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ARCHEOLOGICAL FINDINGS OF NUREMBERG TRAVELLING SUNDIALS FROM BOHEMIA AND MORAVIA

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The core of the presented text consists of descriptions of 22 finds of Nuremberg travelling sundials, mainly from archaeological sites in Prague (10) and South Moravia (10 pieces), the vast majority of which have not yet been published. Brief mention is made of the origins of modern sundials, the material used in Nuremberg for their manufacture, commerce with them, and period prices found from manuscripts in Czech archives. The article includes a table of currently known identified master marks with biographical data of the Nuremberg manufacturers

ARCHEOLOGICKÉ NÁLEZY NORIMBERSKÝCH CESTOVNÍCH SLUNEČNÍCH HODIN Z ČECH A MORAVY

Jádro předloženého textu tvoří popisy 22 nálezů norimberských cestovních slunečních hodin, zejména z pražských (10) a jihomoravských (10 kusů) archeologických lokalit, z nichž naprostá většina dosud nebyla publikována. Stručně jsou zmíněny předpoklady vzniku moderních slunečních hodin, materiál používaný v Norimberku k jejich výrobě, obchod s nimi a dobové ceny zjištěné z rukopisů v českých archivech. Součástí článku je tabulka aktuálně známých identifikovaných mistrovských značek s životopisnými údaji norimberských výrobců.

Key words — Bohemia – Moravia – sundial – Nuremberg – polos – compass – prices – master marks

Klíčová slova — Čechy – Morava – sluneční hodiny – Norimberk – polos – kompas – ceny – mistrovské značky

There is a group of several dozens of examples of portable sundials among the many timekeeping instruments in the state collections in the Czech Republic. They were used for timekeeping in the 16th and 17th centuries and, according to the master marks and style, were made in Nuremberg. Most of them come from museum collections, built up in the past from donations and purchases at various European auctions. Recently, these collections have been enriched with objects recovered during archaeological field excavations; so far, we know of 22 such pieces from the Czech lands. In contrast to traditional museum exhibits, the pocket sundials acquired by expert archaeological methods bear circumstances of their findings that can inform us, among other things, about the locality and social environment in which the objects were used. The aim of the present text is a more detailed presentation of the archaeological findings of Nuremberg pocket sundials stored in Czech and Moravian state collections, allowing a more comprehensive picture of the production by Nuremberg *kompassmachers* and their distribution in the Czech lands and expanding the existing knowledge of this distinctive early modern phenomenon.[1]

There is a wider base of literature on the principles of solar timekeeping devices in general in the Czech environment (e.g. Michal 1980; Příhoda 1983). The monograph by Miloš Nosek (Nosek 2021) with a summary of the existing literature and a glossary of terms is oriented almost exclusively on the application of fixed sundials. The only Czech monograph dealing with portable sundials is the publication by Bedřich Polák (1990). The collections of portable sundials in the National Technical Museum (NTM) in Prague (Horský/Škopová 1968), the Museum of Decorative Arts (UPM) in Prague (Lenfeld 1984) and the Regional Museum in Mikulov (Horský 2011) have been published. Portable inclining and analemmatic sundials by Johann and Anton Engelbrecht are addressed in the diploma thesis of Patrik Pařízek (2011). The primary source of information on portable diptych sundials made in Nuremberg is the study *The Ivory Sundials of Nuremberg* (Gouk 1988), dealing with the history of their manufacture using sources from the Nuremberg archives, published on the occasion of an exhibition of ivory diptychs from the collections in Oxford and the Whipple Museum in Cambridge.[2] Other publications among other major institutions worldwide where Nuremberg diptych sundials are significantly represented include the collections housed at Harvard (Lloyd/Gouk/Turner 1992) and the National Maritime Museum Greenwich (Higton et al. 2002). Among Czech collections, seven Nuremberg diptychs housed at the NTM in Prague (Horský/Škopová 1968) and three instruments at the UPM in Prague (Lenfeld 1984) are described. The sources cited above are mostly related to instruments from the more luxurious

1 The author is grateful and indebted to the staff of the relevant institutions for kindly providing the necessary information, including photographic documentation

2 The term *diptych* is also used in the original Czech by the author in accordance with the English term for this type of sundials *diptych* (*cf*. e.g. Gouk 1988, 7, *passim*). In German the term *Klappsonnenuhr* is used, in Polish *zegar soneczny dwutabliczkowy*. Contemporary names in archival sources were most often *kompass* and *kompast* (*cf*. notes 12 and 15).

category. Archaeological finds of portable sundials, on the other hand, give an indication of the appearance of common goods. Abroad, Roland Schewe provided a broader overview of archaeological finds in 2019; in his article *Fundorte von Taschensonnenuhren in Mittel- und Osteuropa*, he collected brief information on finds in Germany (19 specimens), Austria (7), Switzerland (2), Hungary (10), Slovakia (4), the Czech Republic (5),[3] Poland (3), and two finds from Latvia (Schewe 2019). A similar list was compiled by Zofia Wilk-Woś (2013). Another recent contribution, this time a bulk find, is the report of the recovery of various Nuremberg goods from a wreck on the Mijoka shoal in Croatia. Approximately ten sundials by several Nuremberg masters occupy a prominent place (Zmaić Kralj 2015) among the discovered artefacts. Also recovered from a wreck, this time of the English Mary Rose, sunk two kilometers off Portsmouth harbor in 1545 and raised in 1982, were eight pocket sundials, six of which represent a unique set of wooden circular horizontal dials, until then almost unknown.[4] The issue of the Nuremberg diptychs is thoroughly addressed by the authors of an article on the discovery of a diptych at Uhrovec Castle in Slovakia (Jaššo/Horanský 2022). In the Czech Republic, finds of portable sundials are usually described individually in separate contributions in specialist periodicals (Podliska 2000; Vích/Fomín 2022) or as a marginal part of overall research reports (e.g. Tribula/Bednaříková 1980; Šebela/Vaněk 1982).

The travelling sundials described here come from Nuremberg, with one exception, the origin and maker of which have not yet been identified (cat. No. 6 from Uherský Brod). The city was at its peak around the turn of the 15/16th century. Already in the mid-15th century, at the beginning of the boom in the production of portable sundials, a sufficient level of craftsmanship of various materials had been achieved here. However, the very emergence of the new sundial was made possible by two major European innovations of the first half of the 15th century – the invention of the polos and the compass.

The shadow cast by the Sun during its apparent movement from east to west varies both in length and direction. A sundial can thus use the Sun in two different ways. An ***altitude dial*** determines the time by the changing angular height of the Sun above the horizon, while a ***directional dial*** relies on the changing direction of the Sun in the sky.[5] Here, the gnomon (*polos*) is parallel to the Earth's axis and the time is shown by the angle of its shadow (Gouk 1988, 9). The "modern" directional sundial revolutionized the measurement of time, whereas until then, the altitude sundial had been used.

Fig. 1. Vertical sundial, originally with a stylus. Skalica, Slovakia, parish church of St. Michael from the end of the 14th century (photo by J. Žegklitz, 2018).

The origins of sundials in the Central European environment of the early Middle Ages are closely linked to the building of monasteries during the progression of Christianization. Timekeeping was essential for the observance of the order of prayers, which was done by water and candle clocks in the dark part of the day and by a vertical sundial carved into the masonry of the southern walls with a horizontal pointer (***stylus***) in the light part of the day (Fig. **1**). The division of the light part of the day into twelve sections was adopted by the monks from ancient times. For their own purposes, however, they initially marked on the dials only the times of prayer: the ***Prime*** at sunrise, the ***Terce*** at mid-morning, the ***Sext*** at mid-afternoon, the ***None*** at mid-afternoon, and the ***Vespers*** an hour before sunset. Over time, the time of some hours shifted, e.g. the ***None*** was moved to noon, hence the English designation "noon" (Bláhová 2001, 283–284). These sundials are called canonical (Fig. **2**).

3 Čejkovice, Ivančice, Prague Castle 2nd courtyard, Prague's Old Town Ostrovní Street, Strachotín.
4 *Sine* 2024 online.
5 In Czech, the term ***directional dial*** is taken from English literature in which portable sundials are divided into two basic groups – altitude dial (further divided into column, disc, quadrant, etc.) and directional dial (horizontal, vertical, diptych, etc.). On directional dials, the time is read from the direction of the shadow of the pointer.

