Technology of Sword Blades from the La Tène Period to the Early Modern Age

The case of what is now Poland

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Cover illustrations: Sword blade from Bydlin, the Olkusz District, Lesser Poland, c. AD 350-500 Osterburken-Vrasselt Type, Subtype 2 (M. Biborski, J. Ilkjær), Illerup-Wyhl Type (Ch. Miks) Top: macrostructure of the sample with spots of microscopic observations, and a schematic distribution of structure components and hardness tests; Bottom: martensite near the edge of the blade

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Introduction

The Aim of the Project

This work is an outcome of a research project on the technology of manufacture of sword blades in the territory of what is now Poland (research grant of the National Science Centre, Kraków, Poland, No. N N109 051438). It was initially planned to focus on Late Roman, Migration and Medieval blades; however, in the course of research it was decided to broaden the source base with some available finds from earlier periods.

The main reason behind this project was the fact there was a significant number of La Tène, Pre-Roman and Roman Period swords from the area in question which underwent technological examinations. On the other hand, the number of examined Migration Period, Medieval and Early Renaissance blades has been relatively low. It was possible to examine 45 sword blades. Thanks to this, the total number of examined blades from the territory of what is now Poland exceeds 130. This allows for a more comprehensive analysis of sword blade technology from the La Tène Period to the beginning of the Modern Era.

Most swords which are discussed in this work have already been dealt with in previous scholarship. It was decided, however, to carry out a thorough analysis of their typochronology, as in this way new conclusions could sometimes be proposed (Chapter 1). The same concerns marks and inscriptions on the discussed swords – based on these features, it was possible in some cases to suggest their provenance (Chapter 2). Results of technological examinations are presented in Chapter 3. They are provided with a comprehensive discussion on technological types of sword blades and the chronological framework of individual technological solutions. Furthermore, the issue of identifying the provenance of artefacts based on their technology of manufacture is dealt with. In this part of the work, the examined blades are discussed against the background of previous research on sword manufacture technology in what is now Poland and in other areas of Europe. All research results are summarised in Conclusions. All swords are provided with their unique identification numbers (ID No.), which correspond to those on the website of the research project (www.gladificium.org). On the other hand, as these numbers are not consecutive, all finds were provided with new consecutive numbers, according to their typochronology.

Previous Research

It is worth making some general remarks on previous research on sword blade technology in what is now Poland and to discuss some more important works concerning other regions of Europe. Worth mentioning are also works dealing with typochronology, ornamentation and marks on swords. For the sake of brevity, this overview includes only the most relevant works.

Modern research on sword blade technology in today's Poland was pioneered by J. Piaskowski. His interest was in research in ancient metallurgy and ironworking, including the manufacture of weaponry (Piaskowski 1956). In 1959, he published a brief but informative paper on the technology of sword manufacture from prehistory to the 15th c. (Piaskowski 1959b). Some years thereafter, J. Piaskowski published a major work where he put forward his theory of the so-called 'Holy Cross Mountains Metal.' He claimed that based on a number of traits (low phosphorus content; uneven and rather low level of carburising; shape of metal grains and slag inclusions plus several other traits) it was possible to identify iron artefacts made in the Holy Cross Mountains region in the Antiquity with the use of local low phosphorus ores (Piaskowski 1963a; 1963b). J. Piaskowski continued to use his theory in his later works, also with regard to the issue of the provenance of La Tène and Roman Period swords. Recently, the theory of the 'Holy Cross Mountains Metal' was questioned by Z. Kędzierski and J. Stępiński (Kędzierski, Stępiński 2006).

