection of wood samples for dendrochronological dating. Funds for the programme were provided jointly by the two academies, covering the cost of travel, subsistence, laboratory costs and image processing. In 2004 the instrument used was a Geoscan FM256 single-sensor gradiometer; in 2005 a Bartington 601 dual-sensor gradiometer with two fixed sensors 1m apart was used. The results have been processed using the software Geoplot of Geoscan Research.

## The survey results

Six sites were surveyed (Figure 2) and the results from three are presented here. Results at the others were less informative, but will be included in the final report. A further two sites were inaccessible for survey work because of location or vegetation.

### Sobiejuchy (Figures 3-4)

The Sobiejuchy site was extensively excavated in the 1950s and again in the 1980s. Full details of the later excavations, with references to the earlier work, were recently published (Harding *et al.* 2004). The site, which extends to about 6ha, lies at the present day between two lakes (the Dobrylewo Lake to the south and the eponymous Sobiejuchy Lake to the north), but in ancient times it was almost certainly an island, cut off from the surrounding land by several dozen metres of open water. Work in the 1950s showed that the date of the occupation was close to that of Biskupin, which lies some 14km to the south, and the nature of the occupation was domestic, with hearths, ovens and pits being recovered. Significantly, Zbigniew Bukowski, who became the principal excavator of the site at that time, recovered timber posts at a considerable depth in his cutting near the present-day canal joining the two lakes on the western side (Bukowski 1959-60, 1962). No dating work was carried out on this wood at the time; it came a little too soon for radiocarbon dating in 1950s Poland, nor had a dendrochronological sequence been established for Central Europe. As a consequence, the dating of the pottery from this site and from Biskupin remained the mainstay of the site's chronology until recent times.

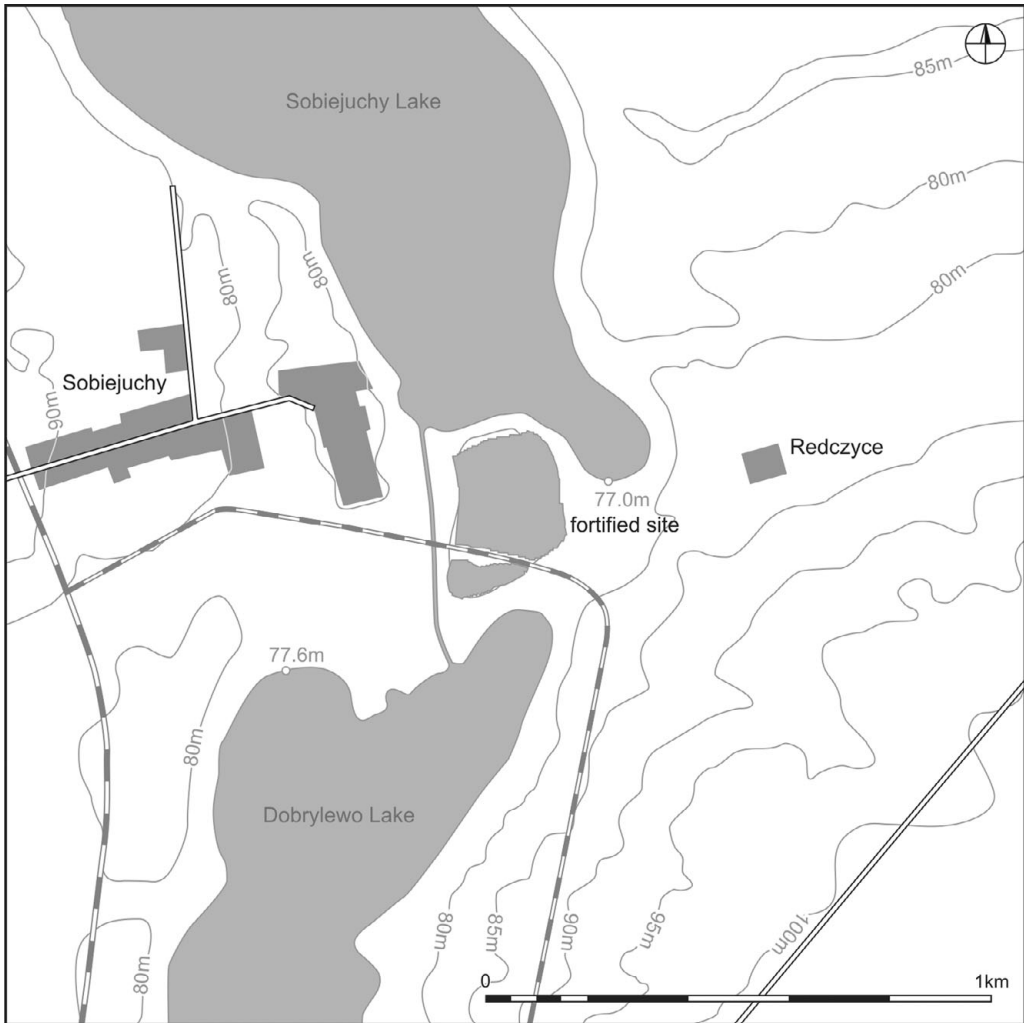


Figure 3. Sobiejuchy, district Żnin: situation plan.

