

Medieval groove plane

A wood-carving tool from the archaeological excavations in Elbląg

By Przemysław Michalik

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The author focuses on explaining the way of using and the function of an iron-and-wood object found during archaeological research of a site at the back of a town plot in the Old Town of Elbląg. The object is dated to the 1240s. A search for analogous archaeological finds in combination with the study of other categories of sources, including ethnographic and iconographic ones, made it possible to establish that this was a tool for cutting grooves in wood. It served to produce long, relatively narrow and not very deep grooves, mainly in shingles.

Keywords: archaeology, ethnography, late Middle Ages, Elbląg, woodworking

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In 1992, during archaeological excavations conducted in the rear part of an urban plot in Mostowa 13 Street, the Old Town of Elbląg (Poland), the cultural layers dated dendrochronologically to the 1240s revealed an unusual item made of wood and iron (fig. 1). In the course of inventorying, it was provisionally labelled as 'unidentified item' and marked with the inventory number of XXIV/1969. The early dating of the aforementioned layers enables linking this find to the very beginning of the Teutonic Order's settlement in what is now Elbląg. Although the town was chartered in the year 1246, it is known that the first houses of this new urban organism were erected a few years earlier – already in 1237 (Czaja & Nawolski 1993, pp. 63, 70).

The discussed artefact consists of an iron part and a wooden handle (fig. 4A). The preserved length of the iron part is 248 mm, which includes a completely-preserved arm measuring 225 mm

in relation to the artefact's axis of symmetry. The handle is 258 mm long, with the maximal width of 41 mm and thickness of 39 mm. The iron part is visibly damaged, with about a half of it missing, and has a form of a rod-like element with the cross-section resembling a square (maximal dimensions of 14.4 x 12.8 mm) but with rounded, gently-formed edges. The ending of the arm, the so-called quill, has been forged into the shape of a knife with triangular cross-section. Its end is bent in a hook-like manner, resembling the letter J. The length of this particular hook is 4 mm and width – measured between the outer walls of the quill – approximately 8 mm. The maximal width of the quill is 25 mm. The sharp edge is present on the bottom side of the quill (figs. 2–3).

According to the dendrological analyses, the handle of the Elbląg tool was made of high-quality, flawless, "fine-ringed ash wood, most likely



Fig. 1. Groove plane from Elbląg. Photo: M. Dąbski.

common ash (*Fraxinus excelsior* L.)" (the dendrochronological analysis of the artefact was performed by Prof. P. Kozakiewicz, EngD, from the Department of Wood Science and Wood Pre-

servation, Faculty of Wood Technology at the Warsaw University of Life Sciences, Kozakiewicz 2011, p. 5). This wood is characterised with considerable hardness as well as resilience and



Fig. 2. Groove plane from Elbląg, detail 1. Visible are the hooked endings of the arm of the tool and the line of the edge. Photo: M. Dąbski.

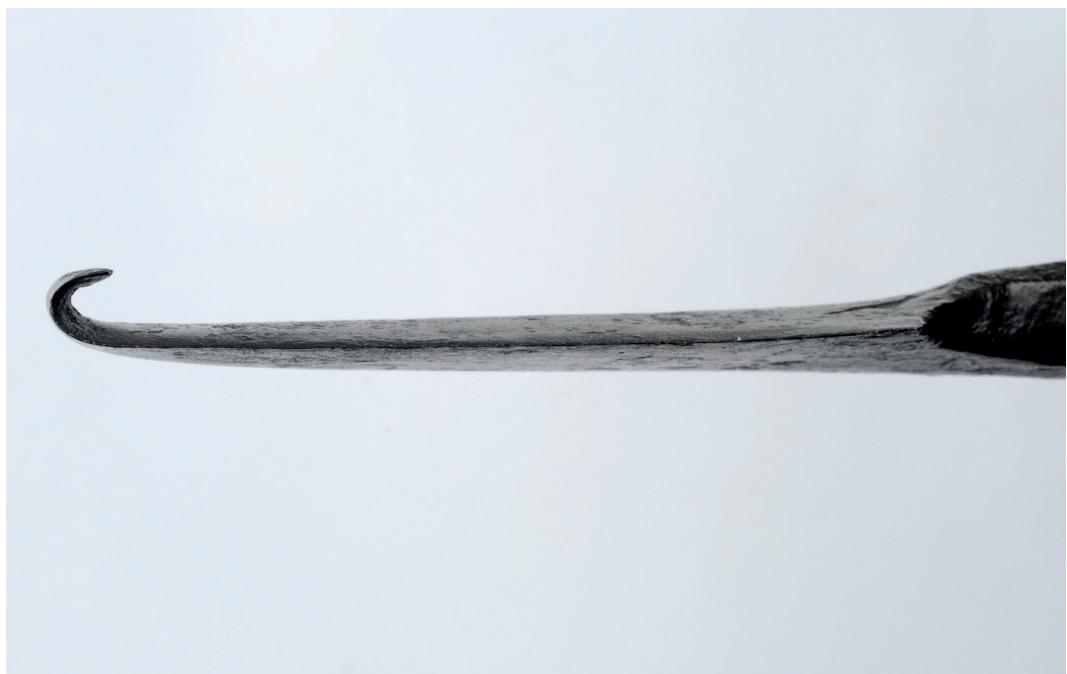


Fig. 3. Groove plane from Elbląg, detail 2. Visible are the hooked endings of the arm of the tool and the line of the edge. Photo: M. Dąbski.

flexibility (hardness is the “resistance offered by wood to solids pushed against it”; resilience is the capacity of the material to return “to its original shape and dimensions after the deforming forces cease to be applied”; and plasticity (flexibility) is a feature of the “material consisting in its capacity to absorb and permanently maintain deformations caused by a deforming force”) (Milewski 1970, pp. 73, tab. 3, 81, 82). Therefore, the fact that this specific type of wood was used for the handle might be legitimately seen as a testimony to a sort of material knowledge derived from practice rather than theory; it may be a manifestation of conscious adjustment between the type of raw material and the method of handling the related tool. Not so long ago, the usefulness of this kind of wood for tool handles (Galewski & Korzeniowski 1958, p. 210;

Milewski 1970, p. 381) and the tools themselves was still recognised (Galewski & Korzeniowski 1958, p. 210) and remains a living tradition in certain communities even today. Dendrochronological analyses of archaeological finds from cultural layers (e.g. Polish sites of Ostrów Lednicki, Opole-Ostrówek, Wrocław, Kolobrzeg, or Szczecin) indicate clearly that ash wood was commonly used for various everyday items (handles or hafts of tools, such as awls, knives, spears and axes, but also wedges, turned vessels – mostly bowls, plates, carved vessels, including troughs – as well as hoops of stave-built vessels, dippers, spoons, small shovels, spindles, wheels and their elements, or other implements) (see Cywa 2018 for a detailed literature overview). In Western Europe, this type of wood was also widely used for making elements of weapons,

