

METALLOGRAPHIC ANALYSIS OF A SPEAR FROM THE MECKLENBURG COLLECTION

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The spearhead from Magdalenska gora Tumulus IV, Grave 25 (**Fig. 1**) is in many ways representative of the numerous fine iron objects in the Mecklenburg Collection. Of the over 300 objects of iron from Magdalenska gora in the Collection, 28 % are spearheads of varying sizes and forms. This particular spear was described by Hencken as possessing a »*sharply angular blade*«. ¹ The surface is relatively unweathered, and the haft contained a well-preserved segment of the original wooden shaft. When this wood was selected for botanical and radiocarbon analyses, an opportunity arose to take a sample of the iron for metallographic study. The metal was found to be highly corroded where it had been in contact with the wood, and the wood was metalized where it had been in contact with the metal, and even contained particles of iron that had been diffused throughout by corrosion. The dimensions of the spear are indicated in **Fig. 1**, as is the location of the sample. The original weight of the spear was 120.3 grams. The sample weighed less than one tenth of one gram.

The specific gravity of the sample was measured to be 5, indicating the state of corrosion, as pure iron would be greater than 7, and steel still higher. Metallographic analysis showed the unweathered metal to be completely ferritic, and to contain several long, stringlike slag inclusions running parallel to the long axis of the spear. The grains themselves demonstrate no evidence of mechanical deformation. Hardness testing showed the sample to lie within the range for unworked pure iron.

Chemical analysis on the electron microprobe, performed at the Department of Geology, Harvard University confirmed the above observations and indicated that the metal was not carburized at all. It is pure iron, with only traces of phosphorus and nickel. The corrosion product contains a number of impurities no doubt derived from the nature of the soil and the wood, both of which would have been active in the weathering process. The slag inclusions are basically fayalitic, containing also calcium, phosphorus, magnesium, manganese, and perhaps titanium. In the future it might be possible to identify at least the ore types, and perhaps the ore sources, by considering the compositions of the metal and the slag inclusions together.

The conclusion of the analysis is that the haft of this spearhead was hot-forged from pure bloomery iron. No attempt was made to carburize this sample, to affect its structure by subsequent reheating or quenching, nor to

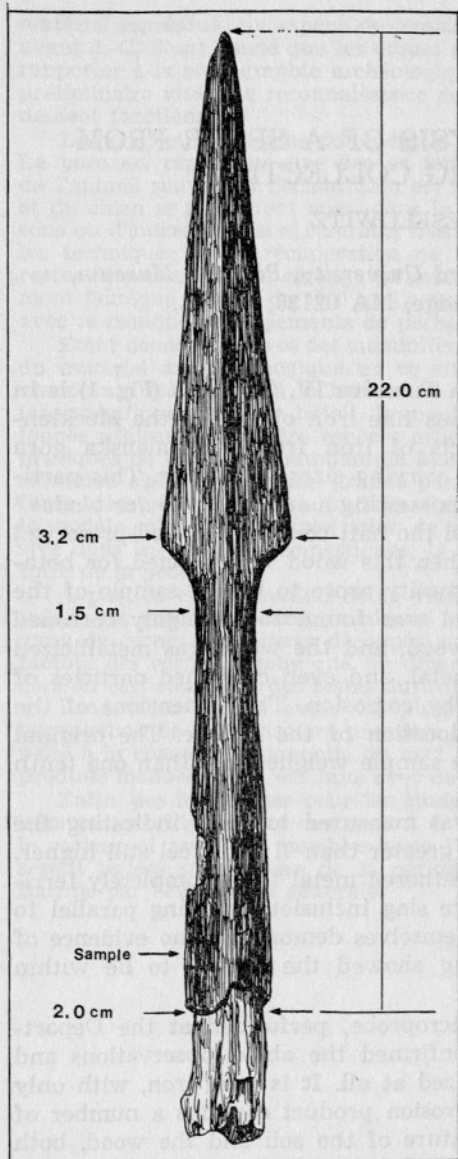


Fig. 1: Dimensions of the spearhead from Magdalenska gora Tumulus IV, Grave 25 and location of sample (after Hugh Hencken, *The Iron Age Cemetery of Magdalenska gora in Slovenia* (American School of Prehistoric Research Bulletin 32, Mecklenburg Collection, Part II), Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Mass., 1978: Figure 63n, p. 119).

Drawing courtesy of the Peabody Museum, Harvard University.