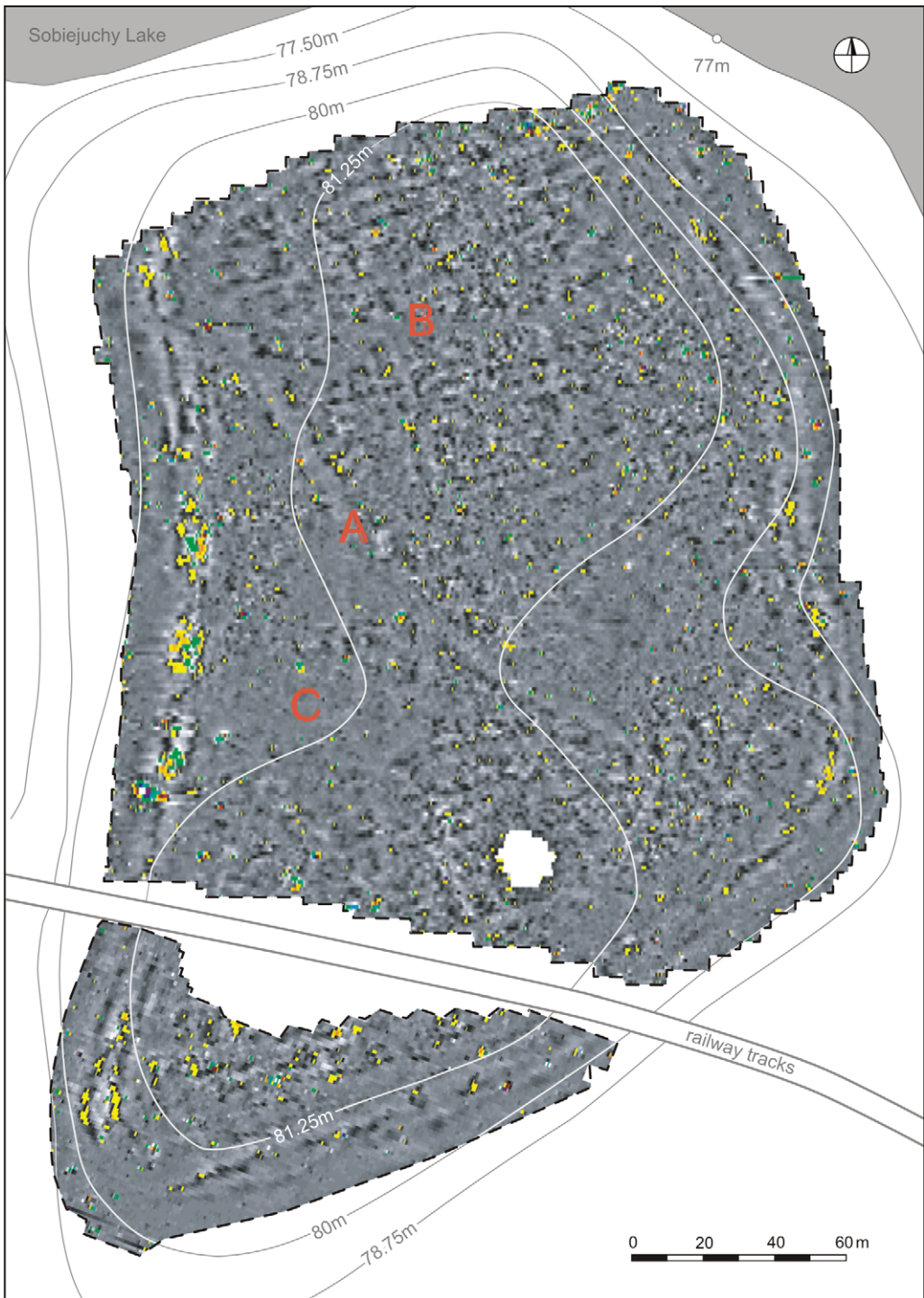
The 1980s excavations uncovered a rather larger area in the north-eastern part of the site, confirming the extensive nature of domestic occupation on the site but still only uncovering a small fraction of the whole. In both 1987 and 1988 geophysical surveys were carried out, that done with a gradiometer in 1988 producing a remarkable pattern of streets and buildings (Harding *et al.* 2004: 36-40, figs. 30-33). In several ways, however, this work was less than satisfactory. Although little has changed in the principles behind the operation of gradiometers (cf. Gaffney & Gater 2003), much has improved in terms of speed and the ease of manipulation of the resulting data, while georeferencing using differential GPS enables rapid and accurate placing of survey grids onto maps. Some scepticism was voiced by colleagues to whom the 1988 survey plans were shown prior to publication, since they



Figure 4. *Sobiejuchy aerial photograph, 2005.*

showed a site that was completely different in layout and organisation from the regimented lines apparent at Biskupin. This was repeated on other sites (if preliminary reports and very partial excavation are anything to go by), such as Izdebno, district Rogowo (Romanowska-Grabowska 1982), and Jankowo, district Inowrocław (Ostoja-Zagórski 1978). The doubts expressed about the 1988 plan revolved around the possibility either that geological features were being detected, or that ‘artefacts’ of the survey itself were being created. Given the advances in technology that had taken place since the original survey work, it was thought worthwhile to repeat the exercise, but covering the entire site instead of only the central area.