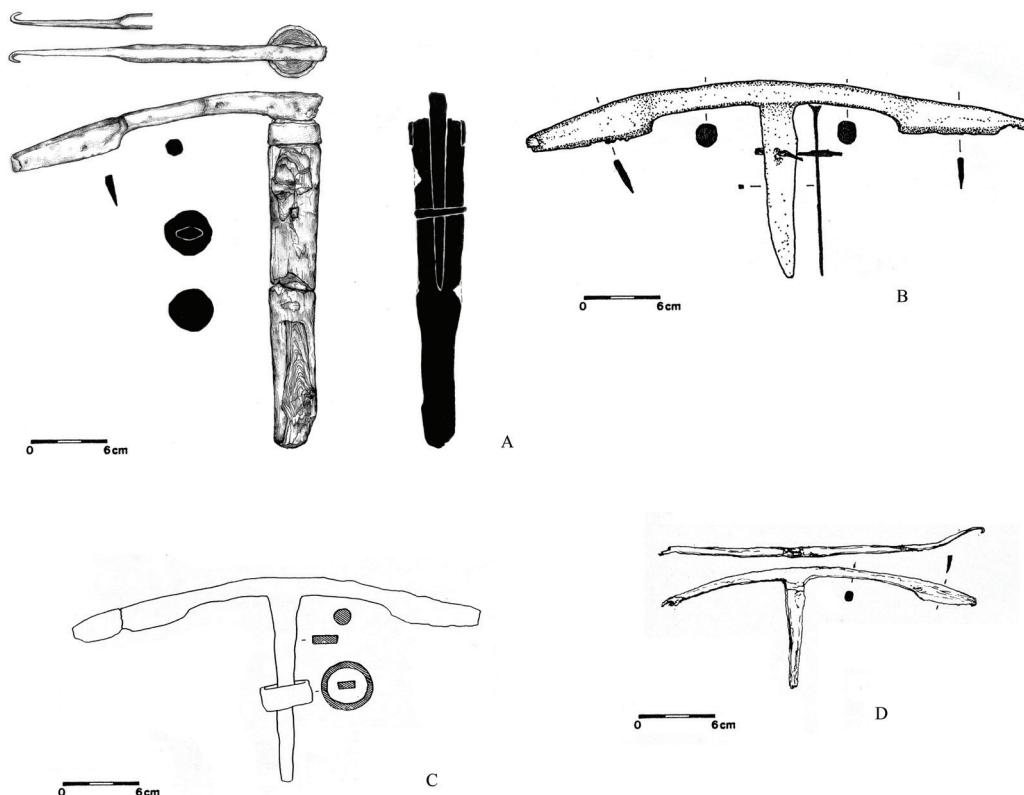


Fig. 4. Finds of groove planes from the area Poland and Europe: A) Elbląg. Drawing: B. Mydlak; B) Plemięta. After Kola 1985; C) Szczecina Castle. After Francke 1993; D) Sezimovo Ústí, the Czech Republic. After Krajíč 2003b.

including the spears and axes mentioned above as well as arrows, scabbards, swords, shields, and even bows (Haneca & Deforce 2020).

The iron part is mounted in the handle with a shank. In addition, both elements were bound at the base with a massive iron band and an iron nail, or rather a rivet. The band is up to 17.1 mm wide and 3.1 mm thick. The length of the iron rivet – passing somewhat diagonally through the handle and shank of the tool and protruding slightly on both sides of the shaft – measures c. 40 mm. Such construction of the artefact indicates clearly that it was intended as a tool.

The above description shows that the state of preservation of the artefact is not homogeneous: the iron parts are in excellent condition – the cutting edge remains sharp; at the same time, the wooden part is in a worse state – its surface is damaged, while the handle is currently composed of two bound elements with cracks running along them and passing through the riveted spot.

Apart from the Elbląg specimen discussed here, only five more artefacts of this kind have been obtained during archaeological excavations up to date: two from Poland and three from Czechia, Lithuania, and the Netherlands. The above statement is based on a survey conducted in fifteen Polish museums and a systematic review of relevant Central-European archaeological literature.

The first of the aforementioned artefacts (fig. 4B) was found during excavations conducted in the years 1974–1977 within the motte-and-bailey in Plemięta (Grudziądz district, Kuyavian-Pomeranian Voivodship) (Kola 1985, p. 156 and tab. XX:2; Boguwolski et al. 2005, p. 68 and photograph on p. 65), that is, in the remains of an old residential tower burned by the Polish-Lithuanian forces at the beginning of the 15th century, most likely in 1414, during the Hunger War (Nadolski 1985, p. 10). Such mottes are interpreted as residences of middle-class knights. The Plemięta artefact is preserved in a relatively good state. Similarly to the Elbląg specimen, it consists of a massive transverse arched rod measuring 398 mm in length, with ends hammered into quills (c. 100 and 106 mm), and a shank mounted perpendicularly to it. Both

cutting edges are jagged. The ending of one of the quills is damaged, while the other one has preserved the characteristic hooked bend. An aperture in the flat shank contains a rivet. However, the wooden handle was not preserved, although the tool must have been mounted. It is also unknown whether the handle was originally reinforced with an iron band at the base, that is, in its upper part. Kola pointed out that at the time it was the first such artefact known in “the archaeological record from Poland” and labelled it as a groove plane – a tool for carving grooves (Kola 1985, p. 149).

The second of the published groove planes comes from the archaeological investigation conducted in the years 1986–1991 in the castle of Szczerba, near Gniewoszów (Kłodzko district, Lower Silesian Voivodship) (Francke 1993, p. 356 and fig. 11b) (fig. 4C). The castle buildings, erected most likely in the first half of the 14th century, were ultimately destroyed and abandoned already in 1428, during the Hussite Wars (Francke 1993, pp. 339–340). The author of the publication interpreting the specimen addressed only its morphology and described it – quite aptly – as an “item shaped like a crossbow” (Francke 1993, p. 356). Unfortunately, due to a very sketchy drawing, suggesting that the artefact was illustrated before conservation, it is impossible to precisely determine its state of preservation or, much less so, its morphological details. However, it undoubtedly has a massive rod widening on both ends, presumably hammered flat into the form of a knife. A relatively wide and thick band is preserved on it, once binding together its wooden and iron parts. The span of the arms of the groove plane currently amounts to c. 317 mm.

Another groove plane obtained during excavations comes from the Czech town of Sezimovo Ústí, also destroyed during the Hussite Wars in 1420 (Drda 1978, p. 14 and fig. VI:8; Krájíč 2003a, p. 163 and 2003b, p. 40 and tab. 132) (fig. 4D). This specimen also has two arms preserved, although the left one lacks a quill. Its iron band, however, was not preserved, similarly to its wooden handle. The drawings do not specify the exact place on the shank in which the rivet aperture is located, if it is present at all.



Fig. 5. Groove plane from Klaipėda, Lithuania. Photo: E. Ubis. After Zabiela et al. 2011.

The preserved spread of the arms is 360 mm and the length of the quill is 60 mm (Krajíč 2003a, p. 40, tab. 48).

The next of the analogous artefacts was retrieved from the 15th-century cultural layers in the castle in Klaipėda (Lithuania) (fig. 5) and labelled as an iron object of unclear function (Zabiela et al. 2011, p. 208). It is known, admittedly, from just a single photograph of its find-spot, but its state of preservation can still be considered as good. And in this case, again, there is an arched and quite massive rod with ends shaped as knives. The description indicates that their endings have hook-like bends. The shank perpendicular to both arms has a clear aperture for a rivet. Sadly, the wooden handle did not survive. It also lacks the iron band-shaped fitting resembling a wedding ring. The authors provide the following dimensions of the artefact: spread of the arms – 422 mm; height – 175 mm; and length – 85 mm.

The last of the groove planes, dated broadly to the medieval period, was found in the Dutch

town of Dordrecht (Janse 1989, p. 1 and fig. 1; Janse 1990, p. 29, fig. 8) (fig. 6). Unfortunately, in both publications only black-and-white illustrations were provided, and without a scale. They also lack drawings with cross-sections. The artefact is preserved in its entirety, in a very good condition. It consists of a two-armed iron part, apparently quite massive, mounted in a wooden handle. The endings of both quills are characteristically bent. Both parts are reinforced with a metal band. The handle of the tool does not seem to be bound to the iron part with a rivet. The handle, however, bears three incisions: a vertical line and two diagonal ones crossing the former and not parallel to each other.

It bears emphasising here that there are terminological problems related to naming the particular part of the tool. In order to solve them, I borrowed some of the terms from ethnographical publications, especially the paper by Maśliński (quill, handle) (Maśliński 1963, p. 94). Others, unknown in the literature, I had



Fig. 6. Groove plane from Dordrecht, the Netherlands. Photo: ROB, Amersfoort. After Janse 1990.

to invent myself, fully aware of their sometimes debatable accuracy (arm, band, shank).