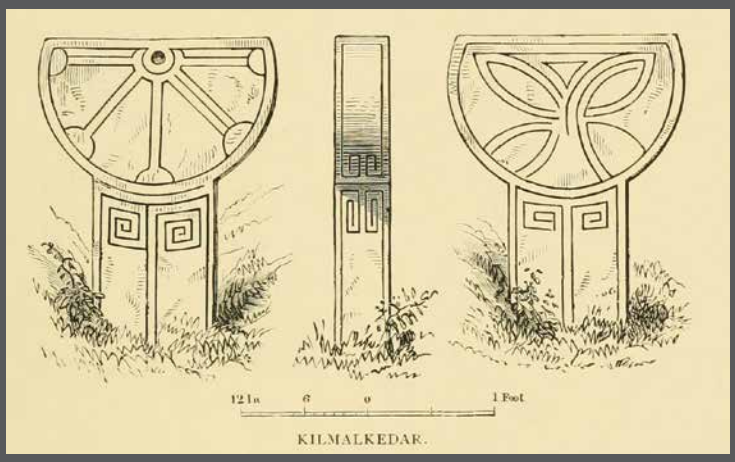


Fig. 2. Dingle, Ireland, Kilmalkedar Church. Canonical sundial, age of the sundial determined to be before the 10th century. ***None*** marked with a triple line (photo J. Žegklitz, 2001; 19th century drawing taken from Gatty 1900, 83).

Fig. 3. Portable canonical sundial from Canterbury, from the 10th century, dimensions of the silver plate 61 × 16 mm (see Bassermann-Jordan 1961, 99; stored at Canterbury Cathedral, 01513; available at <https://www.burlington.org.uk/archive/exhibition-review/anglo-saxon-kingdoms-art-word-war-british-library-london>).

Fig. 4. Portsmouth, Great Britain, 1545. One of the sundials from the wreck of the Mary Rose sunk in 1545 off Portsmouth. The dial divided into full hours only, floral decoration to the sides of the base of the brass folding polos, some other finds from the wreck have figural decoration. Diameter 33 mm. Inside the lid, protecting the polos when folded, there is a mirror which is in no way related to the function of the sundial but is probably just a commercial feature (stored at the Mary Rose Trust, PORMR 80A1669, photo © Mary Rose Trust).

Fig. 5. Table pillar dial, Bohemia, 1745, total height 310 mm, height of brass cylinder 191 mm, cylinder diameter 91 mm. The widely used travelling pillar dial was roughly half the size and was held suspended when measuring (stored at the UPM in Prague, Inv. No. 79462; photo © Ondřej Kocourek, UPM in Prague).

Fig. 6. Heinrich Seus, around 1450: *Horologium Sapientiae* manuscript, excerpt. In the middle of the detail of the illustration we can see a mechanical clock machine on the table and two directional sundials – horizontal at the top back, equatorial on the right. Below the edge of the table hangs the altitudinal sundial (on the left a pillar dial and on the right a quadrant; see Fléchon 2012, 120–121; available at <https://commons.wikimedia.org/wiki/File:Instruments_horaires_XVe.jpg>).

A pocket version of the canonical dial is represented by a unique find in Canterbury Cathedral in 1938 (*sine s. d.* online; Bassermann-Jordan 1961, 99; Fig. **3**). The silver plate with a brass chain hinge ***stylus*** has three columns engraved on each side described by abbreviations of the names of pairs of months, with a hole drilled in the top of each column. When taking measurements, the stylus was inserted into the hole according to the current month and the dial was oriented with the stylus facing the sun, with the weight of the chain on the opposite side balancing the dial in a vertical position. The canonical dial was marked with stamped indents, the end of the shadow indicating the time. This sundial can be considered the forerunner of the pillar dial, on which, however, the position of the stylus in relation to the dial was adjusted by rotating it around the vertical axis of the pillar according to the calendar marked around the perimeter. Until the invention of directional dials, the pillar dial was the most widely used altitude travel sundial, with timekeeping based on the changing height of the sun above the horizon during the year (Fig. **5**). Their use continued into the 19th century.

The primitive dial faces of vertical wall sundials, to which the division into 12 segments gradually returned, measured the hours unevenly, a consequence of the use of a stylus whose position does not allow for the changing direction of the sun's rays for a particular hour during the year. The variable length of the hours during the year was not a serious obstacle for the organization of religious life; complications only arose with the invention of the mechanical clock.

After the advent of the mechanical clock in the 14th century, ***equal hours*** began to be used. Mechanical clocks driven by weights could not easily be set to strike non-equal hours that varied throughout the year, but they were suitable for dividing day and night into equal and reproducible units. These new mechanical devices were initially inaccurate and unreliable; the need to bring them into line with local solar time, defined by the angular position of the sun in the sky, led to the development of sundials calibrated to the same system of equal length clocks (Lloyd/Gouk/Turner 1992, 14). The result was the introduction of the ***polos*** – a pointer parallel to the earth's axis – lying thus in the direction of the local meridian and making an angle with the horizontal equal to latitude.[6] In order for this new pointer to be used on portable sundials, it was necessary to ensure that it was positioned in a north–south direction when making measurements.

The problem of orientation of the instrument was solved by incorporating the compass into a horizontal plate. Although primitive compasses in the form of a magnetic needle on a pin appeared on ships in the Mediterranean as early as around 1200, their use was not reliable because the phenomenon of magnetic variation (the deviation between the geographical and magnetic poles, whose value varies according to the place of observation and also over time) was not yet known. Correct orientation of the sundial by compass is therefore dependent on knowing the current angular value of magnetic variation for the place of measurement. The earliest known sundial with a magnetic variation marked on the bottom of the compass is thought to be the horizontal sundial of the Viennese astronomer Georg Peuerbach (*1423–†1461), dated 1451; it is also the earliest known use of a string polos (Schewe/Goll 2019, 12).

Fig. 7. Hieronymus Reinmann, 1575: miniature diptych sundial for the general public; width 26, depth 31 mm (stored at the Salzburg Museum, K 532-49, photo © Salzburg Museum).

Left: detail of surface **IIb** with master's mark and the letter *N*.

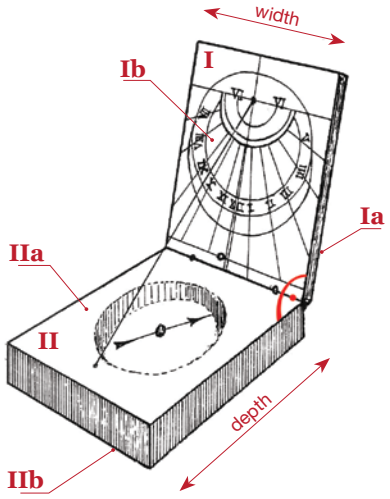
6 On equatorial sundial, the ***polos*** is usually in the form of a needle; on horizontal sundial with a folding triangular brass gnomon, it is represented by a triangular septum (e.g. Fig. **4** or Thun – cat. No. 1) and on diptych clocks by a twine of silk strands stretched between the plates (e.g. Figs **11**, **14**).

Sundials using this new principle (***directional sundial***) were already widespread before the middle of the 15th century. This is evidenced by an illustration in Heinrich Seuse's manuscript *Horologium Sapientiae* from around 1450 (Fig. **6**), which shows a mechanical clock machine, two directional sundials (horizontal, equatorial[7]) and an altitude sundial, the predecessor of the directional sundial – column and quadrant. The Nuremberg diptych with a string polos is still missing from the illustration, but an early horizontal dial of circular form with a folding triangular brass gnomon, the hypotenuse of which functions as a polos, is represented. They are mentioned in the guild rules of the Nuremberg *kompassmachers*, which permit the use of less valuable wood to make the boxes in which the instrument is housed (Gouk 1988, 78). Very few survive, and it has already been mentioned that several were recovered from the wreck of the Mary Rose (Fig. **4**).

Diptych sundials gradually dominated the Nuremberg production. Their name derives from the Greek *diptychos*, which refers to a pair of folding writing tablets – a diptych is thus a portable sundials made of two plates connected by a hinge, which when opened to the functional position form a right angle.[8] The inner surfaces of the plates bear the faces of the vertical and horizontal dials; at the points of intersection of the sixth and twelfth hours they have holes drilled through which the string pointer (polos) is threaded. In the horizontal plate is the compass bowl (Fig. **7**). Vertical dials, functionally redundant, were later dropped and replaced by other indications, especially in larger instruments. The functional position is stabilized by a latch at the hinge, the other two latches on the opposite side serving to securely close the instrument. Johannes Müller, known as Regiomontanus (*1436–†1476), who worked in Nuremberg between 1471 and 1475, was responsible for the development of the Nuremberg diptychs.[9] Another important engineer and producer of sundials and other instruments was Georg Hartmann (*1498–†1564), a mathematician and priest at St. Sebald in Nuremberg. He set up a printing press in his home which he also used to print designs of various types of sundials.