The new plan recovered in 2005 (Figure 5) is remarkable, and while confirming the validity of the previous survey, it adds very considerably to it. All available areas of the site were included; the only parts that could not be covered were a small strip at the north end where trees and shrubs cover the edge of the terrace and its descent towards the lake, and a section near the southern end where a narrow-gauge agricultural railway used to run, nowadays overgrown. A patch of blank readings just north of this is the site of an electricity pylon. Everywhere else the magnetic response was within appropriate limits and features are well differentiated.



*Figure 5. Sobiejuchy: geophysical survey plan, 2005.*

A main street (A) runs diagonally across the site. To its east are structures, marked by darker patches (areas of higher magnetic response) that probably represent lines of fallen daub or burnt clay, such as were found in the excavations of the 1980s (Harding *et al.* 2004). The 1988 survey plan (Harding *et al.* 2004: fig. 30) showed a street running east-west across the northern part of the survey area, but this is less evident in the new plan, where a series of short lengths of street appear to lie between house structures (B). An area on the west side of the site (C) appears not to be built up, perhaps an open area for meetings, animal grazing, or even market activities. Most of the structures seem, as was proposed in the 2004 excavation report, to be up to 20m long and 5-7m wide, which contrasts with the Biskupin houses that typically measure 9 x 8m, but were joined together to form long rows. Indeed, the entire plan appears markedly different from that at Biskupin; we discuss this further below.

### Smuszewo (Figures 6-8)

The site, extending over about 2.2ha, lies at the east end of Czeszewo Lake, around 21km west of Sobiejuchy, and was partially excavated in the 1960s by Dobromir Durczewski, though no final report has been published (Durczewski 1960, 1985 for the finds; Rajewski 1963). It is not known if the site was originally an island, but since the adjacent ground to the east and south is low-lying and damp, this seems likely (Figure 6).

The aerial photograph (Figure 7) shows only the hint of a grid, but the survey plan (Figure 8) shows very clear lines of structures running NW-SE, probably seven in number, and marked by higher anomalies at roughly 10m intervals, perhaps hearths or ovens inside individual buildings. The rampart was marked by a very strong anomaly running all the way around, and inside it a second, weaker line, perhaps from a burnt palisade.

These results appear to confirm that rows of structures, as at Biskupin, were present at Smuszewo; in other words, it seems indeed to have been of 'Biskupin type'.

### Izdebno (Figures 9-11)

The site, which extends over about 1.6ha, lies on Wola Lake 9km south-west of Biskupin (Figure 9). It has been known for many years, and was partially excavated by Olga Romanowska in the 1970s when parts of wooden buildings were recovered (Romanowska-Grabowska 1982). Only a preliminary report is available.

The air photographs of Izdebno show some regular features visible as crop-marks (Figure 10). These are faint but after computer processing some parallel lines can be recognised (?possible streets).

On the other hand the site was magnetically very quiet, though possible lines of features are visible on the survey (Figure 11) that must represent structural components. It is unclear how the geophysical survey relates to the excavation, whose precise location, in the absence of a published report, is not known.