The term “groove plane” (Polish: *nutownik*) was introduced by Kola (Kola 1985, p. 156) – following the paper by Pilarski (Pilarski 1972) – in his publication of the specimen from Plemięta. It is, to the best of my knowledge, one of the very scarce, or perhaps even the only, Polish ethnographic study using this term. In Polish ethnographic publications, other terms prevail: “double scorp” (Polish: *skoblica podwójna*) (Szacki 1981, pp. 7, 10), “double-sided” (*dwustronna*) (Szacki 1981, pp. 7, 10; Pokropek 2019, p. 300), “little scorp with a double-sided edge” (*skobliczka o dwustronnym ostrzu*) (Skuza 2005, p. 41), “plane” (*struh, fugownik* or *fug*) (Brylak 1965, p. 153; Maśliński 1963, p. 94 and Nowicki 1913, p. 60; Maśliński 1963, p. 94 and Pilarski 1972, p. 174), or different devices for making grooves in shingles (“*wyciągacz czyli wyskrobek do fugowania gontów*” (Dekowski 1960, pp. 168, 169), *fugacz do gontów* (Gawron 1967, fig. 16:13), sometimes clarified by referencing the shape of

the given implement (“a T-shaped scorp with a double-sided edge” [Polish: *Skobliczka o dwustronnym ostrzu w kształcie litery T*], Skuza 2005, p. 41; “a T-shaped tool – double-sided scorp [narzędzie w kształcie litery T – dwustronna skoblica] and “a special, double-sided scorp shaped like the letter T” [specjalna, podwójna skoblica w kształcie litery T], Szacki 1981, pp. 7, 10; “Plane”. It is a T-shaped tool [“struh”. *Jest to narzędzie w kształcie litery T*], Brylak 1965, p. 153]. These names reflect the work done with the tool – scraping, whittling, routing, grooving (with the latter two denoting a very narrow, specific type of actions) – as well as its shape. Both Polish terms, *nutownik* (groove plane) and *fugownik*, *fug*, *fugacz*, *fugulec* (this name can be found in the 19th-century sylviculture textbook, Thieriot 1856, p. 78), derive etymologically from German (German *Nut* means a rabbet or groove, while *Fuge* denotes a joint, a slit, but also a hollow or groove, Słownik 1993, part A–O, p. 338 and part M–Z, p. 88; similarly in other dictionaries: Chodera & Kubica 2000, pp. 285, 578; Piprek

& Ippoldt 1994, pp. 183, 629), but of those two only *Nuteisen* is used in German publications dealing with the discussed tool (Engel 1907, p. 29; Phleps 1942, p. 96, fig. 123; Stülpnagel 2000, e.g. pp. 19, 20, 22, 23). Obviously, it is not the only name used for this tool in German. In 1861 (Historische Werkzeugkataloge) and the early 20th century, namely in the year 1909 (Handplane Central...), it was on offer – as Schindel-Zieheisen (Schindelzieheisen) – by the Viennese company Joh. Weiss & Sohn, manufacturing woodworking tools, yet another name is *Nutreissen* (in historical Galicia, i.e. today's Ivano-Frankivsk Oblast in Ukraine (Engel 1907, p. 9). Not being in a position to offer a similar

analysis in the Swedish language, I must limit myself to noting that, as pointed out to me by the Editors, the Swedes call similar carving tools *skölp* or *gröpjärn*. Obviously, there is no way to be sure that any of these terms, attested in texts from the 16th century, refers specifically to the groove plane (SAOB).

The main research question is not to determine the general function of the tool, as it has already been explained in the description of the find from Plemięta (it was meant for cutting grooves), but to clarify how it was handled – which part was the working one (cutting, carving): the hooked ending of the quill or rather the flat part? And if so, then what was the point

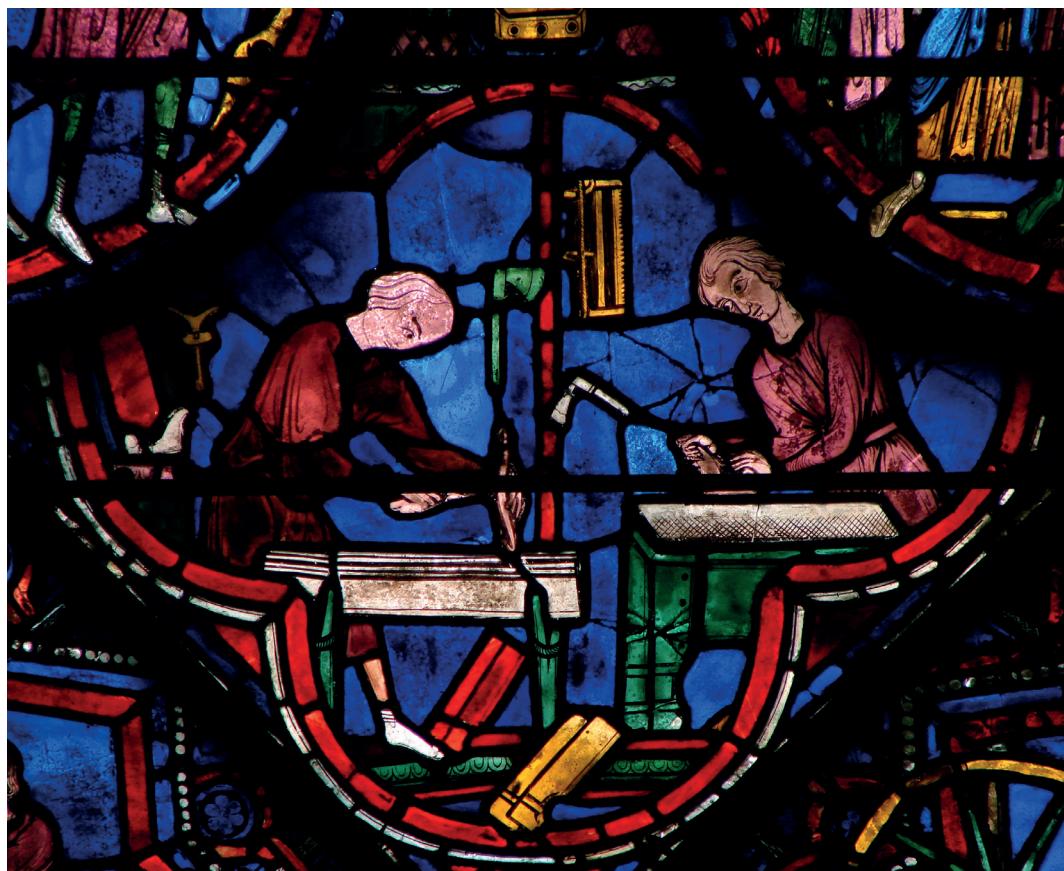


Fig. 7. Fragment of the stained glass window from the Notre Dame Cathedral in Chartres (France), depiction of a craftsman working with a groove plane. Photo: Vassil, Public domain, via Wikimedia Commons (accessed 28 January 2024).

in bending the endings? Or why two arms were needed? Was not one enough to fulfil the same goal? Authors of archaeological works, as well as some ethnographers, seem to ignore the above questions. In result, few people now know the exact function of this tool, as reflected by the previously-discussed difficulties with interpreting such finds. Even less is known about the way in which these tools were handled.

Answering the questions thus posed is, however, impossible on the basis of archaeological data alone. Hence, it is necessary to consult other categories of sources: iconographic and ethnographic (including visuals, such as photographs and video documentaries showing skilled crafts people at work).