Explanatory notes to the description of diptych sundials, which will be used in the following text:

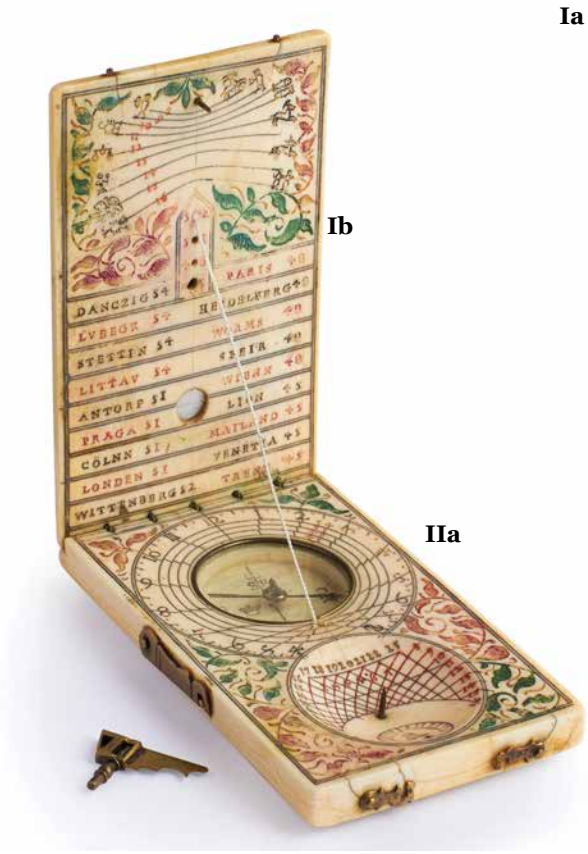
I – vertical plate
II – horizontal plate
Ia – outer surface of vertical plate
Ib – inner surface of vertical plate
IIa – inner surface of horizontal plate
IIb – outer surface of horizontal plate (Fig. **8**)

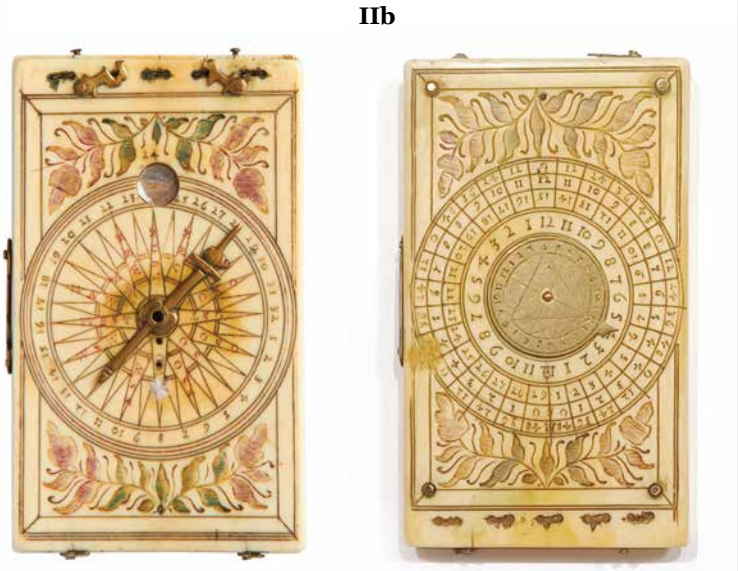


Czech hours – counted from the sunset, usually in the range 9–24
Italian hours – counted from the Ave Maria bells, about half an hour after sunset, usually in the range 9-24 (Lenfeld, 1984, 31)
Babylonian hours – counted from sunrise, usually in the range 2-15
German hours – 2 × 1–12, as usual today
magnetic variation – marked on the bottom of the compass by an engraved arrow
polos – a pointer parallel to the earth's axis; the angle of the polos with the horizontal plane must be equal to the latitude of the place of measurement
stylus – horizontal pointer, time indicated by the end of the shadow
gnomon – generally a sundial pointer, in descriptions a vertical pointer, time indicated by the end of the shadow (hence ***gnomonics***, the science of the sundial)

Fig. 8. Schematics of side markings of diptych sundial, with the faces at right angles to one another.

7 The ***equatorial sundial*** has a regularly divided ring dial which must be set parallel to the equator when measuring. The pointer is a folding polos needle.
8 The term *diptych* implies a pair and is thus used as singular when referring to a particular sundial.
9 Regiomontanus, considered the most important mathematician of his time, studied and taught at the University of Vienna, where he worked with Georg Peuerbach, in Italy, and then in the service of Matthias Corvinus and the Popes Paul II and Sixtus IV. During his stay in Nuremberg, he opened a printing house from which mathematical and astronomical writings were published, and in his own workshop he made astronomical instruments.





Ia – Wind rose with 32 named points and brass index arm. After folding the instrument into a horizontal position, a wind vane is inserted into the hole in the center of the wind rose. The circular compass viewing hole serves as a view onto the needlehead when the wind rose is oriented. After the wind vane settles, a brass index arm pointing to the wind direction is identified with the direction of the wind. This part of the diptych acts as a meteorological instrument. Two latches ensure the perpendicularity of the plates when the instrument is opened.

Ib – at the top, a simple ***calendar*** with zodiac curves and indications of daylight hour length; the indications show the end of the shadow of the needle stylus. In the center on the vertical, four holes marked 45, 48, 51, and 54 to adjust the polos to the latitude. At the bottom a table of cities with their latitudes.
IIa – in the center of the northern half is a ***compass***, at the bottom of which are the cardinal directions and a crown as a master mark. Around the compass are four concentric ***horizontal*** dials for the four latitude values. In the southern half is a concave double dial: in **red** the dial of the Babylonian hours, in **ochre** the dial of the Italian hours. The data is determined by the end of the shadow of the ***gnomon***. On the west side of the plate, is small compartment with a brass cover for wind vane. On the face of the plate are two latches to close the instrument.
IIb – indistinct master mark at the hinge. The center of the surface is occupied by a lunar ***vollvele*** with a rotating brass disc for converting lunar to solar time. For the conversion, it is necessary to know the phase of the moon, which is set by the index of the brass rotating part of the volvelle on the middle scale 1–29. The rotating disc is then used to locate the measurement, and the corresponding solar time is read on the adjacent fixed scale. The time can still be read in hours and minutes on two scales at the volvelle's circumference. A simpler lunar vollvele without minute scale is also found on small diptychs, but here it is located on the face **Ia** (*cf*. cat. No. 18, see below).

Fig. 9. Michael Lesel, 1st third of the 17th century: completely preserved example of a luxury diptych sundial. Ivory, 60 × 100 mm (private collection, Germany; photo by owner).

Thanks to its convenient location in the middle of Europe, Nuremberg became one of Europe's most important trade centers, and portable sundials became one of the export items of local craftsmen. The mass dissemination of modern sundials from Nuremberg made them accessible to all social classes from the common folk, for whom the cheapest wooden instruments of miniature dimensions designed for a single latitude were intended, to wealthy customers purchasing large ivory exhibition pieces with several dials for different latitudes and a number of other indications. These luxurious instruments, measuring around 60 mm wide and 90 mm deep, also served as representational items for their owners (Fig. **9**). There are also sundials of superior dimensions; the largest Nuremberg ivory diptych, measuring 123 × 191 mm, is housed in Prague.[10] In its size and the richness of gnomonic filling, as well as in its elaborate decoration, it represents the culminating work of Hans Troschel the Elder from 1612, at the end of his life.

Nuremberg diptychs dominated the European market for two centuries. This is evidenced by documentary sources and the frequency of Nuremberg diptychs in collections, as well as by the geographical spread of their archaeological finds. According to guild rules, sundials were to be made only of ivory or fine wood, either boxwood or pear. However, a number of instruments of small dimensions have survived in which bone is the designated material, not unlikely sometimes because of the poor distinction between bone and ivory. There is no mention of brass in the rules, despite its use by some masters, notably Paul Reinmann and Hans Tucher. Masters were associated in a guild with their own statutes from 1535 (Gouk 1988, 77–81). It was a "closed" guild; journeymen were forbidden to wander, and masters were not allowed to operate outside Nuremberg. Non-compliance with the guild's statutes was prosecuted; this is evidenced by a case from 1590 in which two Nuremberg compass makers, Ulrich Pfister and

10 Museum of Decorative Arts, Inv. No. 4012.

Martin Friedmann, settled in the New Town of Prague. The New Town Council was warned by a letter from Nuremberg that they were practicing their trade without proper permission, and the guild representatives asked the Prague councillors to inform the two Nurembergers that they were obliged to return and appear at the town hall within two weeks (Bůžek 1997, 19–20, 61).[11]

The expansion of the trade in Nuremberg sundials already at the end of the 15th century is evident, for example, from the surviving inventory of the Nuremberg merchant company Tucher from 1484, which contains over 3,000 unspecified pocket sundials for export to Geneva that year (Schewe/Goll 2019, 17). The sundials reached their customers through Nuremberg merchants with offices in many major European cities. Some 45 Nuremberg trading companies, mostly specializing in luxury goods, operated in Prague between 1520 and 1550, some of them also setting up branches in Moravian cities such as Olomouc. In 1550–1620 their number increased to 151 in Prague (Bůžek 1997, 21).