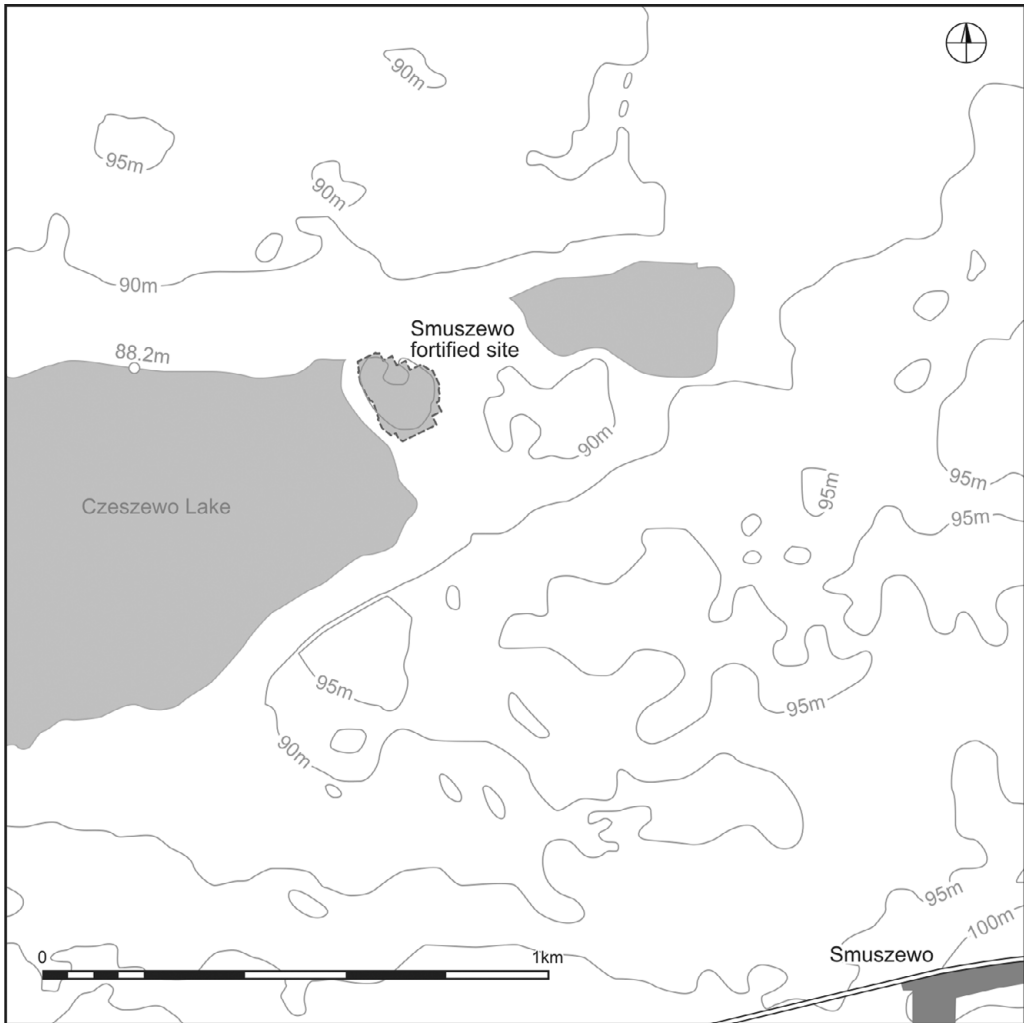


Figure 6. *Smuszewo, district Damasławek: situation plan.*

## Dating

As part of the project, and with the aim of elucidating the hitherto rather imprecise chronology of the Early Iron Age sites of Biskupin type, timbers were sought at Sobiejuchy and Izdebno, and also at the island site of Ostrowite Trzemeszeńskie (Figure 2), where a stockade site is known to exist, in order to obtain dendrochronological dates. As mentioned above, the radiocarbon calibration curve is flat at this point in the first millennium BC (cf. Harding *et al.* 2004: 175-6) but sites of this type are ideal for dendrochronological dating, and at Biskupin a substantial series of dates has already been obtained (Ważny 1994, 2001, 2009).