Enormously important are studies on Pre-Roman and Roman Period swords carried out by M. Biborski, P. Kaczanowski, Z. Kędzierski, and J. Stępiński. In 1978, M. Biborski published an extensive work on Roman Period swords in the territory of the Przeworsk Culture, where he also discussed the issue of technology and provenance of blades (strongly influenced by J. Piaskowski's theory) (Biborski 1978). In 1981, M. Biborski, P. Kaczanowski, Z. Kędzierski, and J. Stępiński published results of technological examinations of a series of Roman Period swords from the Przeworsk Culture cemeteries in Chmielów Piaskowy and Gać (Biborski, Kaczanowski, Kędzierski, Stępiński 1981). A year thereafter, these scholars presented a classification scheme of technology of Roman Period blades and stated that the technology of manufacture could be successfully used as an auxiliary criterion in defining the provenance of swords (Biborski, Kaczanowski, Kędzierski, Stępiński 1982). This classification scheme was used by these authors in their later works (e.g., Biborski, Kaczanowski, Kędzierski, Stępiński 1986; 1997; 2002; 2003; Biborski, Kaczanowski 2003). Quite recently, M. Biborski and J. Ilkjær published a comprehensive study on Roman Period swords from the bog deposit at Illerup Ådal against a broad European background. Questions of blade manufacturing technology were also dealt with and a new version of the classification scheme of technology was presented (Biborski, Ilkjær 2006). This classification scheme (with some modifications and developments)

is used in the present work. It could be also added that issues of technology of Migration Period, Medieval and Renaissance sword blades were dealt with in other works of M. Biborski and J. Stępiński, with a co-operation by G. Żabiński and P. Pudło (Biborski, Pudło, Stępiński, Żabiński 2012; Biborski, Stępiński, Żabiński 2011a; 2011b; 2006; 2004). With regard to other works concerning sword blade technology in what is now Poland, one must mention papers of A. Mazur and E. Nosek (Mazur, Nosek 1973), J. Dunin-Karwicki (Dunin-Karwicki 1978), M. Cabalska and W. Mazur (Cabalska, Mazur 1982), L. Klimek, P. Kucypera, P. Kurasiński, and P. Pudło (Klimek, Kucypera, Kurasiński, Pudło 2009/2010), and K. Rybka (Rybka 2011). From a historian's point of view, problems of weaponry manufacture (including swords) were discussed by J. Szymczak (e. g., Szymczak 1989; 1990; 1998).

Concerning other regions of Europe, extensive studies on the technology of weaponry (including sword blades) in the Baltic Sea region were carried out by A. K Antein (Anteins 1966; Antein 1973). B. A. Kolčin examined a series of Early Medieval sword blades from Rus (Kolčin 1953). Numerous swords from the territory of the Czech Republic were analysed by J. Košta, J. Hošek and P. Žákovský, sometimes with support from other researchers (e. g., Hošek 2003; Hošek, Košta 2006; 2011; 2013 – with a critical discussion of A. R. Williams' theory of Central Asian crucible steel in Early Medieval sword blades, see below; Hošek, Košta, Bárta 2012; Košta, Hošek 2008; Žákovský, Hošek, Sedláčková 2013). Research results on several Early Medieval sword blades from Scandinavia were published by L. T. Bergman and B. Arrhenius (Bergman, Arrhenius 2005).

The technology of some Migration Period Lombard swords was discussed by V. La Salvia (La Salvia 2007; 1998). A series of La Tène Period and Roman Period swords from Britain was examined by J. Lang (Lang 2006; 1988). In 1986, R. F. Tylecote and B. J. J. Gilmour discussed the technology of numerous sword blades from Britain (Tylecote, Gilmour 1986). Three years thereafter, J. Lang and B. M. Ager published results of X-ray examinations of nearly 150 Anglo-Saxon and Viking Period blades from the British Museum. This significant study, although it is perhaps influenced by certain local peculiarities, demonstrates some important technological trends in the manufacture of sword blades, with special reference to the role of pattern-welding (Lang, Ager 1989).

Of crucial significance for the manufacture of La Tène Period sword blades is the book of R. Pleiner (Pleiner 1993). This author pointed to a variety of technological solutions (including pattern-welding) and proposed his own classification scheme. R. Pleiner says that the quality of swords from the period in question is very diversified. There were many blades (both one-piece and complex) made from iron or low carbon steel and thus of rather low quality. On the other hand, blades with good or even excellent functional properties can also be found. Furthermore, although there is a series of blades which demonstrate intentional carburising, heat treatment was generally not applied.