An insight into the assortment of the Prague shopkeeper who also sold sundials is offered by the inventory of Hanus Que (Kwe) taken after his death in 1590. Que owned the house U tří labutí in today's Karlova Street (No. 169) and rented another house. The surviving inventory describes the goods in his shop in Vladislav Hall at Prague Castle.[12] From the mid-16th century, the hall served as a trading house for the nobility whose members came here both for shopping and for social reasons. Sadeler has admirably captured the movement in the hall in a perspective view from 1607, a detail of which (Fig. **10**) shows two of the shops with goods on display, one of them with a clock. Hans Que ran two shops in the Vladislav Hall. His "shop second at the castle to the palace" contained, according to the inventory, a variety of goods: hunting horns, hats, gloves,

Fig. 10. Aegidius Sadeler, 1607: *Prospectus of the Vladislav Hall* – excerpt (NG, Collection of Prints and Drawings, Inv. No. R 78014). Engraving, 562 × 616 mm (Metropolitan Museum of Art, New York, Drawings and Prints, inv. No. 53.601.10(1); available at <www.metmuseum.org/art/collection/search/409008>). The detail shows the artist himself selling prints at the bottom left. In the neighboring shop there are, for example, jars, cups, or horns displayed for sale. The next shop, with clocks on shelves, is occupied by a woman, probably Zuzana Solisová, by 1607 already the widow of Erasmus Habermel (a prominent Prague manufacturer of instruments), or her sister-in-law Lidmila Glockner, who at that time jointly ran a clock shop here (Fomín 2022, on pp. 72–73 the genealogy of the Habermel couple and their family connections).

cloth, iron chains, brushes, ivory combs, bone spoons, mirrors, goldsmith's ties, buttons, etc. as well as a number of sundials. Out of a total of 177 pieces, 87 were made of wood, 24 of bone,[13] 21 of ivory, 8 of brass, and for 37 pieces the material is not specified. Like the other items in the inventory, the sundials are priced item by item. Naturally the highest valued instruments are ivory – "4 large compasses with scales of leather for 8 R" at 2 Rhenish gulden. These would have

11 Regest edition of the more important letters in Bůžek 1997, 57–67; the source cited is StAN RN, No. 207, fol. 44–45 (Bůžek 1997, 61).

12 AMP, sign. 1173, fol. 207r–218r from the year 1590.

13 "2 dozen bone compasses for 1 R".

been luxury Nuremberg diptychs of standard size, that is, about 6 cm wide and 9 cm deep, supplied in leather pouches or cases (Fig. **9**). Another item specifically mentions the incorporation of lunar vollvele in the instruments: "5 large ivory compasses with brass lunar vollvele for 1R". For some pieces the maker Hans Tucher is even mentioned, so they were signed: 1 large Tucher compass 1 R 35 kr, 2 Tucher ivory compasses at 48 kr each, 1 Tucher round compass nicely gilded for 1 R. In the last case, the pieces are a brass diptych in a circular box (Fig. **11**). Other similar sundials in brass, probably of simpler design, are valued at 30 kreuzers. Smaller ivory diptychs are valued at 11 to 24 kreuzers apiece. Most of the sundials in the inventory, however, are inexpensive devices of bone and especially of wood, priced from 1 to 4 kreuzers; the cheapest small wooden ones are even three for a kreuzer. More than four-fifths of the assortment is therefore made up of cheap instruments.[14]

Fig. 11. Hans Tucher, 2nd half of 16th or 1st half of 17th century: signed brass diptych in a circular box, diameter 42 mm. **A** – side **Ia** – lunar vollvele; **B** – side **IIb** master mark on the bottom of the box, detail; **C** – open sundial, complete; **D** – master mark of Hans Tucher (private collection, Germany; photo by owner).

Another inventory, written in 1606 after the death of the Old Town merchant Katerina Milderberger, lists sundials in 636 pieces.[15] The cheap sundials are again the most numerous: 216 wooden ones, of which the cheapest (96) are a dozen for 5 kreuzers, others (48) for about one kreutzer, and painted ones (72) for 2 kreuzers. Of ivory, described as "white", there are 385 pieces, ranging in price from 8 to 23 kreuzers. Of these, 40 pieces at 12 kreuzers and 12 "in red leather cases" at 23 kreuzers "hanstucher".[16] The most expensive two "nice compasses in red leather

14 ***R*** – abbreviation of the numerical unit of ***Rhenish gulden*** (Grossmannová 2016 online, table on p. 9). By order of Rudolf II in 1577, its value was set at 60 kreutzers (= 30 white groschen): in 1594, a carpenter earned 2 thalers + 18 white groschen for a month (Staněk 1995, 34), which is 182 kreutzers = about 3 Rhenish gulden. From 1594 we know the prices in units of thaler and white groschen (Staněk 1995, 34), which shows that a horse cost approximately 37 R, a hog 2 R + 20 kreutzers, 1 kg of butter approximately 1 R, 100 kg of wheat 1 R + 40 kreutzers, a sheep 32 kreutzers, a goose 12–20 kreutzers, a hen 5–8 kreutzers, and 60 eggs 10–20 kreutzers. Shoes cost about 15–36 kreutzers.

15 AMP, sign. 1174, fol. 219r–224r from the year 1606.

16 The repeated mention of Hans Tucher's instruments indicates his permanent business ties to Prague.

Fig. 12. Lienhart Miller, 1st half of the 17th century: sundial shaped like a violin; 26 × 73 mm.
A – opened sundial; **B** – master mark of L. Miller on the bottom of plate **IIb** (The Collection of Historical Scientific Instruments – Harvard, Cambridge, Massachusetts, Inv. No. 7348).

Fig. 13. Probably Lienhart Miller, 1st half of 17th century: sundial in the shape of a lute; 27 × 63 mm (Kunsthistorisches Museum Wien, Kunstkammer 763; photo © Kunsthistorisches Museum Wien).

Fig. 15. Lienhart Miller, 1631: horizontal sundial as a ring; 38 × 30 × 28 mm, monogram L.M. (taken from Kern 2010, Fig. 28, description 496–497).

◄ **Fig. 14.** Paul Reinman, c. 1600, horizontal sundial with ivory face in a brass case. Gilt brass, ivory and enamel. w. 35, d. 42, thickness 14 mm, master mark on bottom of compass (History of Science Museum in Oxford, UK, OX 38669; photo © University of Oxford).

bags" cost 1 R 15 kreuzers. The most interesting item are the "compasses made in the manner of a lute and violin" at 40 kreuzers each. Lienhart Miller was a specialist in the manufacture of such sundials, close in design to jewelry and probably intended for a female clientele (Figs **12** and **14**).

In addition to the usual rectangular diptychs, and less frequently oval or octagonal ones, horizontal sundials with ivory dials in brass cases were available on the market, either heart-shaped (e.g. from the workshop of Lienhart Miller found in the Mijoka wreck) or octagonal (Fig. **14**), and rarely on rings of gilded brass or ivory (Fig. **15**; Kern 2010, 348).

In the inventory of Katerina Milderberger there are also three hundred hourglasses of 2 kreuzers each, these apparently in wooden boxes, as well as around thirty brass "sand clocks" of 7.5 kreuzers each and five sets of four hourglasses in one case, used by the clergy during sermons, of 15 kreuzers each. Simple hourglasses were commonly used in the kitchen or by craftsmen to measure the time of work (Fig. **16**).