I am aware of but one medieval image of a groove plane, from France. It is depicted on a stained glass window in the Cathedral of Our Lady of Chartres showing a carpenter's workshop of some kind (fig. 7). This refers to the stained glass window no. 21 (according to the current numbering) depicting the life of St Julian the Hospitaller located in the northern, left side of the ambulatory of the cathedral, or rather its lower part showing – as per its interpretations – the founders of the artwork (panel 3). The window is dated to between 1210 and 1225 (over the last several decades, its dating changed multiple times: in the current database of the French ministry of culture it is dated to the years 1210–1225: Ministère de la Culture, whereas in another database it is dated to 1215–1225: ULS Digital Collections, University of Pittsburgh; the same, slightly narrower dates, the years 1215–1225, can be found on the cathedral's own website: *Les vitraux de la cathédrale de Chartres*); therefore, it may be assumed that it was created somewhere between 1210 and 1225; regardless of the exact date, the discussed groove plane and the stain glass window come from roughly the same period). Among the tools depicted there – a frame saw, two hatchets, a plane, and a hand borer hanging from the workshop wall – there is also a groove plane. It is shown being used by one of the two craftsmen depicted there, who is leaning over a short beam or plank with clearly visible parallel lines. He is holding the handle with his right hand, whereas with the left he is

grabbing the iron part in a characteristic way, so that the iron arms are positioned vertically. And this is all the information provided by the image.

Much more productive in this regard seem to be results of ethnographic studies, not only Polish but also Czech, Slovak, and even first and foremost – Hungarian and Romanian. They bring not only information on the functions but also the handling of these tools, as well as data on various differences in their construction and sizes.

Undoubtedly, the most common function of the groove planes was manufacturing shingles (fig. 8). The relevant ethnographic accounts of them being used to carve grooves in shingles come from south Poland (Pilarski 1972, p. 174; Maśliński 1963, p. 94; Dekowski, 1960, pp. 168–169; Szacki 1981, p. 7; Gawron 1967, p. 48, fig. 16:13; Brylak 1965, p. 153), Slovakia (Zajonc 2014–2023), Czechia (Starý 1925, p. 102), Romania (Haáz 1942, pp. 13–15), and Hungary (Csilléry 1982); however, these tools may have served other functions as well.

The groove planes were used also to make household items or, more generally, utility objects. This is attested by a Hungarian documentary showing the traditional process of manufacturing a wooden chest (Keszi-Kovács 1955). The same method was described also slightly earlier, in a Hungarian publication on wood-working (Haáz 1942, pp. 45–48). In both cases, the groove plane was used not only to carve grooves in the edges of boards, such as shingles for building side walls, but also in laths making up the frame in which elements of the walls and lid were later mounted. The same use of a groove plane was described also by Csilléry (1982). Without going into the genesis of chests of this construction, it should be stated that they were certainly known and used in the Middle Ages. Evidence of the age of this carpentry tradition are fragments of two chests found during excavations in the German city of Schleswig. One is dated to the 12th century, the other to the beginning of the 13th century (von Stülpnagel 2000, pp. 308–309). Many more similar chests, but preserved in their entirety, are in museum collections, e.g. an artefact dated dendrochronologically to the year 1174 or slightly later (von



Fig. 8. Grooving shingles, the region of Východné Slovensko, Slovakia. Encyclopedia of Slovak Folk Culture 2. <https://www.ludovakultura.sk> (accessed 12 September 2021).

Stülpnagel 2000, p. 236) and the other ones to: the year 1230 or slightly later; first half of the 13th century; the year 1260 or slightly later; and the year 1261 or slightly later (von Stülpnagel 2000, pp. 205–208). It should be noted, however, that it is impossible to clearly determine what tools were used during their manufacture. The mentioned video (Keszti-Kovács 1955) shows that the same tool could be used to decorate the outer side of the manufactured chest (see also Krajíč 2003a, p. 163; Csilléry 1982). After painting it uniformly in one colour, the groove plane and another groove-carving iron apparatus (*fuzek*) attached to a compass were used to make shallow, surface, and relatively short grooves, thus creating a decorative pattern. Such ornamen-

tation technique, called insculping (Polish: *ryzowanie*), used to be quite common and well-known, also in Poland (Maśliński 1963, p. 108).

Ethnographic studies revealed one more function of the discussed tool. It could serve to make slits in basins (Maśliński 1963, p. 94) and flax-brakes (Szacki 1981, p. 10, photograph 10) (fig. 9). In those cases, it required even greater amount of work than carving grooves in shingles, because the longitudinal slit would have to be carved all the way through. It is difficult to unambiguously decide whether and to what extent these tools could find use in traditional wooden construction, which relied on tongue and groove connections. Such opinions have been voiced in Czech and German scholarship

(Štajnoch 1983b, p. 216; and after him: von Stülpnagel 2000; Krajíč 2003a, p. 163).

It appears that the aforementioned examples do not exhaust the subject of potential functions of the groove plane. The tool could be used wherever it was necessary to make relatively narrow grooves of various depths – from shallow ornamental ones to those going all the way through, as seen in scutching devices.

The archaeological and ethnographical analogies discussed before enable a preliminary conclusion that, contrary to appearances, the discussed tool is not as mysterious as it initially seemed. Information about it is, however, dispersed in expert literature of niche character, mostly ethnographic, and usually a few decades old. Hence, it comes as no surprise that it is not widely known by non-experts. Nevertheless, the presented data allows for reconstructing the incompletely-preserved artefact from Elbląg. With considerable confidence, it may be stated that it was a tool with two identical and symmetrical arms.

A question that poses itself then is how this groove plane was handled? What purpose was served by the knife-like endings of the two arms or the hook-like bends? Were both arms equally indispensable? Perhaps one would suffice for it to work as intended? In answering these questions it seems justified to have a closer look at the whole manufacturing process in which it took part. The relevant information comes, first and foremost, from ethnographic studies, albeit of certain use in this regard is also the aforementioned fragment of the 13th-century stained glass window (fig. 7).

Primarily, a piece of wood selected for further reworking (e.g. a wedge-shaped board) would have to be immobilised so that the surface in which the hole was to be made faced upwards. Such arrangement was necessitated by the fact that the groove plane was operated with two hands (figs. 8–9). The exact way to work with it would differ, depending on the technological advancement in a particular time and place. In general, simple benches were used for this, with a pair of pegs mounted in them, incised vertically in the upper part, or two pairs of specially-arranged little boards. Sometimes,



Fig. 9. Carving of grooves in a flax-brake, Rakszawa, the Podkarpackie Voivodship. Photo: U. Gmachowska, 1975. Archive, National Museum of Ethnography, Warsaw.

a single massive bolt of wood with a slit was enough, often tied around with a cord to prevent it from cracking (Zajonc 2014–2023).

In the Kielce region (Poland), a bench of somewhat more complex construction, with a mounted peg (Polish: *trzymacz*), a block with a V-shaped notch for the worked board (*stepka*), and a raw hook protecting the craftsman during work (*kulka*), was known as ‘router’ (*fugowanka*) (Maśliński 1963, p. 96, photograph 4). In the Gorlice district, “the bench in which shingles are immobilised with chock placed between

four pegs impaled into the board which mark its length and thickness" was called "a stool for grooving" (*stolec do paszenia*) (Brylak 1965, p. 153). On the other hand, Skuza quotes yet another name for the grooving stool: "a pony" (Polish: *konik*) (Skuza 2006, p. 41). In some areas, for instance in Romanian central Transylvania, the Harghita district, a simple massive log-bench was used, with a vast carved cavity in which several dozen (up to 60–70) shingle boards could be stacked. However, they were arranged cross-wise, while the rabbits were made by two persons sitting on the opposite sides of the bench (Haáz 1942, pp. 13–14 and fig. 17). There is also a kind of a special frame attested for Czechia – it was mounted on trestles (two pairs of crossed wooden bars) stuck into the ground, which enabled arranging and carving several dozen shingles in a single manufacturing cycle (Starý 1925, p. 102 and ill. 5).

