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THE DATE AND INTERNAL ORGANISATION OF EARLY IRON AGE FORTIFIED SITES IN NORTH-WESTERN POLAND: NEW RESULTS FROM GEOPHYSICAL SURVEY AND DENDROCHRONOLOGICAL DATING

Geophysical and aerial survey of a number of Early Iron Age sites in central Poland has produced information on the internal organisation of these sites that contributes to the question of the so-called "Biskupin type". In particular, a new plan of Sobiejuchy suggests that the type of spatial organisation present there was significantly different from that at Biskupin, Izdebno and Smuszewo. Samples for dendro dating were also obtained which suggest that the main period of use of Sobiejuchy was a little earlier than that of Biskupin. A single date was also obtained on a post from Ostrowite Trzemeszeńskie. Together these contribute to the question of the start date of Hallstatt C in Central Europe, the period to which the material culture of these sites mainly belongs.

KEY-WORDS: geophysical survey, aerial photographs, dendro dating, Biskupin, Sobiejuchy, Early Iron Age

INTRODUCTION

The Early Iron Age site of Biskupin in central Poland has been well known to archaeologists for many years, 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 stockade of the period (Fig. 1), and for the pioneering techniques which were used in its investigation, including balloon photography, the construction of a caisson to create suitable conditions for excavation, and for the reconstruction of the rampart and several internal buildings on the site. Although one part of the site remains unexcavated, the recovered plan shows thirteen parallel rows of buildings that ran through the interior, with an internal street running round the inside of the rampart and breakwaters or defences of oblique pointed posts lying outside (Kostrzewski 1950).

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

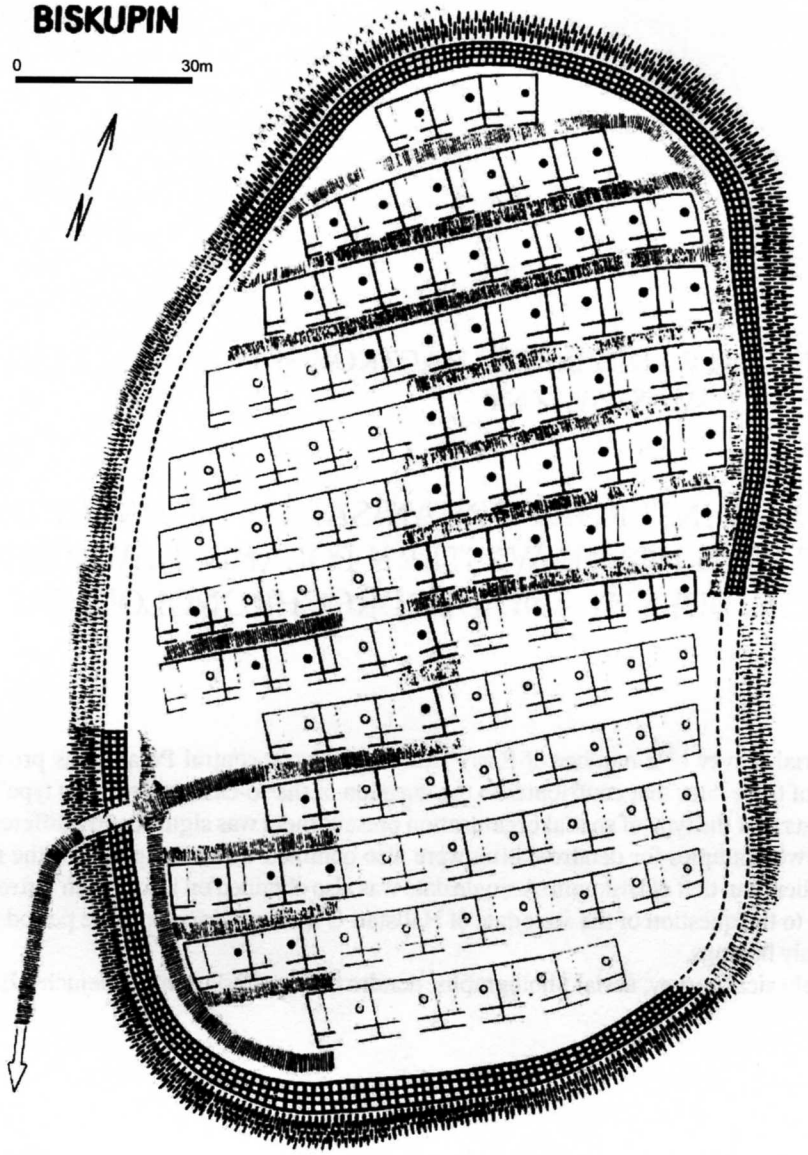

Fig. 1. Biskupin, district Żnin: plan of the excavated areas of the site

ca 700 BC and the start of Ha D at ca 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 peninsulas in or on the shores of lakes, and (where excavation took place) dating to the Late Bronze and Early Iron Ages. Although published excavation results to support this notion were few, the notion of a Biskupin "type" arose. Sites of this type were similar in date and function to other Early Iron Age forts in Central Europe, including those on hilltops, but were 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. Excavation took place at some of these sites, usually on a relatively small scale: that at Sobiejuchy, Jankowo and Izdebno may be mentioned. The problems of the sites, in terms of their function and their relatively short lifespan, were addressed on a number of occasions (e.g. Ostoja-

Zagórski 1976; 1991; Niesiołowska-Wędzka 1974; 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.