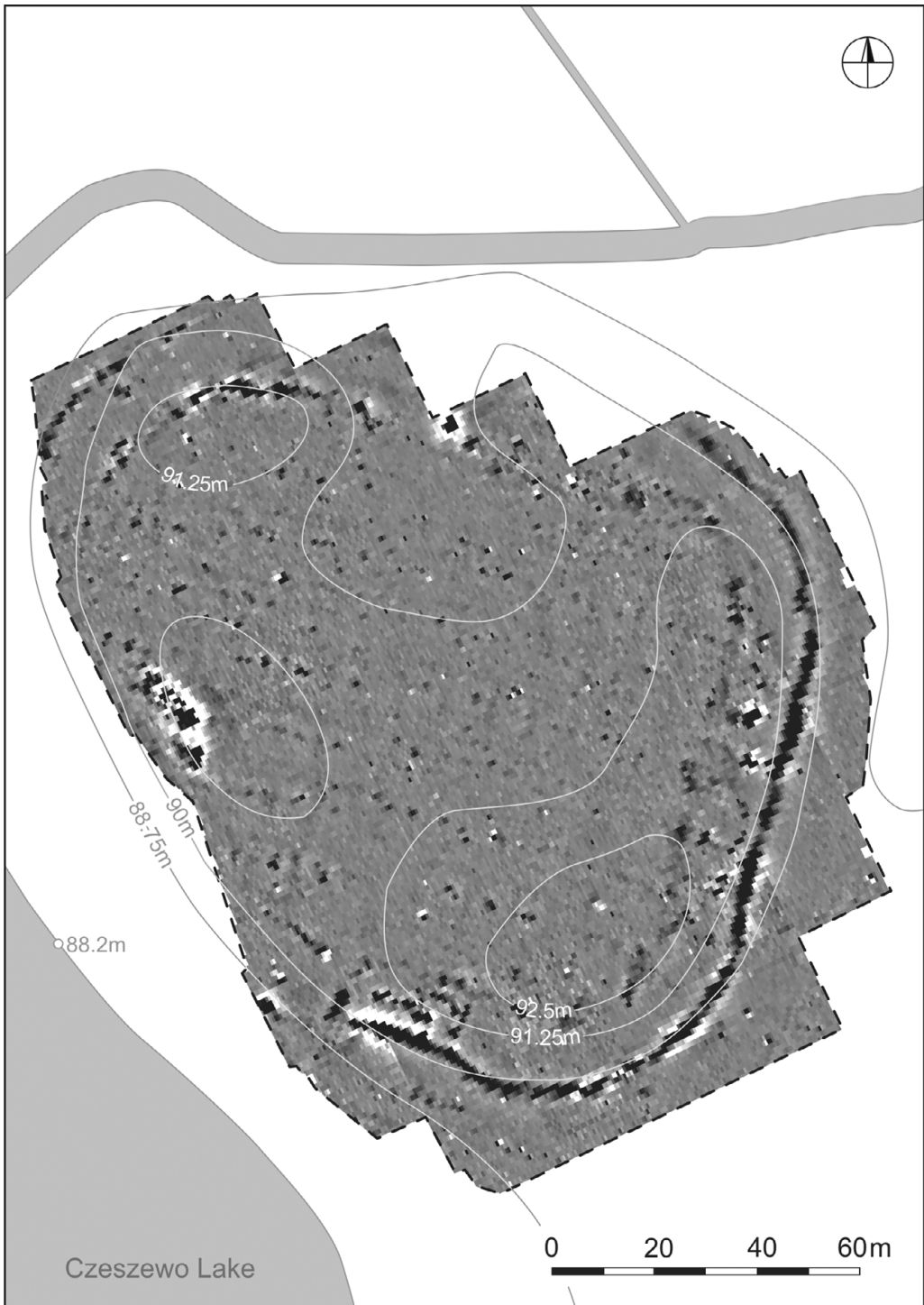
No timbers were visible at Izdebno, though they have been noted in the past and were present in excavation. Timbers were recovered at Sobiejuchy and Ostrowite Trzemeszeńskie



Figure 7. Smuszewo: aerial photograph, 2006.

and dendrochronological analysis was carried out by Tomasz Ważny (Cornell/Toruń). At Sobiejuchy, a small cutting was made into the site terrace where the Polish excavations of the 1950s had taken place (Figure 12). A machine with narrow front bucket was used and timber was quickly found. The timbers noted in 1959 were seen at a depth of around 2.5m, and ten piles (and some fragments) were extracted for dating purposes. Six of the ten came from a line lying in the easterly part of the trench; the remainder from the middle and western part. It was unclear whether the western timbers formed another line, but this seems likely given that Bukowski found two lines forming a timber-framed rampart.

Ważny's study indicates that the most likely felling date for the Sobiejuchy timbers was within a few years of 750 BC. This compares with the date of 738-737 BC for the felling date of timbers of the 'first phase' at Biskupin (Ważny 1994), while his subsequent work (Ważny 2009: 61) which dated samples from the western part of the Biskupin Peninsula confirmed that the vast majority of timbers originate from felling activity in 739-736 BC, though the range is wider than before at 750 to 708/7 BC. The difference between the two sites is not great, but there are other reasons for believing the Sobiejuchy material to be a little older than that from Biskupin (Harding *et al.* 2004: 174-5), which this gap would allow. It is notable, for instance, that little or no material uniquely characteristic of Ha D has been recovered from Sobiejuchy, such as Encrusted Pottery; it is, however, present at Biskupin (Mikłaszewska-Balcer 1991), where certain metal forms are also believed to fall in