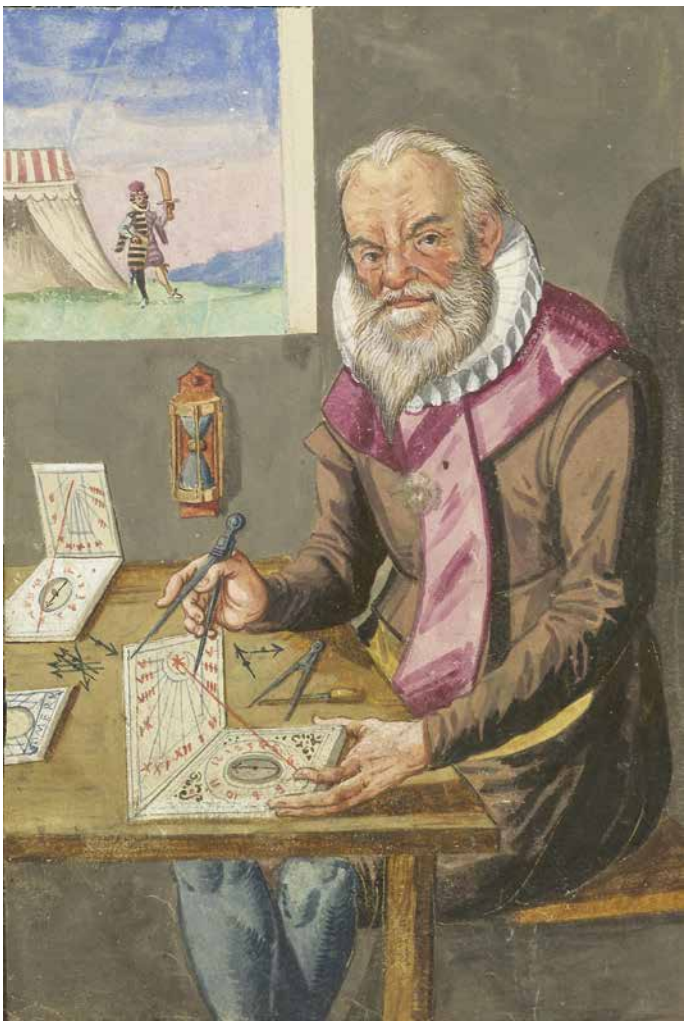


Fig. 16. Hans Tucher III at the age of 84 in his workshop on 12 September 1631. An hourglass hangs on the wall, the maaster holds a ***compass*** in his hand, ***needles*** and the master's essential tools (***compass*** and ***chisel***) are strewn on the table among the diptychs. (Milderberger's inventory lists the price of the brass compass at 4 kreuzers, the smaller one at approximately 2 kreuzers.) It is worth noting the coloring of the polos to match the color of the numerals. Excerpt from manuscript *Hausbuch der Mendelschen Zwölfbrüderstiftung*, Nurmberg, Mendel II, Stadtbibliothek im Bildungscampus Nürnberg, ca. 1670–1677, Amb. 317b2°, fol. 108v. <https://online-service.nuernberg.de/viewer/image/0f5e1d20-0f54-473b-9516-8cf87c93689a/222/>.

Very few examples of the most numerous wooden instruments have survived to this day, both because of the low resistance of wood to the effects of time and the environment, and because of the low price, which did not encourage the owner to be careful or to repair them.

After the peak of craftsmanship and artistic rendering of the Nuremberg diptychs at the turn of the 16th and 17th centuries in the works of Paul Reinmann, Hans Troschel Sr., and both Hans Tuchers, a gradual decline followed from about the middle of the 17th century, caused mainly by the devastation of Central Europe by the Thirty Years' War. Ivory was used less and less in Nuremberg to make sundials.[17] In the first half of the 18th century, miniature diptychs with an ivory vertical plate and a sandwich horizontal part made of a wooden core covered with ivory plates were still leaving the workshops of the last Karner family. The last known large ivory diptych (45 × 100 mm) signed with the initials L.A.K (Leonard Andreas Karner) dates from 1745 and is now housed in Budapest.[18] At the end of the 17th century, Nuremberg faced competition from the Augsburg workshops and their brass ***equatorial sundials***. The production of Nuremberg diptychs in the workshops of David Beringer (*1756–†1821) and his brother Paul Philipp Beringer (*1760–†1834) switched to cheap wooden instruments with printed and hand-colored dials glued on. In the 19th century, production of these diptychs continued in nearby Fürth in the workshops of the Kleiningers and Stockerts (Gaab 2024 online).

17 This is in contrast to the French ivory processing center of Dieppe, where sundial production increased in the second half of the 17th century. However, it was a sundials of a different principle (***magnetic-azimuthal***).

18 Budapest, Iparművészeti Múzeum, Inv. No. 80.273.

CATALOGUE

List of described archaeological finds of portable sundials:

Cat. No.	Type of sundial	Part	Locality	Master
1	horizontal ivory on a stand		Prague-Malá Strana, Thunovská No. 192/III	Casper Milner
2	wooden diptych	**II**	Prague-Prague Castle, Vladislav Hall	Casper Milner
3	ivory diptych oval	**I + II**	Pouzdřany, No. 241	Casper Milner
4	ivory diptych of sandwich type	**II**	Strachotín, No. 862	Hans Miler
5	ivory diptych	**II**	Strachotín, No. 862	Hans Rieger
6	horizontal ivory with writing tablet		Uherský Brod, extinct No. 2158	*(unmarked)*
7	ivory diptych	**I + II**	Landštejn castle	*(unmarked)*
8	ivory octagonal diptych	**II**	Prague-Prague Castle, 2nd courtyard	*(unspecified)*
9	ivory diptych	**II**	Prague-Staré Město, U Milosrdných, No. 909/1	Albrecht Karner
10	ivory diptych	**II** (fragment)	Prague-Staré Město, U Milosrdných, No. 906	
11	ivory diptych	**I** (fragment)	Prague-Hradčany No. 180/IV	
12	ivory diptych	**I + II**	Prague	Hans Troschel
13	ivory diptych	**I**	Prague-Hradčany No. 181/IV	
14	ivory diptych	**II** (fragment)	Prague-Hradčany No. 79/IV	*(unspecified)*
15	ivory diptych	**I**	Prague-Nové Město, Ostrovní No. 125	
16	ivory diptych	**I**	Prague-Prague Castle, Zlatá ulička	
17	ivory diptych	**II**	Brandýs nad Orlicí–castle	family Tuchers
18	ivory diptych	**I**	Čejkovice, No. 1	
19	ivory diptych	**II** (fragment)	Ivančice, No. 3535	
20	ivory diptych	**I + II**	Pouzdřany, No. 241/1	*(unmarked?)*
21	ivory diptych	**I**	Strachotín, No. 862	
22	ivory diptych oval	**I**	Strachotín, No. 862 or around	

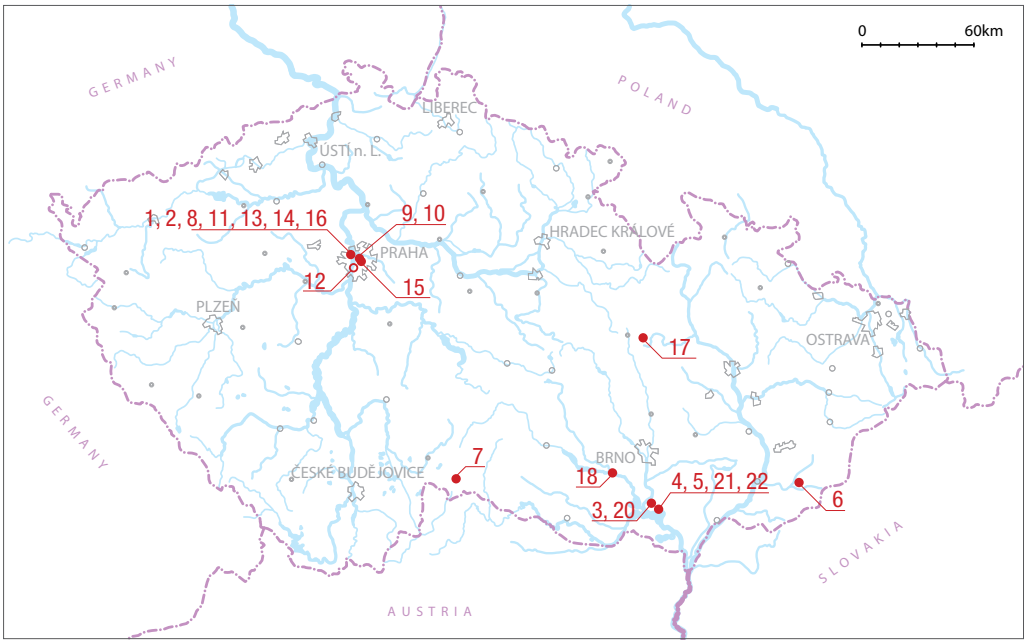


Fig. 17. Situation of sites 1–22 with findings of portable sundials in Bohemia and Moravia (inserted from public sources by S. Babušková).