A special place is held by works of A. R. Williams. In 1977, this scholar published a paper on manufacturing technology of Medieval European swords (Williams 1977; see also Edge, Williams 2003). In 2007, he proposed a very interesting theory concerning the use of Central Asian crucible steel in Early Medieval sword blades of the VLFBERHT group (Williams 2007; see also Williams 2009a). Eventually, he has recently published a general book on the technology of manufacture of sword blades in Europe from the La Tène Period to the 16th c. Of special value is the fact that he discusses this issue against a broad background of methods of obtaining iron and steel at that time. Individual periods are covered to a different degree in this work (e.g., much less attention is paid to Celtic and Roman swords than to Medieval ones, and much space is devoted to the crucible steel theory). Nevertheless, this book is an excellent summary of hitherto state of research on European sword blades.

Last, but not least, it is necessary to mention the work of V. F. Buchwald and H. Wivel (Buchwald, Wivel 1998). These authors proposed an interesting method of defining the provenance of iron artefacts based on the analysis of the chemical composition of slag, with special reference to the content and proportions of such compounds as SiO_2, Al_2O_3, CaO, K_2O, MgO and V_2O_5. They assumed that differences chiefly resulted from different chemical composition of ores in individual regions of Scandinavia (Buchwald, Wivel 1998). Regrettably, as it turned out impossible to carry out more extensive chemical analyses within the framework of the present research project, this method could not be tried out in practice. It was applied on a broad scale in later works of V. F. Buchwald (Buchwald 2005; 2008).

Concerning more relevant works on the typochronology of swords, Pre-Roman and Roman Period finds were discussed based on contributions by T. Bochnak (Bochnak 2005), Ch. Miks (Miks 2007), M. Biborski and J. Ilkjær (Biborski, Ilkjær 2006), and P. Łuczkiewicz (Łuczkiewicz 2006; 1997a). One must also mention the work of P. Kaczanowski, devoted to Roman weapon imports in the territory of *Barbaricum* (Kaczanowski 1992). For Viking Age swords, the book by J. Petersen is still of fundamental importance (Petersen 1919). Results of newer research were summarised by E. Oakeshott (Oakeshott 2004), Lee A. Jones (Jones 2004), and I. G. Peirce (Peirce 2004). Concerning the problem of territorial distribution of Viking Age swords, the book of M. Jakobsson must be mentioned (Jakobsson 1992). For Viking Age swords in Rus, the book of A. N. Kirpičnikov retains its significant importance (Kirpičnikov 1966a). Concerning Central Europe, valuable remarks can be found in the book of L. Marek (Marek 2005). For regional studies concerning this period, one must mention the books by P. Strzyż (Strzyż 2006) and P. Świątkiewicz (Świątkiewicz 2002). With regard to Early Medieval swords, attention is also drawn to the book

by A. Geibig (Geibig 1991), with a thorough discussion on the chronology of marks, signs and inscriptions on sword blades. As far as the issue of the significant VLFBERHT group swords is concerned, attention is drawn to works of A. Stalsberg (Stalsberg 2011; 2008; 2006).

For the Medieval Period, the typology by E. Oakeshott was used (Oakeshott 2000a; 1964). Worth mentioning is also another book of this author, dealing with Modern Period arms and armour (Oakeshott 2000b). Concerning Central Europe, of enormous significance are works by M. Głosek (Głosek 1984; 1973a; see also newer works by this author, Głosek 1990; 1998). Apart from discussing issues of typochronology and geography of finds, they also offer a thorough analysis of marks and inscriptions on swords. For south-eastern Europe, one must mention the book by M. Aleksić (Aleksić 2007). L. Marek has recently published a thorough analysis of Late Medieval and Early Modern edged weapons in Silesia, with a comprehensive analysis of sword finds (Marek 2008). For the Teutonic Order's state in Prussia, the book of A. Nowakowski must be mentioned (Nowakowski 1994).