*Figure 8. Smuszewo: geophysical survey plan, 2004.*

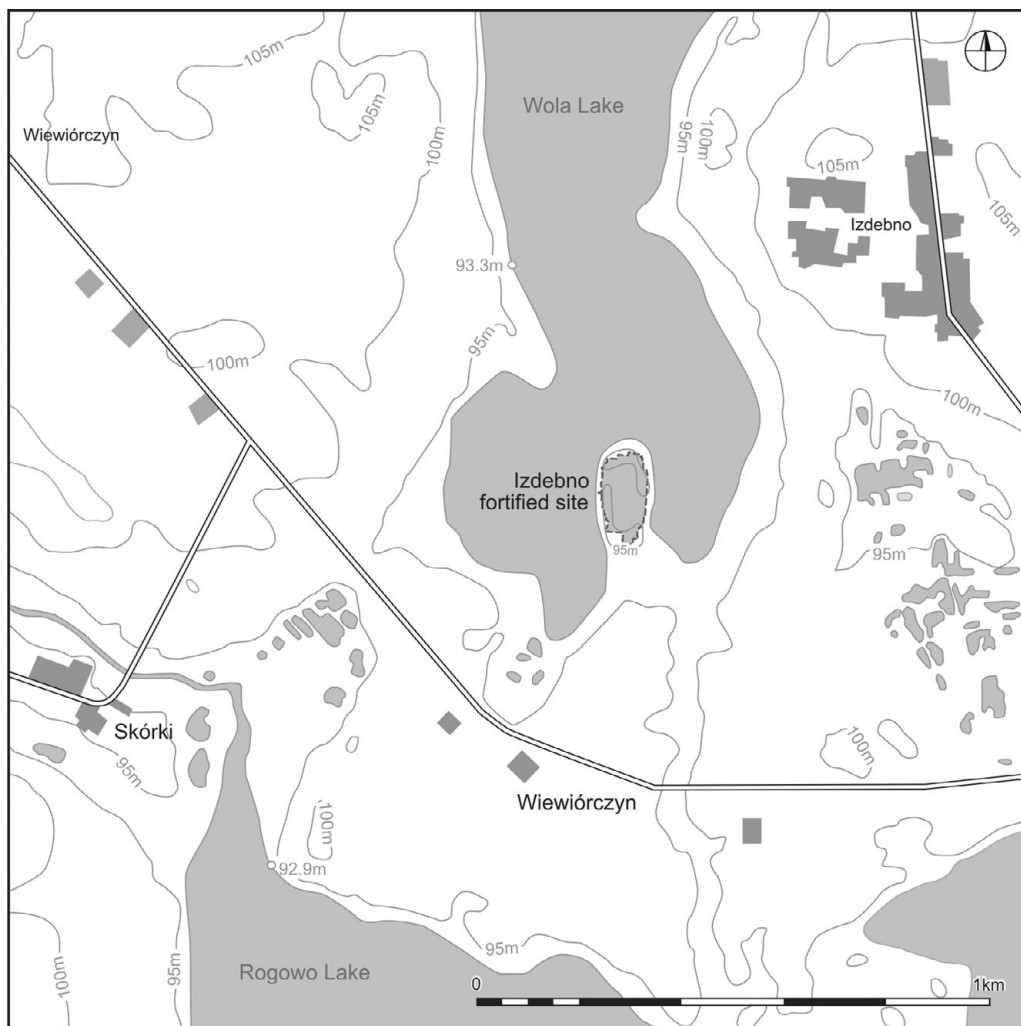


Figure 9. Izdebno, district Rogowo: situation plan.

that period. The majority of datable material at Sobiejuchy falls in Ha C, though it cannot be ruled out that it continued later than this, as some metal forms have a long lifespan.

At Ostrowite Trzemeszeńskie two wooden piles were extracted from the lake muds at the southern end of the island and dating is available for one of them (Figure 13). Its most likely felling date is 706 BC, which falls significantly later (40-50 years) than either Sobiejuchy or Biskupin, but with a single date available at present not too much can be read into this. The same is true for Izdebno, where the single date obtained so far, 'around or after 729 BC', lies between the two extremes represented by Sobiejuchy and Ostrowite (Ważny 2009).

The dendrochronological dates thus obtained clearly indicate a date in the mid-eighth century BC for Sobiejuchy. This confirms, but also adds much greater precision to, the date range obtained by radiocarbon and thermoluminescence for the site (Harding *et al.* 2004:



*Figure 10. Izdebno: aerial photograph, 2005. Note possible lines of structures showing in the grass.*

175-9). Because of the difficulties of using radiocarbon for the time period in question, a broad span between 760 and 410 cal BC was suggested. It is clear now that the earlier part of that time bracket is involved.

## **Discussion**

The results from the sites surveyed in 2004-5 are important and revealing in a number of respects. First, they confirm that Biskupin was not alone in having regular rows of structures filling the entire enclosed area: this pattern is present at Smuszewo and probably present at Izdebno. A similar pattern can be reported from the Jurkowo site (Figure 2), which was found from the air by one of us (Nowakowski & Rączkowski 2000), surveyed in 2004, and partially excavated by a Polish team in 2000. Secondly, and possibly more importantly, they show that a quite different arrangement of structures was used at the near-contemporary site of Sobiejuchy. Here the houses were not arranged in such regular rows, and they did not cover the entire site interior – which at 6ha is in any case much larger than the other sites considered here. Sobiejuchy lies only 14km from Biskupin, and may have been slightly earlier in date (see above); but it is close enough in time and place that the inhabitants of one site must have been aware of those of the other. Instead, it may be argued that a different type of social organisation was present at the two sites, that at Sobiejuchy being of a looser, and arguably less risk-prone, nature than that at Biskupin.



Figure 11. Izdebno: geophysical survey plan, 2005.