Shortcuts:

ARÚ Prague (ARÚ AV ČR, Praha, v. v. i.) — Archeologický ústav Akademie věd České republiky, Praha, v. v. i. – Institute of Archaeology of the Czech Academy of Sciences, Prague (IAP)

NPÚ ÚOP in Prague — Národní památkový ústav, územní odborné pracoviště v Praze – National Heritage Institute, Department in Prague

UPM (UPM in Prague) — Uměleckoprůmyslové muzeum v Praze – The Museum of Decorative Arts in Prague (MDA)

1. PRAGUE-MALÁ STRANA, Thunovská No. 192/III

HORIZONTAL SUNDIAL ON A STAND

Obverse

Reverse

photo © UPM in Prague, O. Kocourek

Research / Institution / Year • NPÚ ÚOP in Prague No. 2011/3, supervised by J. Čiháková, 2018 (probe XIV, ditch backfill)
Stored • NPÚ ÚOP in Prague, Inv. No. 2011/3-3720; long-term loan UPM in Prague, 3rd collection
Date • 3rd third of the 16th century
Origin • Nuremberg, Germany
Author • Casper Milner
Signature • without signature
Master mark • *Agnus Dei* on the bottom of the plate and on the polos
Material • ivory, brass
Dimensions • w. = 21–22 mm, d. = 23 mm, th. = 5 mm
Latitude • due to the irregularities of the dial and the polos and the miniature size of the instrument, the latitude could not be determined
Description • ***Obverse*** – On the upper surface of the approximately square plate a circular dial 4–12–8 divided only into whole hours. In the center of the southern half, a 9 mm diameter compass bowl, with an eastern magnetic variation of approximately 11° marked with an arrow at the bottom. From the equipment of the compass, glass cover, wire ring to hold the glass in place and magnetic compass needle survived in a heavily corroded state; they were removed from the instrument during conservation and stored. The folding brass triangular-shaped polos is connected to the plate by a double hinge, with a relief master mark on the eastern surface of the polos. Remnants of red colour still in the engraving of the face. The interior of the dial is decorated with a pair of birds, the corners of the plate and the sides of the compass with dot rings.
Reverse – Holes for the hinge of the polos and the master mark on the bottom of the plate.
Stand – The sundial is mounted in a prismatic stand made of brass sheet 0.5 mm thick, the prism was originally joined on one edge by soldering, the bottom of the stand is a soldered brass square sheet. Weight and dimensions: 20.23 g, w. 23 mm, h. 31 mm. In the stand, the sundial was mounted on two oppositely soldered flat wires and clasped.
Comment • Not many miniature Nuremberg horizontal sundials have survived, although at least initially they must have formed a substantial part of the production. The square-shaped find described here, in dial and polos design, is close to the circular ones mentioned above (Mary Rose). However, the surviving brass stand is quite exceptional, certainly originally with a cap protecting the polos. At the time of the discovery, the space under the compass glass was completely filled with accumulated dirt.

Obverse with a raised polos

polos

mark

Found condition after cleaning,
photo © NPÚ in Prague, M. Müller

2. PRAGUE-PRAGUE CASTLE, Vladislav Hall

SUNDIAL DIPTYCH – PART **II**

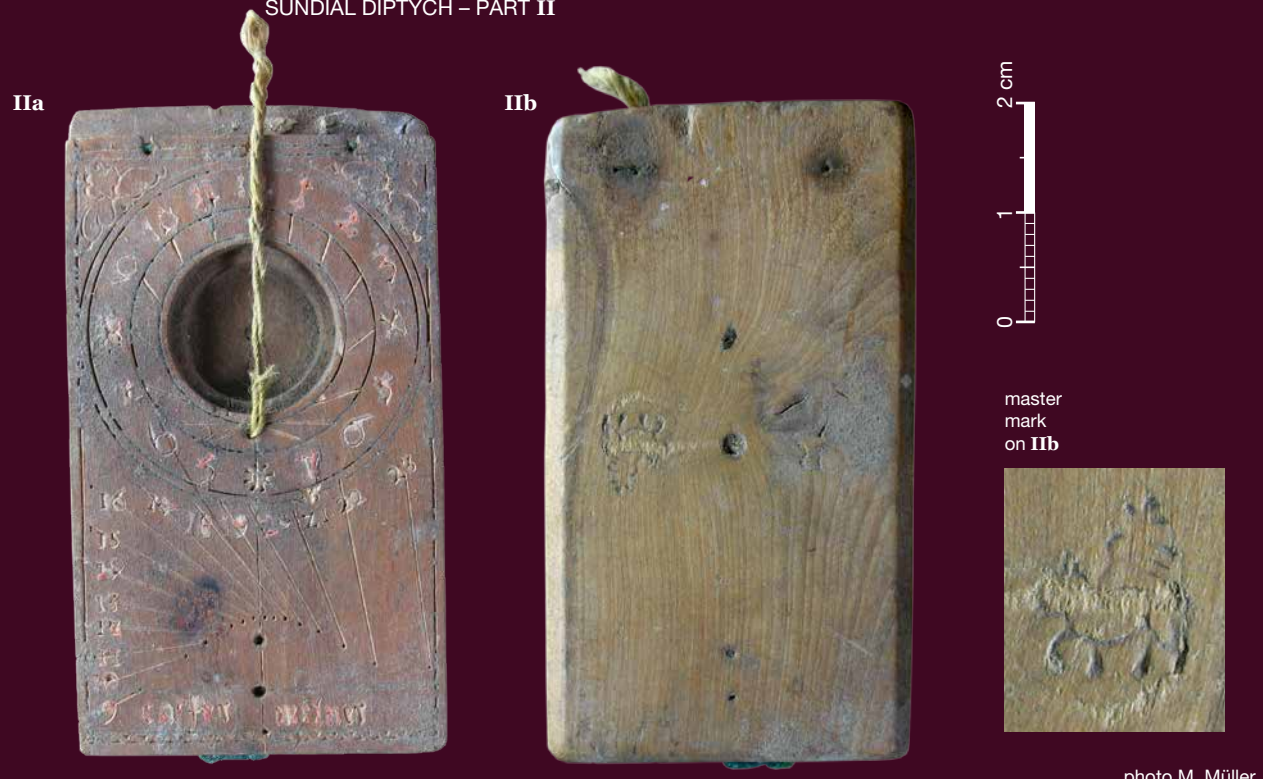


photo M. Müller

- Research/Institution/Year • Institute of Archaeology CAS, Prague (below ARÚ Prague), supervised by J. Frolík and J. Matiášek, 2008
- Stored • ARÚ Prague, Prague Castle, PHSKP 100
- Date • 3rd third of the 16th century
- Origin • Nuremberg, Germany
- Author • Casper Milner
- Signature • *Casper Milner* on the southern edge of surface **IIa**
- Master mark • *Agnus Dei* on **IIb**
- Material • Boxwood
- Dimensions • w. = 34, d. = 63, th. = 6 mm
- Latitude • 49° (determined by measuring the dial)
- Description • **IIa** – In the northern (upper) half of the area, a compass bowl was hollowed out, with the eastern magnetic variation of approximately 11° marked on its bottom; the compass equipment (glass cover, wire ring, needle) was not preserved. Two intermediate circles engraved around the compass, black filling in the circles. In the inner inter-circle hour stripes for whole hours only, in the outer inter-circle horizontal dial 5-12-7, stamped numerals filled in red. In the place of the night hours a sun motif is stamped, in the upper gusset* a floral decoration is stamped. The original string polos is woven from two strands of green dyed silk. In the southern half of the area the dial of the Italian hours numbered from 9 to 23, the pin-gnomon originally set in the upper of the two holes has not survived. The lower bore was used to insert the stylus, the pointer on the unpreserved vertical plate. On the lower edge of the plate a band decoration of stamped triangles, with a signature above. Remnants of red filling in the numerals and signature, remnants of black filling in the frame around the perimeter of the plate. On the face plate is a latch to close the instrument after folding (by inserting it into a loop drilled into the face plate of the vertical plate). Remains of a double hinge on the upper edge.
  IIb – The surface is empty except for the master mark and the guild mark – the letter *N*. According to the magnetic variation value, it could have been made around 1590.
- Comment • These are medium size diptych (wooden painted, 2 kreuzers each), the only ones made of wood in the set of instruments described here. Finds of wooden sundials (subject to rapid deterioration) are rare. They have survived thanks to the favorable conditions under the floor of the Vladislav Hall; they could have been lost by their user or thrown there due to damage by a shopkeeper – for example Hanus Que, active here until 1590.

* ***Gusset*** as a term from the field of art see Blažíček/Kropáček 1991, 42. Gusset in the structural sense, meaning the corner space between the sides of a square and a circle inscribed inside the square.

3.

POUZDŘANY (district Břeclav), No. 241/1

SUNDIAL DIPTYCH OVAL

quality mark "*N*" on **IIb**

master mark on **IIb**

photo © Regional Museum in Mikulov, K. Piačková

Research/Institution/Year • National Institute of Folk Culture in Strážnice, supervised by J. Pajer, 1999, research of early modern waste dump

Stored • Mikulov, Regional Museum in Mikulov (sub-collection History) Inv. No. 17907

Date • 3rd third of the 16th century

Origin • Nuremberg, Germany

Author • Casper Milner

Signature • no signature

Master mark • *Agnus Dei* on **IIb**

Material • ivory

Dimensions • w. = 34 mm, d. = 45 mm, th. of plate **I** = 3.3 mm, th. of plate **II** = 6.5 mm (closed = 10 mm)

Latitude • undetermined

Description • **Ib** – The surface is filled with a vertical dial numbered VII-XII-V with numerals in a circular frame, division only into whole hours, hour lines stretched to the edge of the plate. To the right of the hole for missing polos, a recess is drilled to fit the stabilizing pin. On the edge of the plate on the top left, the remains of a latch to close the instrument.
IIa – In the middle of the surface, a compass bowl with a diameter of 19 mm, the degree of preservation of its components is unknown due to the degradation of the glass cover, the wire ring is not preserved. The area around the compass is filled with the horizontal dial 4–12–8, in the place of the night hours two suns are stamped and a stabilizing pin is inserted. A brass wire loop with a ring for hanging is drilled in the face of the plate, a pin with a head for inserting the latch is to the left of the loop.
Ia – Double hinge, area empty, surface damaged.
IIb – Double hinge. Surface blank, only master mark and quality mark *N*.