Another, much more complicated, device for immobilising worked pieces of wood was a shaving bench (Polish: *kobylica*). However, up to the second half of 20th century it was used in traditional folk craftsmanship for smoothening the surface of wood with a draw-knife (for instance: Maśliński 1963, pp. 95–96; Brylak 1965, p. 152; Dekowski 1960, p. 169; Pilarski 1972, p. 173; Keszi-Kovács 1955; Kaucký 1955) rather than to carve grooves. Maśliński noted, nevertheless, that "the ingenuity of particular craftsmen turned it into a universal tool" (Maśliński 1963, p. 96), which led to the shaving bench being used also for making grooves in shingles. Nowadays, it finds use during historical craftsmanship shows or in contemporary workshops employing old or slightly modified traditional manufacturing methods (e.g. Region Vysočina; Blanenský deník or the film: *Idnes TV*). I am not aware, however, of any considerably older cases of this particular device being used for grooving. The quoted examples may be, therefore, considered a purely modern attempt at adapting the shaving bench for new purposes. In effect, it is doubtful that it was used in the latter way a few centuries earlier, especially since it remains uncertain whether this device was at all known in 13th-century Elbląg or when exactly it was invented. Mentions published in the ar-

chaeological literature, already quite old, are not very helpful in that regard (Barnycz-Gupieniec claims, referencing the opinion of two other scholars, that "shaving benches are thought by ethnographers to be a relatively late invention", Barnycz-Gupieniec 1959, p. 51).

However, the simplest, most primitive way to immobilise a piece of wood – and thus the most easily-available one – is to chock a vertically positioned or dug-in wood block in a crevice (Phleps 1942, p. 96, figs. 123.9 and 123.13; Dekowski 1960, p. 169; as well as a contemporary photograph: *Die kleine Seite...*), between two furcate tree branches impaled or dug into the earth close to each other (Štajnoch 1983a, p. 169 and tab. XII:1), or in one or two incised or partly-split (cracked) massive pegs (posts) also dug into the ground (in this case, the pegs would sometimes be protected from further cracking by tying them below the cracking point, see: Štajnoch V., 1983a, tab. XII:2; for instance, a bast band may have been used for binding, Štajnoch V., 1983a, p. 169) – the last method can be seen on the 13th-century stained glass window (fig. 7). The immobilising with two pegs was practiced for a few centuries, both in Western Europe and in Central-Eastern Europe, where it remained in use well into the modern times. This method was also used for making shingles by the Lemko People from the Gorlice area (Poland) (Brylak 1965, p. 153). The same way to immobilise the worked board, but with addition of wedges, is known also from the Kielce region (Poland). It was used for making flax-brakes or, more precisely, for carving grooves in them; in this case, *kule* (solid beams measuring about a dozen centimetres in diameter, incised in the upper parts) were dug into the ground c. 80–100 cm from each other (Maśliński 1963, p. 96 and photograph 5); similarly about manufacturing flax-brakes in the Rzeszów region (Poland) (Szacki 1981, p. 10 and photograph 10). For more examples, see: Štajnoch 1983a, p. 169 and tab. XII:2 and Keszi-Kovács 1955.

Depending on the manufactured item as well as the available workshop, this work was performed either while sitting – e.g. grooving shingles (Starý 1925, p. 102) or parts of chests (Keszi-Kovács 1955) – or standing – e.g. making

(Janotka 1963, unnumbered photograph after p. 160 [p. 160c, photograph 2]) and ornamenting chests (Keszi-Kovács 1955), manufacturing flax-brakes (Maśliński 1963, p. 96, photograph 5 and Szacki 1981, p. 10 and photograph 10) or shingles (Starý 1925, p. 102 and ill. 5). Grooves could be made separately on each of the worked elements or “en masse”, after immobilising several pieces (for instance: Phleps 1942, s. 96, Abb. 123.9) (fig. 8) or – as mentioned earlier – even several dozen boards at once (Starý 1925, p. 102 and ill. 5; Haáz 1942, pp. 13–14 and fig. 17). In either case, further work proceeded in the same way. The grooving was performed by a single person, but sometimes – to make the work more efficient – also in pairs. Paired work was possible when the bench (or arm) had at least several boards attached at the same time and the craftsmen could sit on it or next to it, opposite each other. Then, one would carve the groove up to a certain length of the board and the other – the rest. Meanwhile, the first one would already carve a groove in the next board (nowadays teams of two could also be observed, with one person preparing wedge-shaped boards on the shaving bench, while the other was carving grooves on another bench, e.g. Maśliński 1963, photograph 4; Such work division is also mentioned in a Hungarian publication by Petercsák 1984, p. 77). Such procedure shortened the time necessary to carve the grooves and eliminated the need to flip the boards and re-attach them to the bench each and every time.

The tool was operated with both hands: one hand was always placed on the wooden handle, while the other held the iron part at the junction of both elements (four bent fingers on the metal part; handle between the fingers and the thumb) (Szacki 1981, photograph 10; Maśliński 1963, photograph 4; Keszi-Kovács 1955; Haáz 1942, fig. 14) or only the iron arm (Janotka 1963, unnumbered photograph after p. 160 [p. 160c, photograph 2]), sometimes, the work would be performed with the groove plane held with two hands on the shaft, so that the arms of the groove plane were positioned vertically (figs. 8–9). It seems that this method ensured strong and secure grip and thus allowed for applying greater force (both in parallel and perpendicularly to the

carved groove) during carving, improved control over the tool, and resulted in better precision. At the same time, it prevented the iron part from disconnecting from the handle, as the tool was drawn simultaneously by the handle and, with the other hand, by the iron part. This was important, because the key elements of the tool were not always connected as strongly as in the Elbląg specimen, reinforced with a rivet and an iron band. Such reinforcements are missing from some tools, e.g. those published by: Dekowski 1960, p. 168, fig. 4b–c; Haáz 1942, p. 45, fig. 69; Gawron 1967, p. 48, fig. 13:6; Nowicki 1913, p. 60, fig. 45.

The grooves were made along the wood fibres (Szacki 1981, p. 10), except for making decorations (Keszi-Kovács 1955), and the carving would begin from approximately the 2/3 (for instance, a film documenting the work performed with a groove plane – Keszi-Kovács 1955) or, sometimes, 3/4 (Starý 1925, p. 102) of the length of the worked element, although it must have depended on its size and the reach of the arms of the craftsman himself. He would draw the tool towards himself, once or several times, with the hooked ending of the quill across the surface of wood, thus removing some of it in the form of wood shavings, and next turned the tool by 180 degrees in his hands to repeat the same action with the other ending of the groove plane. But what was the point of this procedure? What purpose was served by the turning of the tool? As explained by Maśliński: “Each time the tool is drawn, the groove gets deeper and slightly wider, since the whole edge of the tool is at work, bent like the letter J (...). Both [edges – P. M.] work alternately, thus widening and deepening the groove together from the right and then from the left side” (Maśliński 1963, p. 107). Such gradual deepening of the groove and its alternate, left- and right-hand widening was also noted by Szacki and Krajc (Szacki 1981, p. 10; Krajc 2003a, p. 163). The described actions can also be observed in the documentaries showing manufacturing of shingles and elements of a wooden chest (Kaucký 1955; especially: Dorňák 2022; Keszi-Kovács 1955). The craftsman would repeat this procedure until the groove reached the desired depth and width and then he would turn

the worked piece of wood by 180 degrees and apply the method again to carve a groove on its opposite side. This way, a groove with a V-shaped cross-section and slightly rounded bottom was achieved. The right wall of the groove was formed with the left arm of the groove plane (since the J-shaped cutting edge would then gradually remove wood on the right side and the bottom) and the left – with the right one (Phleps 1942, fig. 123:13).