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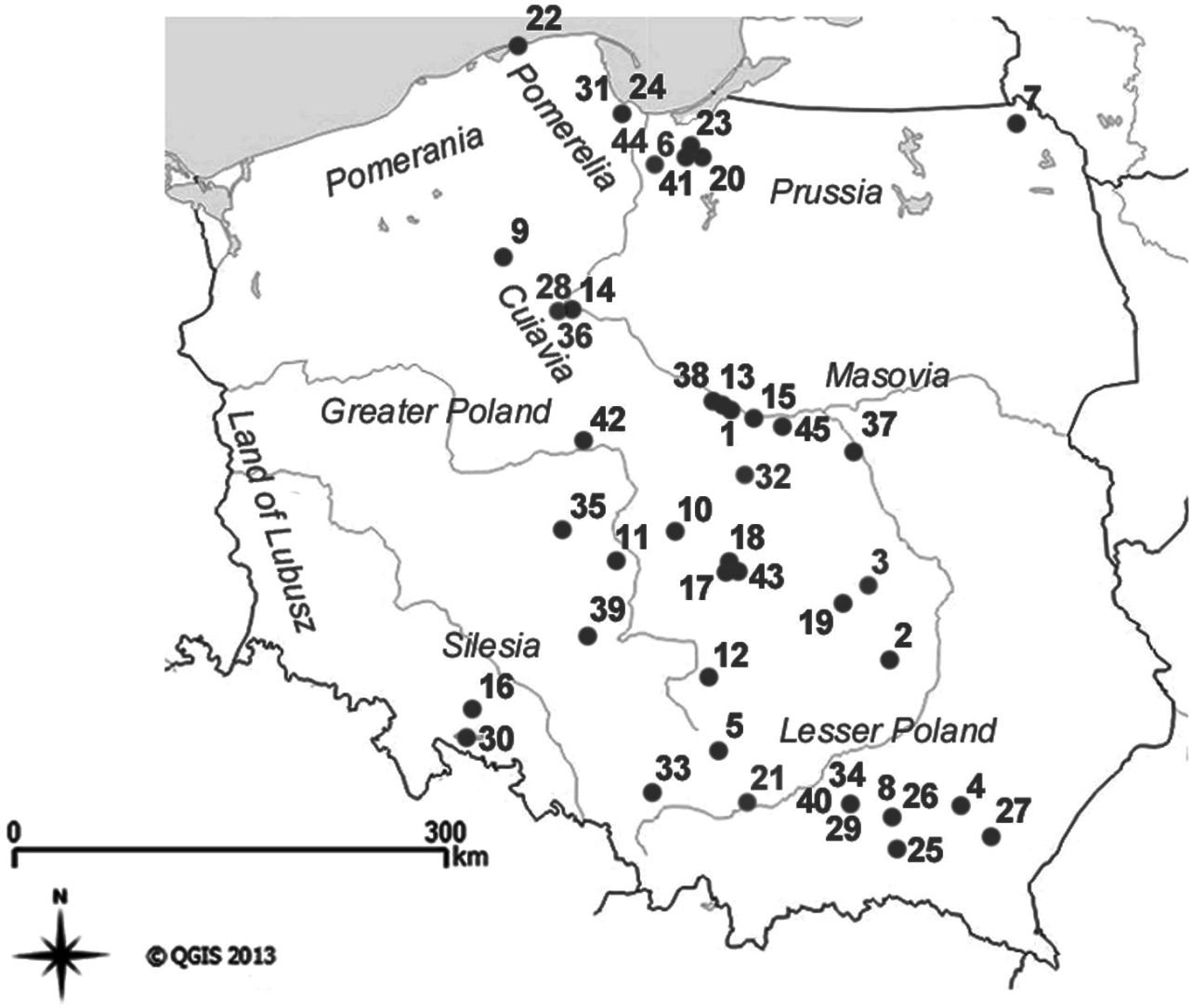

MAP 1. SWORD FINDS WHICH ARE DISCUSSED IN THIS WORK.