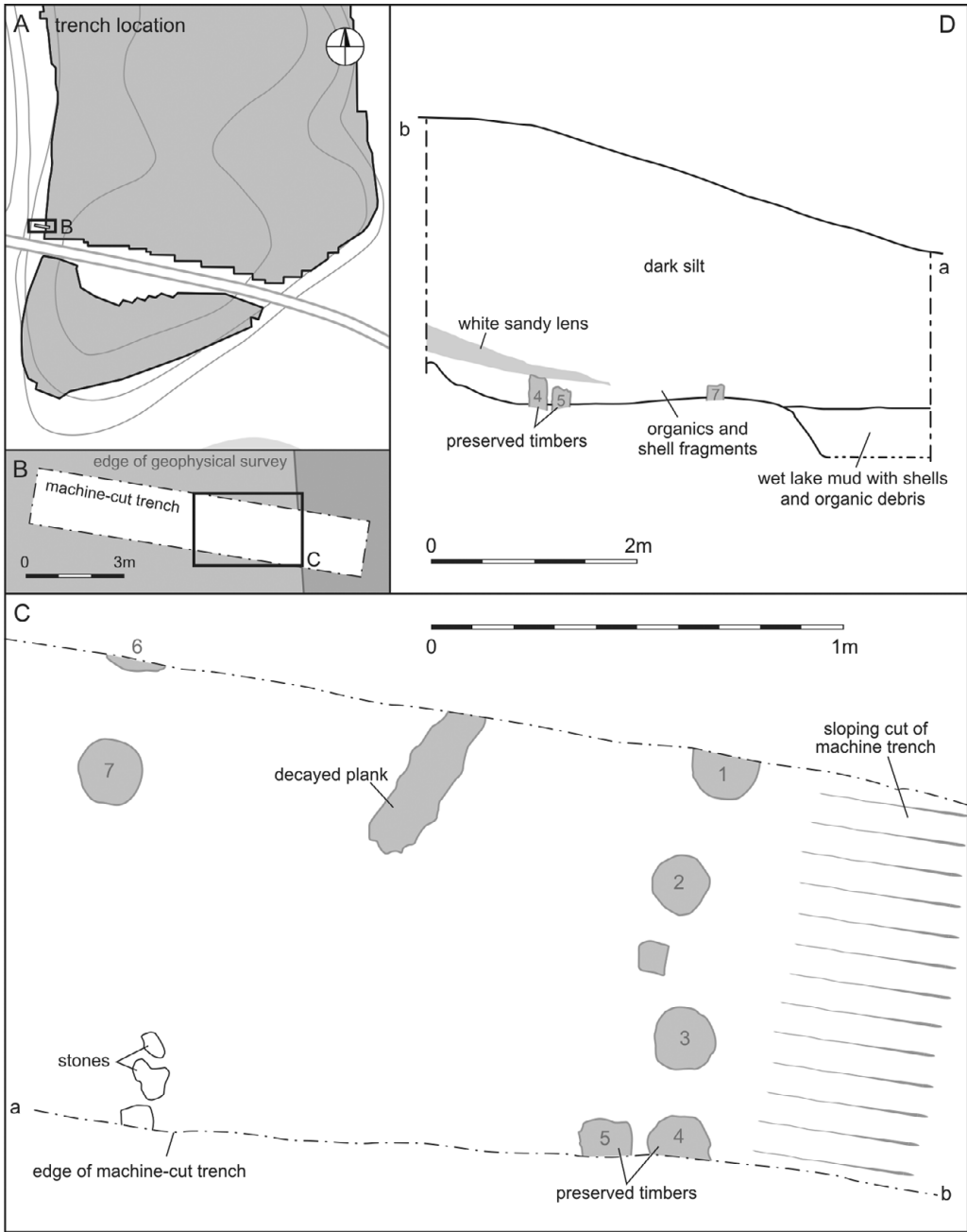


Figure 12. Sobiejuchy: A-B) location plans for the trench dug in 2005 to recover rampart timbers; C) sketch plan of the trench showing recovered timbers (numbered); D) north-facing profile of the trench.



Figure 13. *Ostrowite Trzemeszeńskie: post recovered from lake bed at southern end of site (photograph: Marcin Michalski).*

Was the ‘Biskupin type’ then the standard stockade of the Early Iron Age in north-western Poland? Clearly the lakeside site, surrounded by a wood-framed rampart, with regular rows of houses in the interior, was a major element of settlement patterning in that area and period. On the other hand, it is clear from the surveys reported here that other forms of house and street organisation were also possible.

It has been pointed out on occasion that sites like Biskupin must have been unstable politically and socially, with all the inhabitants crowded into a confined space, perhaps with their animals as well; there is no open area for gatherings, recreation, or neighbour and spouse avoidance; craft activities, including perhaps even metallurgy and pot-firing, took place on the sites; subsistence, on the other hand, was dependent on the mainland, so that all food must have been brought in by boat, and all agricultural activities necessitated a journey to the mainland, and no doubt some way into the hinterland. If the ramparts were intended to deter hostile attack, they may have succeeded in that goal for a time but they simultaneously brought about the danger that the islanders could be cut off from their source of food and other resources. If human rather than environmental explanations are to be sought for the rise and fall of Biskupin and related sites, then the inherent structural instability of the settlement form must surely emerge as a highly plausible candidate.