Such two-stage grooving was necessary, because, for many reasons, it is difficult to make a groove running along the full length of the product in one go. It is much easier to simply start this process, which is quite obvious, at some distance, even if small, from the upper edge. In this situation, the edge, or rather its tip, enters the wood gently and somewhat diagonally. It has to be noted that the worked pieces of wood could measure more than 50 cm in length (the bolts of wood used for riving shingles usually measured 50 cm, Brylak 1965, p. 152; or 60 cm, Starý 1925, p. 99; according to H. Phleps, shingles could be 25 to 100 cm long, Phleps 1942, p. 95; a slightly shorter range is indicated by A. von Engel: 30–70 cm, Engel 1909, p. 29; archaeological finds of shingles would also imply considerable differences in length, e.g. 40 and 65 cm, Bagniewski & Kubów 1977, p. 26; 69–81 cm, with the prevailing range of 70–71 cm, Prusicka-Kołcon 2001, p. 142; 70–80 cm, Bojęś-Białasik & Zaitz 2011, p. 109; and 64–80 cm, Krajc et al. 1998, pp. 121, 122, 192–3), whereas the convenient reach of a groove plane operator in the sitting position does not exceed 30 cm, as can easily be verified in practice. Secondly, even when the entire surface in which a groove was to be made was within the reach of the craftsman, it would still be difficult to carry out the work. It would require permanent meticulous measuring not to remove too thick a shaving, since this could make the work extremely hard and even impossible by chocking the tool in the wood. Therefore, only by turning the tool by 180 degrees free access to the remaining uncarved surface was ensured, thus making it possible to complete the task.

Working with this kind of tool generated variously-directed forces applied to the handle

and the rest of its elements. This is presumably what necessitated reinforcing the structure of the tool (with the iron fitting on the handle and a rivet) and manufacturing it from a suitable kind of wood. Carving a groove required applying certain pressure on the handle and the iron part, that is, forces directed both perpendicularly and in parallel to the tool and the worked surface (in motions drawing the tool “towards oneself”).

The groove plane is, obviously, not the only groove-making tool used by medieval craftsmen. However, this question would require a separate study and cannot be addressed here. It should nevertheless be noted that larger grooves could be carved in wood with a combination of mallets and ordinary flat chisels (e.g. Krajc 2003a, p. 155; Krajc 2003b, p. 36 and tab. 125, p. 115). Carving with this method would be time-consuming and labour-intensive but still possible. Another tool used to the same end was the gouge, that is a “curved blade of uniform width with square cutting edge and straight tang of rectangular section” (Arwidsson & Berg 1999, pp. 13, 35; pl. 26:59; for a schematic depiction of the tool at work, see fig. 5c on p. 36). More efficient (easier and faster) grooving could be achieved with a different tool, namely a hooked knife with a J-shaped longitudinal cross-section (pulling chisel; e.g. the exhibit from the Swedish Mästermyr in Gotland, no. 55; Arwidsson & Berg 1993, pp. 13, 35 and pl. 28:55) attached to a long shaft (how it had been used was shown in a movie by: Almevik et al. 2021). Yet another interesting tool is the moulding iron, very similar to the drawknife but with cavities along the edge line which allowed it to be used to make a series of parallel, decorative notches (exhibit no. 57 from Mästermyr; Arwidsson & Berg 1999, pp. 13, 35; pl. 27:57; for a schematic depiction of the tool at work, see fig. 5d on p. 36).

Having examined how the groove plane would be handled, it is possible to return to the questions posed earlier. Making a relatively symmetrical groove would be very problematic, if at all possible, with a single-armed tool with just one J-shaped ending. By necessity, one side of the groove carved with an edge measuring a few centimetres would be formed differently

from another, carved with an edge measuring a few millimetres. The rabbet achieved this way could prove incompatible with the angular edge (tongue) of the neighbouring shingle. This, in turn, would lead to difficulties in arranging the shingles into a water-proof roofline. Similarly, in the case of carving particular elements of chests, incompatibility between grooves and edges of the subsequent parts would be a major obstacle: assembling a chest required maintaining right angles between the four corner posts and the walls; the walls themselves had to create a more or less even plane, just as both sides of the slanting lid. A two-armed tool, such as the groove plane, facilitated avoiding these difficulties. I also believe that the intended effect – grooves with symmetrical cross-sections – was obtained quicker with the use of such a tool.

Finally, it needs be asked what the exact function of the groove plane was? Which of the aforementioned tasks were actually performed with it? Perhaps it was used in yet some other way? Does the current, in my opinion under-developed, state of research on this category of archaeological finds allows for answering the above question at all, if we simultaneously include information on the medieval realities of Elbląg? First of all, can this particular find be a sufficient ground for determining the materials and methods used at that time for making rooflines of newly-erected residential and commercial buildings in Elbląg?

Given the lack of unambiguous data, such as at least a single shingle with a groove in the local archaeological record or a relic reliably interpretable as one, conclusions need to remain tentative (archaeological shingles are not common, but they are, nevertheless, known, e.g. Zaitz 2006, pp. 80, 90 and fig. 56 and Bojęś-Białasik & Zaitz 2011, p. 109 and ill. 17; Krąpiec et al. 2006, tab. 1, p. 185; Prusicka-Kołcon 2001, pp. 142 and 145; Prusicka-Kołcon 2012, p. 230; Kubów 1977, p. 259; Wysocka 2001, pp. 147, 162, and tab. II, p. 190 and fig. 17a, p. 165; Kozłowska 1998, pp. 105, 107; Bagniewski & Kubów 1977, p. 26 and fig. 21; Krajc et al. 1998, pp. 121, 122, 192–193, 212, 216, and ill. 56, 60–63, and 67; Kochan 2012, pp. 767, 769, 781 and tab. 1, p. 783; other Czech finds have been listed in

the extended version of the paper, Kochan 2011, p. 56). On the other hand, it is hardly surprising that these finds are missing. Old unneeded shingles could be removed from the roof and re-used, for instance as firewood. Therefore, it may be assumed that the Elbląg groove plane could have been used for making shingles, but it seems equally probable that it would find use in carving other wooden items (e.g. construction elements, household and domestic equipment). However, in order to confirm the use of such tools in this particular purpose one would need to find wooden relics with specific, almost V-shaped grooves measuring c. 4–5 mm.

What seems least likely is that the Elbląg groove plane was used for decorating wooden objects. Nevertheless, its size, although it is one of the largest known, do not render it entirely unthinkable as an ornamentation tool. It is true that a chest-making craftsman could use the same tool, even a large one, first for carving grooves and then for applying decoration (Kesz-Kovács 1955). It seems, therefore, justified to reject the assumption that decorative insculping was performed only with smaller tools, additionally fitted with quill endings bent in the opposite directions, as suggested in some ethnographical studies (for instance, the photographs of a contemporary workshop and an insculping craftsman: Fotoarchiv Muzeum regionu Valašsko and Šenfeldová 2021). A question remains, though, whether this ornamentation technique was known in our part of Europe in the Middle Ages. Again, it is beyond the scope of this paper to deliver an answer on this matter with any authority.

Minor research questions include the provenance of the artefact. When it comes to the concept of this type of tool, currently I would be largely confident – although, admittedly, mostly based on intuition – to assume a Western European origin. Firstly, this is corroborated by the lack of similar finds from today's Poland and – more generally – the neighbouring lands which would predate the 1240s and whose context of discovery would frame them clearly as local products. Secondly, there exists at least one slightly older indirect piece of evidence witnessing the use of groove planes in Western Europe

– the aforementioned stained glass window from the cathedral in Chartres, dated to between 1210 and 1225 (fig. 7). I am aware, nonetheless, that this is not a particularly strong basis for the proposed hypothesis.

As for the Elbląg specimen, its origin cannot be determined with any certainty, especially given its dating which coincides with the very beginning of the town, i.e. its earliest organisation phase. Was it brought there by German settlers along with other belongings from their homeland, or rather manufactured by one of them already in the new town, only based on an older design? What is certain is that ash wood, used to make the handle, was at the time available both near Elbląg and in the homeland of the settlers.

It bears mentioning the use-wear analysis, often overlooked by scholars, as a research avenue potentially fruitful in future analyses of the discussed categories of artefacts. A good example of this approach applied to archaeological studies on craftsmanship can be a recent Swedish publication on investigating traces left by medieval tools. Wood processing with accurate replicas of archaeological tools left specific traces on the worked materials. These traces were then compared to those found on wooden items dated to the Middle Ages (Almevik et al. 2021). In the light of such contributions, it would be interesting to apply an analogous procedure to the groove plane in order to determine the kind of traces its use leaves on wood. Perhaps it would allow – provided that the tool would indeed produce characteristic traces – to identify tools used to make particular grooves, maybe even differentiating between chisels, groove planes, and others implements.