Sl. 1: Mere sulične osti z Magdalenske gore, gomila IV, grob 25 in mesto vzorca (po: Hugh Hencken, *The Iron Age Cemetery of Magdalenska gora in Slovenia* (American School of Prehistoric Research Bulletin 32, Mecklenburg Collection, Part II), Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Mass., 1978: sl. 63n, str. 119).

Risba: z dovoljenjem Peabody Museum, Harvard University.

affect it by cold-working.² It must be recognized that the smith may have treated the blade separately from the haft. Without analysis of the edge, a final statement cannot be made about the level of technology that went into the production of this spear. The treatment of the haft was, to this researcher, disappointingly simple. This is especially so since the grave in which this spear occurred was dated by Hencken to late in the sequence, either Certosa

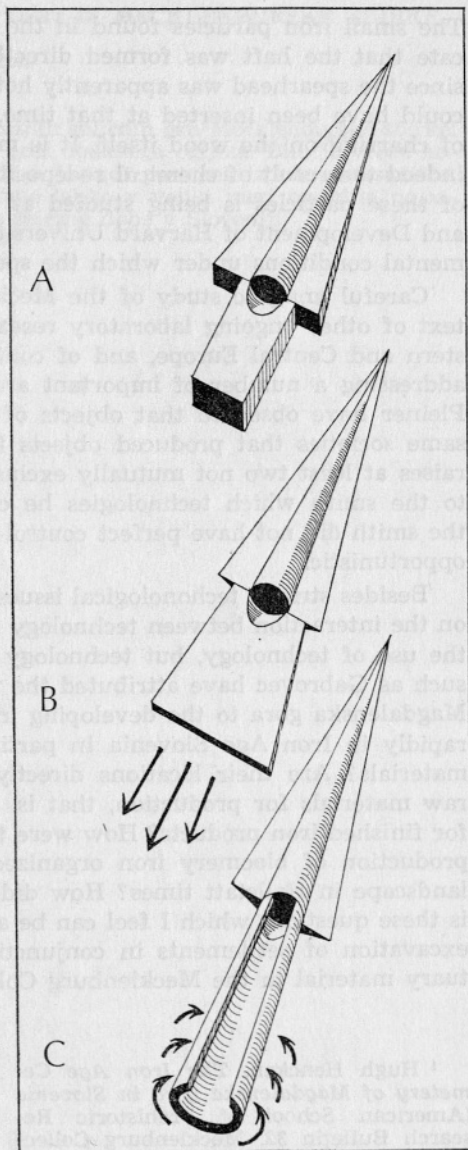


Fig. 2: Reconstruction of the steps involved in the manufacture of the haft. Drawing by T. Cuebas, *Harvard University*.

SI. 2: Rekonstrukcija posameznih stopenj v izdelavi nasadišča.

Risba: T. Cuebas, *Harvard University*.

or Negau,³ which would place it around 500—300 B. C.⁴ In fact, within this span, spears of this sort were more numerous towards the end, in Negau 2.⁵

One fact can be ascertained about the construction of the spear from the orientation of the slag inclusions. The haft must have been first formed as a bar, then flattened along the long axis of the spear. This flattened piece would then have been rolled to form the haft. This process is illustrated in **Fig. 2**.

The small iron particles found in the wood and mentioned above could indicate that the haft was formed directly around the wooden shaft.⁶ However, since the spearhead was apparently hot-forged, it seems unlikely that the wood could have been inserted at that time, especially since there was no evidence of charring on the wood itself. It is more probable that the iron particles are indeed the result of chemical redepositon during weathering. The exact nature of these particles is being studied at the Center for Archaeological Research and Development of Harvard University in order to shed light on the environmental conditions under which the spear was buried.

Careful analytic study of the Mecklenburg Collection, viewed in the context of other ongoing laboratory research on the Iron Age metallurgy of Eastern and Central Europe, and of continued excavation, holds the promise of addressing a number of important archaeological issues. Researchers such as Pleiner have observed that objects of simple construction were made by the same societies that produced objects forged from more than one steel.⁷ This raises at least two not mutually exclusive possibilities: Either society dictated to the smith which technologies he could apply to which circumstances, or the smith did not have perfect control over his craft, and had to be somewhat opportunistic.

Besides strictly technological issues, an analysis of this kind can shed light on the interaction between technology and society. Not only can society dictate the use of technology, but technology can in its turn affect society. Scholars such as Gabrovec have attributed the fluorescence of such sites as Stična and Magdalenska gora to the developing iron industry.⁸ Did these centers develop rapidly in Iron Age Slovenia in partial response to a demand for new raw materials? Are their locations directly attributable either to the location of raw materials for production, that is, iron ore, or to the position of markets for finished iron products? How were the procurement of the iron ore and the production of bloomery iron organized and distributed across the Slovenian landscape in Hallstatt times? How did this change in the La Tene period? It is these questions which I feel can be answered by a combination of continued excavation of settlements in conjunction with systematic study of the mortuary material in the Mecklenburg Collection.