PROGRAMME OF WORK AND METHODS

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 work on several of these sites was undertaken in the summers of 2004 and 2005. The work consisted of geophysical surveys (using a gradiometer) supported by aerial survey, and the collection of wood samples for dendrochronological dating[1]. In 2004 the instrument used was a Geoscan FM256 single-sensor gradiometer, belonging to the University of Durham. In 2005 a Bartington 601 dual-sensor gradiometer with two fixed sensors 1 m apart was used, belonging to the University of Exeter. The latter machine enabled rapid progress to be maintained, the main barrier to even swifter progress being the need to lay out grids on the sites. The results have been processed using the software Geoplot (produced by Geoscan Research Limited).

In 2005 the grids were georeferenced using a Leica differential GPS 1200 system. Considerable difficulty was experienced in fitting this to the available Polish maps (1965 system at 1:10 000), whose coordinate system is not a standard one, so that simple conversion to the European Standard Grid or latitude and longitude is possible only with difficulty; only after the application of a transformation package applied by Sławomir Królewicz was a fit possible. Most recently, orthophotomaps have become available, which would easily facilitate carrying out work of this kind.

Aerial photography in the region has most commonly been linked with Biskupin, where it was used to document the progress of excavations in the 1930s. After World War II several aerial photographs were taken of sites like Sobiejuchy, Izdebno or Jankowo, but they mostly played an illustrative role in presenting the location of sites (Kobyliński 2005). The discovery of the settlement at Jurkowo in 1999 (Nowakowski, Rączkowski 2000) has moved the interests of some archaeologists towards the potential of aerial photographs in the investigation of Biskupin-type settlements. The aerial photographs analysed here were taken during aerial survey managed within other projects carried out by the *European Landscapes: past, present & future* Project, the Archeological Museum in Biskupin, and Wojewódzki Konserwator Zabytków in Poznań. Air photographs have been rectified using AirPhoto, facilitated by the availability of these orthophotomaps and maps at 1:10 000 converted to the 1992 system.

Dendro samples were taken from Sobiejuchy and Ostrowite Trzemeszeńskie. No timbers were visible at other sites, though it is known that they exist in some cases.

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[1] Funds for the programme were provided jointly by the two Academies, covering the cost of travel, subsistence, laboratory costs, and image processing. The official partner on the Polish side is Professor Janusz Ostoja-Zagórski (Institute of Archaeology and Ethnology of the Polish Academy of Sciences and the Kazimierz Wielki University in Bydgoszcz), but the two authors are the active participants. Thanks are expressed to the two Academies for financial support. Professor Romuald Schild, at the time Director of the Institute of Archaeology and Ethnology of the Polish Academy of Sciences was of enormous assistance. The work on the ground was carried out by the first author with the assistance of Marcin Michalski, Lidia Żuk and Darryl Freer; air photography was carried out by the second author, who also organised the ground-based survey work. The post-survey mapping was initially carried out by Chris Carey, with notable assistance with map transformation being provided by Sławomir Królewicz. The final form of the plans is presented thanks to work in Exeter by Brynmor Morris.

THE RESULTS BY SITE

Six sites were surveyed (Fig. 2): Smuszewo, district Damasławek; Izdebno, district Rogowo; Pudliszki Site 5, district Krobia; Tarnowa, district Pyzdry; Jurkowo, district Krzywiń; and Sobiejuchy, district Żnin. A small area was also surveyed inside the rampart at Biskupin. Survey was impossible at two further candidate sites because of difficulty of access or the overgrown nature of the sites: Ostrowite Trzemeszeńskie, district Trzemeszno (which nevertheless provided timber for dating purposes), and Koziegłowy, district Kleczew. The results from Pudliszki are not presented here as the site is very disturbed and our work was limited in extent; a more extensive programme of work, including geophysical survey and excavation, was subsequently conducted by a team from Poznań and Kiel universities (Jaeger *et al.* 2008).

Aerial photographs of all these sites were taken by Rączkowski either in 2004-5 or subsequently; only the photographs of Jurkowo (the subject of interpretation here) were taken back in 1999. Most of the settlements are located in low, marshy areas, which means that cropmarks or grassmarks were unlikely to be found. Only Smuszewo is located on higher land, and the area of the site cultivated.

Sobiejuchy (Figs. 3-5)

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 6 ha, 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 (Fig. 3). Work in the 1950s showed that the date of the occupation was close to that of the much better known Biskupin, some 14 km 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.

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 Geoscan FM18 gradiometer in 1988 producing a remarkable pattern of streets and buildings (Harding *et al.* 2004, 36 ff., 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 2004), much has improved in terms of speed and the ease of manipulation of the resulting data, while georeferencing using differential GPS enables rapid and highly accurate placing of survey grids onto maps. Somewhat more troubling, however, was the scepticism voiced by some colleagues to whom the survey plans were shown prior to publication. These plans show a site that is completely different in layout and organisation from the regimented lines apparent at Biskupin, and repeated on other sites (if preliminary reports and very partial excavation are anything to go by), such as Izdebno, district Rogowo (Romanowska-Grabowska 1982), or 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 to be worth-while to repeat the exercise, but covering the entire site instead of only the central areas.

The new survey was carried out over three days in August 2005. The entire site was surveyed using traverse intervals of 1 m (east-west) and sample in-