Comment • Oval and octagonal diptychs (see Finding 8) are a less common variant of Nuremberg sundials. Finding circumstances are given for the New Baptist settlement at Pouzdřany (Pajer 2021, 115, map fig. 71 on p. 113). Mention of the sundial on p. 118, with antler given as the material.

Price category • 15–20 kreuzers

4. STRACHOTÍN, No. 862

DIPTYCH SUNDIAL – PART **II** OF SANDWICH TYPE

IIa

IIb

motif of the sun on **IIa**

photo © Regional Museum in Mikulov, K. Piačková

analogy

F4. © Wien Museum

- Research / Institution / Year • National Institute of Folk Culture in Strážnice, supervised by J. Pajer, 1983; research of an early modern waste dump
- Stored • Regional Museum in Mikulov, Inv. No. 17908
- Date • 3rd third of the 16th century
- Origin • Nuremberg, Germany
- Author • Hans Miler II.
- Signature • no signature
- Master mark • *horseshoe* on **IIb**
- Material • ivory, the wooden part was not preserved
- Dimensions • w. = 28 mm, d. = 40 mm, th. of each sheet = 2 mm
- Latitude • 50–51° by dial measurement
- Description • **IIa** – A compass bowl was cut in the middle of the circular part of the plate, nothing of the equipment has survived. The 13 mm diameter hole surrounds the circular horizontal dial numbered 5–12–7 divided only into whole hours. The molded extension is decorated with a crossed double line, one sun motif stamped in each of the two lower fields.
  IIb – Remains of a double hinge on the edge of the extension. The surface is empty, the sides of the hole for stretching the unpreserved string polos are stamped with the master mark and the letter *N*. The thickness of the plates of No. 17908 is 2 mm, not the same everywhere as the plates are deformed (bent).
- Comment • A wooden core was originally inserted between the thin plates, creating enough space for the compass and saving precious ivory material. A considerable number of small rectangular "sandwich" diptych survive, mainly from the Karner workshop in the last period of their activity, especially by Leonard Andreas Karner in the first half of the 18th century. The circular device with an extension (holder) described here is exceptional in form. Only two similar examples are known to the author: the instrument of Hans Tucher II from 1568 (Wien Museum, Inv. No. U 3204, photo **F4**) and the instrument of Hans Troschel from 1595 (Antiquorum auction, Geneva, 12 April 2003, item 362). It is worth noting some similarity with the attachment of the horizontal sundial found in Uherský Brod from the 15th century (cat. No. 6). Finding circumstances are given for the New Baptist settlement in Strachotín (Pajer 2021, 146, map figs 94 and 95). A passing reference to "pocket sundials" on p. 154 (not illustrated).
- Price category • 10 kreuzers

5. STRACHOTÍN, No. 862

DIPTYCH SUNDIAL – PART **II**

IIa

IIb

mark on **IIb**

photo © Regional Museum in Mikulov, K. Piačková; drawing M. Müller

Research / Institution / Year • National Institute of Folk Culture in Strážnice, supervised by J. Pajer, 1983; research of early modern waste dump

Stored • Regional Museum in Mikulov, Inv. No. 17910

Date • 1st quarter of the 17th century

Origin • Nuremberg, Germany

Author • Hans Rieger

Signature • no signature

Master mark • *hand holding scimitar* on **IIb**

Material • ivory

Dimensions • w. = 27 mm, d. = 34 mm, th. = 5 mm

Latitude • 50°, determined by dial measurement

Description • **IIa** – In the middle of the area a recessed compass bowl with a diameter of 13.5 mm, nothing of the equipment preserved, the bottom of the compass pierced in the place of the spike. The rest of the area is filled with the horizontal dial numbered 4–12–8 divided only into whole hours. The surface is unadorned except for a double line on the southern and northern edge.
IIb – On the edge, the remains of a double hinge, on the sides of the hole for stretching the string polos, on the right is a letter *N* and on the left the master mark, a hand holding a saber.

Comment • Simply made miniature sundial. The master mark has been identified thanks to a signed instrument of the same maker in the collections of the West Bohemian Museum in Pilsen (Inv. No. UMP 656). In this case, however, it is a luxury ivory diptych of superior size (95 × 146 mm) dated 1631, the only known signed instrument of Hans Rieger to date. In the case of the described specimen from Strachotín, it should be an older instrument, as the stamping of the letter *N* was no longer carried out after 1610 (Gouk 1988, 66-67). Finding circumstances are given for the New Baptist settlement in Strachotín (Pajer 2021, 146, map figs 94 and 95). A passing reference to “pocket sundials” on p. 154 (not illustrated).

6. UHERSKÝ BROD (in the place of No. 2158)

HORIZONTAL SUNDIAL WITH WAX WRITING TABLET

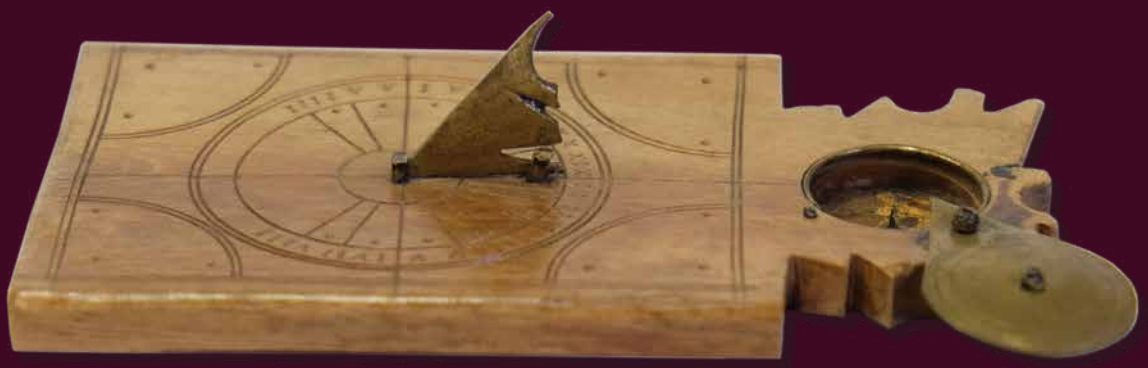


photo © Uherský Brod Muzeum, V. Provodovská

Lokalities • former synagogue (now approximately house No. 2158 in the block between Jirchářská, Soukenická, U Fortny and Tkalcovská streets)

Research / Institution / Year • J. A. Comenius Museum under the supervision of J. Pavelčík, 1971

Stored • Jan Amos Comenius Museum in Uherský Brod, Inv. No. A9633

Date • 1st half of the 15th century

Origin • Nuremberg (?), Germany

Author • unknown

Signature • no signature

Master mark • unmarked

Material • ivory

Dimensions • w. = 55 mm, d. = 91 mm, th. = 6 mm

Latitude • 49°, determined by measuring the polos

Description • The object has the shape of a rectangular plate with a crown-shaped extension.
Obverse – Surface framed by a double line, quadrants in the inner corners with three dots inside the corners. In the center of the surface a dial IIII–XII–VIII framed by a double circle, the numerals stamped, the half-hours marked with pits. The folding brass pointer, whose sloping edge acts as a polos, is connected to the plate by a double hinge. Around the base of the polos is a circle from which the hour lines radiate. In the center of the forked extension a compass bowl, 18 mm in diameter, has been hollowed out; in its center is a pivot for mounting an unpreserved needle, with remnants of gilding on the bottom and a magnetic variation marked with a line. A wire ring is around the perimeter to hold a glass, unpreserved. The compass is protected by a rotating cooper-alloy lid decorated with three engraved concentric circles.
Reverse – At the bottom of the rectangular part of the plate there is a hollow in the surface originally filled with a layer of wax (a writing tablet). The border of the tablet on the left has been cut to accommodate a stylus, which could have been an object now firmly inserted along the edge.