Engaging different categories of sources (archaeological analogies, ethnographic studies – photographs, films – and medieval iconography) allowed for determining not only the range of tasks performed with the tool but also the way in which it was handled. The dendrological analysis performed on its handle ascertained that its maker deliberately selected the wood used for it. It has to be added that future museum searches are presumably going to reveal more groove planes. It may be supposed that some of

them are simply unidentified or misclassified as, for instance: “unidentified object”, “T-shaped object”, etc. Beyond doubt, the difficulties in identification of these artefacts stems not only from their state of preservation but also from the fact that they were not very popular. These tools were used only in some regions and were later replaced by newer types of planes, employed not only for smoothening the surfaces of wooden objects but also for carving grooves and tongues (hollow and tonguing planes).

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References

Almevik, G., Pärnsten, B. & Sjöholm, M., 2021. Between Hemse and Mästermyr: Craft interpretations of two archaeological findings from Gotland, *FormAkademisk*, vol. 14 (2), <<https://doi.org/10.7577/formakademisk.4405>> (accessed 07 December 2023).

Arwidsson, G. & Berg, G., 1993. *The Mästermyr Find: A Viking Age Tool Chest from Gotland*. Stockholm.

Bagniewski, Z. & Kubów, P., 1977. Średniowieczny młyn wodny z Ptakowic na Dolnym Śląsku, *Kwartalnik Historii Kultury Materialnej*, vol. XXV(1):3–30.

Barnycz-Gupieniec, R., 1959. *Naczynia drewniane z Gdańska w X–XIII wieku*. Łódź.

Boguwolski, R., Kola, A. & Wilke, G., 2005. *Plemięta. Wieżowa siedziba rycerska z XIV–XV wieku w ziemi chełmińskiej (Ein Rittersitz auf einem Turmhügel des 14./15. Jahrhunderts im Kulmerland)*. Grudziądz.

Bojęś-Białasik, A. & Zaitz, M., 2011. Kramy drewiane odkryte w 2004 roku po zachodniej stronie Sukiennic na Rynku Głównym w Krakowie, *Czasopismo Techniczne*, vol. 108, Architektura, no. 7-A (23):99–118.

Brylak, M., 1965. Zajęcia pozarolnicze ludności kęmkowskiej. *Nad rzeką Ropą: Zarys kultury ludowej powiatu gorlickiego*, ed. R. Reinfuss. Kraków.

Chodera, J. & Kubica, S., 2000. *Podręczny słownik niemiecko-polski*. Warszawa.

Csilléry, K., 1982. Vésett díszítés, metszett díszítmény. *Magyar néprajzi lexicon*, vol. 5: Szé–Zs, ed. Gy. Ortutay, Budapest; digital version: <<https://www.arcanum.hu/en/online-kiadvanyok/Lexikonok-magyar-neprajzi-lexikon-71DCC/v-74097/vesett-diszites-metszett-diszitmeny-74182/>> (accessed 02 March 2020).

Cywa, K., 2018. Trees and shrubs used in medieval Poland for making everyday objects, *Vegetation History and Archaeobotany*, vol. 27 (1):111–136, DOI: https://doi.org/10.1007/s_00334-017-0644-9.

Czaja, R. & Nawroński, T., 1993. Pierwotny Elbląg. *Historia Elbląga*, vol. I (do 1466), ed. S. Gierszewski & A. Groth. Gdańsk.

Dekowski, J. P., 1960. Las w życiu Borusów sieradzkich, *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi*, Seria Etnograficzna, no. 3:139–174.

Drda, M., 1978. Soubor nálezů ze Sezimova Ústí, *Husitský Tábor: Sborník Muzea husitského revolučního hnutí*, vol. 1:7–44.

von Engel, A., 1907. *Österreichs Holz-Industrie und Holzhandel*, vol. I. Wien.

Francke, C., 1993. Wstępne wyniki badań zamku Szczerba w Gniwoszowie, gmina Miedzylesie, *Śląskie Sprawozdania Archeologiczne*, vol. XXXIV:339–366.

Galewski, W. & Korzeniowski, A., 1958. *Atlas najważniejszych gatunków drewna*. Warszawa.

Gawron, W., 1967. Stara Wieś. *Materiały etnograficzne z powiatu limanowskiego*, no. 1, Archiwum Etnograficzne, vol. 30, ed. P. Kaceliak. Wrocław.

Haáz, F., 1942. *Udvarhelyszéki famesterségek*. Kolozsvár.

Haneca, K. & Deforce, K., 2020. Wood Use in Early Medieval Weapon Production. *Archaeological and Anthropological Sciences*, vol. 12, no. 9, DOI: https://doi.org/10.1007/s_12520-019-01000-5.

Janotka, M., 1963. Příprava a užití štípaného dřeva v tradiční výrobě (Úvod do problematiky), *Český lid*, vol. 50 (3):152–163.

Janse, H., 1989. *Houtenkappen in Nederland 1000–1940*. Delft-Zeist; digital version: <http://www.dbln.org/tekst/jans353hout01_01/colofon.php> (accessed 24 December 2019).

– 1990. Vlotmerken, *Restauratievademecum*, RV blad Merk ophout, nr 3:1–2; digital version: <<https://docplayer.nl/3207542-Timmermansmerk-carpenter-s.html>> (accessed 25 November 2019).

Kochan, Š., 2011. Dřevěné středověké artefakty z Jihlav, <<https://is.muni.cz/th/pmii6/>> (accessed 15 March 2023).

– 2012. Dřevěné středověké artefakty z Jihlav, *Archaeologia historica*, vol. 37 (2):767–795.

Kola, A., 1985. Narzędzia do obróbki drewna z grodziska w Plemiętach. In *Plemięta. Średniowieczny gródek w Ziemi Chełmińskiej*. Nadolski, A. (red.). Warszawa/Poznań/Toruń.

Kozłowska, K., 1998. Sprawozdanie z ratowniczych badań archeologicznych przy ulicy Rzeźniczej w Raciborzu, województwo katowickie. *Badania archeologiczne na Górnym Śląsku i ziemiach pograniczych w 1995 roku*. Tomczak, E. (red.). Katowice.

Krajíč, R. et al., 1998. *Dům pastiře Prokopa v Táboře (Archeologický výzkum odpadní jímky v domě čp. 220)*. Tábor.

Krajíč, R., 2003a. Kovárna v Sezimově Ústí a analýza výrobků ze železa, cz. I, Sezimovo Ústí. *Archeologie středověkého poddanského města*, vol. 3, Krajíč, R. (ed.). Praha/Sezimovo/Ústí/Tábor.

– 2003b. Tabulky s lokalizací a metrickými hodnotami želez ze Sezimova Ústí. Kresebná a fotografická dokumentace. Kovárna v Sezimově Ústí a analýza výrobků ze železa, cz. II, Sezimovo Ústí. *Archeologie středověkého poddanského města*, vol. 3, Krajíč, R. (ed.). Praha/Sezimovo/Ústí/Tábor.

Krápíec, M., Szychowska-Krápíec, E., Danek, M. & Klusek, M., 2006. Analiza dendrochronologiczna drewna pozyskanego w trakcie badań wykopalskowych prowadzonych w Krakowie na Rynku Głównym po zachodniej stronie Sukiennic, *Materiały Archeologiczne*, vol. XXXVI:181–187.

Kubów, P., 1977. *Brzeg, ul. Polska, woj. opolskie*. In *Informator Archeologiczny. Badania rok 1976*. Warszawa.

Maśliński, M., 1963. Tradycyjne techniki obróbki drewna na północnym pograniczu Łysogór. *Zeszyty Naukowe Uniwersytetu Jagiellońskiego*, vol. LIII, Prace Etnograficzne, no. 1:83–115.

Milewski, A., 1970. *Materiały i wyroby z drewna. Poradnik zaopatrzeniowca branżysty*. Warszawa.