¹ Hugh Hencken, *The Iron Age Cemetery of Magdalenska gora in Slovenia* (American School of Prehistoric Research Bulletin 32, Mecklenburg Collection, Part II), Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Mass., 1978: p. 21.

² For one discussion of these processes, see Radomir Pleiner, »Die Herstellungstechnologie der germanischen Eisenwerkzeuge und Waffen aus den Brandgräberfeldern der Südwestslowa-

kei«, *Slovenská Archeológia*, 30—1 (1982): 79—101.

³ Hencken, p. 21.

⁴ Hencken, p. 11.

⁵ Hencken, p. 22.

⁶ Elizabeth Coughlin, personal communication.

⁷ Pleiner, *passim*.

⁸ See, for example, Stane Gabrovec, »Zur Hallstattzeit in Slowenien«, *Germania*, 44 (1966): p. 42.

Povzetek

Pisec je metalografsko proučil eno od železnih suličnih osti Mecklenburške zbirke. Ugotovil je, da je izdelana iz čistega železa, brez dodanega ogljika. Bila je vroče kovana in nima sledov hladne obdelave. Razložen je tudi postopek izdelave nasadišča. Avtor želi poudariti, da bi nadaljnje raziskave lahko v veliki meri osvetlile nejasnosti v zvezi z gospodarstvom in tehnologijo železne dobe v Sloveniji.

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Die generalistische Erforschung des Siedlungs von Manching tritt nicht — zum ersten — in zwei größeren archaischen Archaische gliedern. Der erste umfasst die 3 Kampagnen der Jahre 1965—67, in deren Verlauf unter der Leitung von Werner Köhler eine Fläche von etwa 1000 Quadratmetern abgedeckt worden ist. Der zweite Abschnitt ist mit dem Namen Franz Schubert verbunden; unter seiner Leitung wurden im Verlaufe weiterer 3 Kampagnen in den Jahren 1968—73 insgesamt nochmals rund 42.000 qm untersucht. Verbunden werden diese beiden Grabungsperioden durch die Untersuchungen von Ralf Gensen in den Jahren 1981 und 1982, in deren Mittelpunkt die Erforschung des Osterris stand. Aber in allem hat man bis heute in Manching eine Fläche von nahezu 75.000 qm untersucht. Für viele Stellungen würde dies bereits die vollständige Erforschung der Anlage bedeuten; für die etwa 300 ha große Anlage von Manching heißt dies jedoch, daß lediglich knapp 3% des unwilligen Areals untersucht werden sind.

Die Veröffentlichung des in diesem Fundmaterials hat mit der Ausgrabung der Anlage nicht Schritt halten können. Das ist sicherlich verständlich, wenn man bedenkt, daß allein mehr als eine Viertel Million Scherben gefunden worden sind. Über die Grabungen von Köhler sind zahlreiche Vorberichte erschienen; eine umfangreiche monographische Bearbeitung haben bisher aber nur die verschiedenen Keramikgruppen, die Werkzeug- und Gerätschaften sowie die Tierknochen erfahren. Über die Osterris-Grabungen hat Gensen eine ausführliche Dokumentation vorgelegt, allerdings ist dabei die Bearbeitung des Fundmaterials, insbesondere die der Keramik, zu kurz gekommen. Über die Grabungen von Franz Schubert in den Jahren 1968—73 ist dagegen in der Literatur bisher wenig bekannt. Es gibt lediglich einen kurzen Vorbericht der Jahre vor die Grabungen der Jahre 1968—69 anfaßt und das Fundmaterial nicht berücksichtigt. Einige wenige Funde dieser Grabungen sind in dem bereits erwähnten monographischen Arbeiten aufgenommen worden, andere, besonders bemerkenswerte Fundstücke wie die beiden bronzernen Achselnagel, ein Schraubenschlüssel oder die mit Grafit versehenen Schaben, hat man separat veröffentlicht.

Mit der Gründung der Forschungsstelle Manching im Jahre 1980 ist die Aufarbeitung und Auswertung der Funde und Befunde in den Vordergrund gerückt. Im Rahmen der laufenden Forschungsprogramme ist mit die Be-

* Zusammenfassung eines Vortrags, gehalten auf dem Kongresskongress in Dresden, September 1984.