Seen in this light, the internal organisation of Sobiejuchy can be seen as greatly preferable to that of Biskupin or Smuszewo. The defences and the island situation, however, still emerge as crucial weaknesses in the organisational scheme.

It has been shown before now that the traditional chronology for Ha C established by Kossack, Müller-Karpe and others for Germany and adjacent areas needs to be revised somewhat; in particular that the start date for Ha C falls much earlier than the 700 BC that they advanced. Wood from the Wehringen waggon-grave (Wehringen I ‘Hexenbergle’, Tumulus 8: Hennig 2001: 259-68) has an estimated felling date of  $778 \pm 5$  BC, the last measurable ring being 793 BC, with some 15 years allowed for the sapwood (Friedrich &



Hennig 1995, 1996; Friedrich 2001), while the latest dates for Ha B3 contexts on the Swiss lakes are all earlier than 800 BC. These datings confirm the arguments by Pare for an early phase of Ha C characterised by Gündlingen swords (into which the Wehringen grave falls) (Pare 1987), and by Parzinger for a start date around 750 BC (Parzinger 1989; Parzinger *et al.* 1995).

The new dendrochronological dates obtained here are in perfect accord with these arguments. On the other hand, the recent dating of timber in a Ha C grave in the Isis and Great Mother sanctuary in Mainz to 704 BC suggests that Ha C may have been a long period (Bauer 2008). The dendrochronological dating of the south German Iron Age has recently been reviewed by Billamboz (2008); the present work adds new material of some relevance to his survey, which bears only indirectly on the problem in hand.

## **Conclusion and prospects**

It is abundantly clear that there were two – or more – site types in use in the Early Iron Age of north-western Poland at this time. On the face of it, the Sobiejuchy type may have been the more likely to succeed: one of the crucial objections to the sustainability of the Biskupin type was the fact that there is no open space in the site where people could meet. The size of Sobiejuchy may be another pointer here: at nearly 6ha it is roughly four times larger than Biskupin, with potentially a considerably larger population, no doubt with varied craft and other skills to match. It is uncertain if flooding played a part in the demise of Biskupin, but Sobiejuchy seems always to have been dry land even though separated from the mainland by water or boggy ground. The question of environmental changes during the course of the eighth century BC is a large one which cannot be considered here, though it may be crucial for an understanding of why Biskupin and related sites came to exist and why they then collapsed.

If, as discussed above, there is a small time difference between Sobiejuchy and Biskupin, the scene is set for a dynamic relationship between these two sites, and no doubt between these two and Izdebno, where we have only one dendrochronological date so far. Clearly, in order to specify this relationship in greater detail, we need a greatly expanded programme of dendrochronological dating, so that the phases by which the ramparts at the sites came into being can be specified; by that means, one could see whether adaptation and refortification (as is alleged for Biskupin) took place as a result of, or concurrent with, activities at neighbouring sites. Potentially a highly detailed picture could be obtained; one which could hardly be rivalled in European prehistory.

This does raise the question of the sequence of events at Biskupin, the most extensively excavated site of all those discussed here, and the site with the most recovered wood. From the earliest stages of excavation it has been repeatedly stated that two phases are present on this site; the second following a conflagration which destroyed the first, and used less oak. This is a matter which requires detailed investigation, since the reports from the first 15 years of excavation give little clear indication to support the idea (no section drawings, many ambiguities on the published plans, no clear typological sequence). Coupled with these doubts one may add that the dendrochronological dating gives no indication of two phases, merely that some timbers were still being brought on to the site after the main felling

period, and indeed up to 40 or so years after the fort was first constructed (although we do not know for sure when that first construction took place). Ważny's recent work (2009) confirms this picture, suggesting that repairs took place at Biskupin over a period of 30 years or so, with an eventual abandonment in 708 BC. This date naturally raises questions over the cultural affinities of the site, since it is far too early for Ha D – a start for which cannot be much earlier than the latter decades of the seventh century BC. This suggests that the material attributed to Ha D at Biskupin did in fact start earlier than that.

These doubts can be conclusively laid to rest, however, if a systematic programme of dating were to take place, not only at Biskupin (where there are now more than 120 dendrochronological dates) but elsewhere. It should be easy enough to get more timbers from Izdebno, and the same type of programme might be applied to other microregions, for instance that at Jankowo near Kruszwica (itself also a prehistoric and early medieval fortified site, perhaps of 'Biskupin type') – which was dug as a rescue project in the 1970s prior to flooding when the lake level was raised (Ostoja-Zagórski 1978).

The work reported here is therefore merely a start, but it has demonstrated some of the potential of what are now routine methods used in archaeology. Some of them involve expense, and some time; but all are accessible. It is to be hoped that other researchers will now take up the challenge.

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