Nadolski, A., 1985. Gródek w Plemiętach: Wprowadzenie w problematykę. *Plemięta. Średniowieczny gródek w ziemi chełmińskiej*. Nadolski, A. (ed.). Warszawa/Poznań/Toruń.

Nowicki, A., 1913. *Użytkowanie lasów (technologia leśna): Podręcznik dla właścicieli lasów i leśników podług najlepszych źródeł i praktyki własnej*. Kraków.

Petercsák, T., 1984. Az erdőhaszna. *Répáshuta: Egy szlovák falu a Bükkben*, Szabadfalvi, J & Viga, G. (eds.). Miskolc.

Phleps, H., 1942. *Holzbaukunst: Der Blockbau*. Karlsruhe.

PilarSKI, S., 1972. Ośrodek goniarski w Krzyżowej Dolinie, powiat Opole, *Opolski Rocznik Muzealny*, vol. V (1):167–178.

Piprek, J. & Ippoldt, J., 1994. *Wielki słownik niemiecko-polski z suplementem*, vol. 1: A–K, vol. 2: L–Z. Warszawa.

Pokropka, M., 2019. *Etnografia: Materiałna kultura ludowa Polski na tle porównawczym*. Warszawa.

Prusicka-Kołcon, E., 2001. Drugi sezon badań na tzw. gródku stożkowatym w Gozdowie, stan. 1, pow. Hrubieszów. *Archeologia Polski Środkowowschodniej*, vol. VI:142–145.

– 2012. Gozdów, st. 1, gm. Werbkowice, woj. lubelskie, AZP 87-93/1. *Informator Archeologiczny. Badania* 2000:230.

Šenfeldová, H., 2021. *Tradiční techniky zdobení dřevěných předmětů 1. díl – výzdoba rytím*, <https://www.stavba-profi.cz/2021/02/09/tradicni-techniky-zdobeni-drevnych-predmetu-1/> (accessed 25 October 2022).

Skuza, Z. A., 2006. *Ginace zawody w Polsce*. Warszawa.

Slownik 1993. *Słownik naukowo-techniczny niemiecko-polski A–Z*. Sokolowska, M., Bender, A. & Źak, K. (eds.). Warszawa.

Štajnochr, V., 1983a. Tesařské hoblíky, nástroje tesařské technologie. *Muzejní a vlastivědná práce*, vol. 21 (91), no. 3:152–173.

– 1983b. Tesařské hoblíky, nástroje tesařské technologie (dokončení). *Muzejní a vlastivědná práce*, vol. 21 (91), no. 4:216–237.

Starý, F., 1925. Zaniklá výroba šindele, kolomazi a dřevěného uhlí, *Český lid*, R. 25, nr 3:99–105.

von Stülpnagel, K. H., 2000. *Die gotischen Truhen der Lüneburger Heideklöster: Entstehung – Konstruktion – Gestaltung. Quellen und Studien zur Regionalgeschichte Niedersachsens*, vol. 6. Cloppenburg.

Szacki, P., 1981. *Ludowa wytwórczość ręczodzielnicza: Przewodnik po wystawie*. Warszawa.

Thieriot, A., 1856. *Technologia leśna czyli nauka korzystnego użycia drzewa i produktów leśnych*. Kraków/Warszawa.

Wysocka, I., 2001. *Wyroby drewniane: Produkcja i dystrybucja. In Rynek wrocławski w świetle badań archeologicznych*, vol. 1, Wratislavia Antiqua, vol. 3. Buško, C. (ed.). Wrocław.

Zabiela, G., Bukanaitė, V., Česna, Ž., Kraniuska, R. & Ubis, E., 2011. *Klaipėdos pilies pietinė dalis ir kurtinos. In Archeologiniai tyrinėjimai Lietuvoje*. Vilnius.

Zaitz, E., 2006. Sprawozdanie z badań archeologicznych prowadzonych w Krakowie w 2004 r., przy przebudowie nawierzchni płyty Rynku Głównego po zachodniej stronie Sukiennic. *Materiały Archeologiczne*, vol. XXXVI:79–142.

Zajonc, J., 2014–2022. Šindliarstvo. *Elektronická encyklopédia: Tradičná ľudová kultúra Slovenska slovom a obrazom*, <<https://www.ludovakultura.sk/polozka-encyklopiedie/sindliarstvo/>> (accessed 27.01.2023).

Unpublished studies

Kozakiewicz, P., 2011. Ekspertyza – identyfikacja gatunkowa drewnianego trzonka narzędzi (nr inw. XXIV/1969), Warszawa (archive, Department of Medieval and Early Modern Archeology, Faculty of Archeology, University of Warsaw).

Film library

Dorňák, L., 2022. *Krytina ze štípaného šindele (Výroba ručně štípaného šindele na Valašsku 2)* <https://www.youtube.com/watch?v=GQWGT3gaWcU> (accessed 06 December 2023).

Idnes TV, <https://tv.idnes.cz/domaci/remeslnik-z-havlickobrodská-ukazuje-jak-se-vyrobí-sindel.V170324_132813_jihlava_jda> (accessed 24 October 2022).

Kaucký F. (dir. and scen.), 1955. *Staré Valašsko, Česko-slovenský státní film*, Czechoslovakia, <<https://www.youtube.com/watch?v=zRsOwn5V59c>> (accessed 27 January 2020).

Keszi-Kovács L. (dir.), 1955. *Az ácsolt láda*, Néprajzi Múzeum, Hungary, <<https://www.youtube.com/watch?v=T35Mm5p4GHU>> (accessed 01 March 2023); German version: *Stollentruhe*, <<https://www.youtube.com/watch?v=3VogQ9M45G8>> (accessed 01 March 2023).

Online bases

Blanenský deník, <https://blanensky.denik.cz/galerie/smrzov_jarmark.html?photo=1&back=2998786187-2980-67> (accessed 24 October 2022).

Die kleine Seite für den privaten Holzwurm, <<http://hw.roesch.de/Bilder/B4584.jpg>> (accessed 23 February 2023).

Fotoarchiv Muzeum regionu Valašsko, <<http://fotoarchiv.muzeumvalassko.cz/detail.php?id=110113x>> and <<http://fotoarchiv.muzeumvalassko.cz/detail.php?id=110114x>> (accessed 12 September 2021).

Handplane Central. Hand planes, Stanley planes, infill planes & planemaking, <[www.handplane.com/images/Catalogs/Joh-Weiss-And-Sohn-1909-Catalog37-Big.jpg](http://www.handplane.com/images/Catalogs/Joh-Weiss-And-Sohn-1909-Catalog/Joh.WeissAndSohn1909Catalog37-Big.jpg)> (accessed 19 February 2022).

Historische Werkzeugkataloge, <<https://kataloge.holzwerken.de/index.html?name=weiss&lfdnr=5#&gid=1&pid=59>> (accessed 23 October 2022).

Les vitraux de la cathédrale de Chartres, <http://www.vitraux-chartres.fr/vitraux/21_vitrail_vie_st_julien_hospitalier/index.htm> (accessed 15 March 2023).

Ministère de la Culture, <<https://www.pop.culture.gouv.fr/notice/palissy/PM28000818>> (accessed 15 March 2023).

Region Vysočina, <https://www.regionvysocina.cz/uws_images/uzivateli/vladimira-fiedlerova/clanky/vysocina-ma-tri-nove-mistry-remesel-136484/image-1_10707_vysocina_h.jpg> (accessed 24 March 2023).

SAOB – Svenska Akademiens ordbok, <https://www.saob.se/artikel/?unik=S_06067-0029.GsMV&pz=3> and <https://www.saob.se/artikel/?seek=+gr%C3%B6pj%C3%A4rn&pz=1#U_G1121_113824> (accessed 18 December 2023).

ULS Digital Collections, <<https://digital.library.pitt.edu/islandora/object/pitt%3AFCW021AGA010>> (accessed 15 March 2023).