Comment • This is the oldest instrument in the set of described sundials and the oldest portable sundial in the Czech Republic (and Germany). The combination of a sundial and a writing tablet is quite unusual. A previously unknown type of sundial connected to a writing tablet was first described in 2019 (Schewe/Davis 2019). In it, the authors date three previously known examples (found in Nuremberg, Florence, and Dover) to the first half of the 15th century, based on a thorough analysis. The best-preserved of these, housed in the GNM in Nuremberg, suggests an origin in the same workshop as the described specimen from Uherský Brod. The remaining two specimens had a differently shaped attachment which can be assessed despite their torsional condition. Writing wax tablets (*tabulae ceratae* in Latin), usually rectangular in height and made mainly of wood but also of ivory or precious metals, were widely used in antiquity. They had a layer of wax either on one side only or on both and were often joined by a hinge into pairs (***Diptychon***), triplets (***Triptychon***) or a bundle of a larger number of plates (***Polyptychon***). The wax was written into with a stylus (***stilus***) pointed on one side and flattened on the opposite side to allow the record to be rubbed out. The Uherský Brod specimen, with its attachment rather reminiscent of alphabetical tables used in the Middle Ages for teaching (*hornbook*), could serve the user not only as a timekeeping device but also to record business affairs.

Note • The discovery of the sundial was mentioned in the annual review of the museum's archaeological activities (Pavelčík 1972, 160). It is not related to the Jewish community, which settled in the area only in the 1630s.

Obverse

Reverse

0 1 2 cm

polos

detail from obverse

7. LANDŠTEJN CASTLE (district Jindřichův Hradec), western fence

DIPTYCH SUNDIAL

Ib

Ia

0 1 2 cm

IIa

year on **Ib**

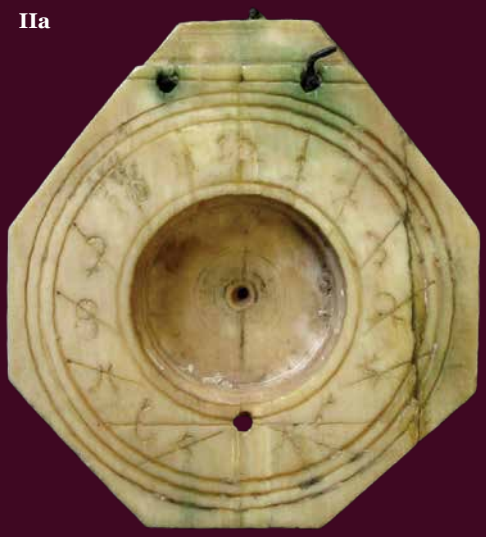
photo © P. Břicháček

Research / Institution / Year	• ARÚ Prague, Exposition for South and West Bohemia in Pilsen, 1993, supervised by P. Břicháček
Stored	• Temporarily in Pilsen, West Bohemian Museum in Pilsen, registration number OZAV 67/1993, planned to be handed over to the NPÚ České Budějovice office; currently exhibited in the exhibition of the Landštejn state castle
Date	• 1543
Origin	• Nuremberg, Germany
Author	• unknown
Signature	• —
Master mark	• missing/not found
Material	• ivory
Dimensions	• w. = 20 mm, d. = 24 mm, th. of plate **II** = 5.5 mm, th. of plate **I** = 3 mm (total th. = 8.5 mm)
Latitude	• estimated at 50°, due to the size and inaccuracies of the dial
Description	• **Ib** – Vertical dial numbered 6–12–6 divided only into whole hours, framed by a double line, quarter-circle at the bottom, with one star in the scroll. Below the dial is a simple frame with the year 1543 between two stars. **IIa** – In the center of the plate framed by a double line, a compass bowl with a diameter of 11 mm, the dial and glass corroded, the glass partly broken, the wire ring preserved. Surrounding the compass is a circular dial of horizontal hours 5–12–7, with half-sun motifs in the scrolls. **Ia** – The surface is empty, the hinge is double, there is a remnant of the latch attachment ensuring the perpendicularity of the plates when the instrument is opened. Opposite the hole for threading the string polos. **IIb** – Empty surface.
Comment	• The oldest known dated diptych in the Czech lands. The shape of the numerals *4* and *7* corresponds to the way they were written prevailing until approximately the middle of the 16th century. Comparison can be made with the numerals on the specimen of cat. No. 8.

8. PRAGUE-PRAGUE CASTLE, 2nd courtyard, ditch

DIPTYCH OCTAGONAL SUNDIAL – PART **II**

IIa



IIb

mark on **IIb**

numeral 7

numeral 4

photo J. Žegklitz; drawing M. Müller

Research / Institution / Year	• ARÚ Prague, supervised by I. Borkovský, 1964–1965
Stored	• ARÚ Prague, Prague Castle, without Inv. No. (5/0000 in Bravermanová et al. 1997, 18)
Date	• 1st half of the 16th century
Origin	• Nuremberg, Germany
Author	• unknown
Signature	• —
Master mark	• undetermined (*Turk head*?)
Material	• ivory
Dimensions	• w. 32 mm, d. 35 mm, th. 7 mm
Latitude	• 54°, determined by dial measurement
Description	• **IIa** – In the middle of the surface is a recessed compass bowl with a diameter of 14 mm, nothing of the equipment has survived. Around the compass is a circular dial in the range 5–12–7 framed by a single circle on the inside and a triple circle on the outside. Magnetic variation partly marked on the bottom. **IIb** – Empty surface, double hinge, only at the hole for stretching the string polos is an indistinct master mark, perhaps the head of a Turk or St. Maurus(?).
Comment	• The shape of the numerals *4* and *7* corresponds to how they were written until about the middle of the 16th century. We can compare with the numerals on find cat. No. 7. The master mark is as yet unknown and unidentified and is therefore not listed in the inventory of makers and their marks. A fragment of the diptych was presented in an internal supplement to the exhibition catalogue (Bravermanová et al. 1997, 18, photo 18).

9. PRAGUE-STARÉ MĚSTO, U Milosrdných No. 909/1 (former No. 816)

DIPTYCH SUNDIAL – PART **II**

IIa

IIb

dekorations/stars on **IIa**

mark on **IIb**

photo J. Žegklitz

F9.
© Historical Scientific Instruments Harvard, No. H 7546.

- Research / Institution / Year • Archaia-Praha No. P11/2021, supervised by V. Kašpar, 2021
- Stored • Archaia-Praha, within the findings from the field context P11/2021-74-004
- Date • 3rd quarter of the 17th century
- Origin • Nuremberg, Germany
- Author • Albrecht Karner
- Signature • no signature
- Master mark • *hanging horn* on **IIb**
- Material • ivory
- Dimensions • w. = 34 mm, d. = 47 mm, th. = 6.2–6.6 mm (fluently)
- Latitude • 51° by dial measurement
- Description • **IIa** – In the middle of the area is a compass bowl hollowed out with a step used for storing a glass cover, the compass equipment was not preserved. The rest of the area framed by a double line is filled with the horizontal dial 4–12–8, half-hours marked with dots. Just below the center of the junction of the sixth morning and sixth evening hour, a hole is drilled to thread the polos. Near the edge of the plate, a brass pin is set into the surface to ensure, in conjunction with the corresponding hole in the vertical plate, that the plates are stabilized when they are folded. Another pin on the face of the plate, in conjunction with a latch attached to the vertical plate, served to close the apparatus. On the opposite shorter edge of the plate, a notch was cut longitudinally to allow the vertical plate to seat after the instrument was opened. Here are the remains of a double hinge on the upper edge, while below the lower edge is a pin used in conjunction with a latch screwed onto the vertical plate to secure the perpendicularity of the plates after the instrument has been opened.
  IIb – The surface is empty except for the master mark near the opening.
- Comment • The original appearance of the instrument is shown in the Harvard collection specimen H 7546 (photo **F9**). It comes from the same manufacturer, differs in dimensions by only a few millimeters, and the design is essentially identical, including the two red stars as the only decoration.

10. PRAGUE-STARÉ MĚSTO, U Milosrdných No. 906 (former No. 819)

DIPTYCH SUNDIAL – FRAGMENT OF PART **II**

IIa

IIb

detail of the compass bed

dekoration /suns and numeral 7 on **IIa**

photo J. Žegklitz

Research / Institution / Year	Archaia-Praha No. P11/2021 in 2021, supervised by V. Kašpar
Stored	Archaia-Praha, within the field context of P11/2021-32-004 (the identical number of layer 004 in both probes [74 and 32] is a coincidence)
Date	1st half of the 16th century
Origin	Nuremberg, Germany
Author	unknown
Signature	—
Master mark	not found
Material	ivory
Dimensions	w. = 19+x mm, d. = 34.5 mm, th. = 6.3 mm
Latitude	unspecified
Description	**IIa** – In the middle of the surface, a compass bowl with a diameter of 14 mm was hollowed out with a step used to hold the cover glass, the compass equipment was not preserved. The rest of the area framed by a double line is filled with the horizontal dial, originally numbered 5–12–7, subdivided into whole hours only. A semicircular decoration with a radius of 3.5 mm stamped three times in the drills, stamped once in the place of the night hours. **IIb** – Surface of the fragment empty.
Comment	The method of writing the numeral *7* in the shape of a canopy (bottom center, see detail) was common on sundials until about the middle of the 16th century. The decoration adjacent to this numeral is of the same appearance and size (diameter 3.5 mm) as on item of cat. No. 13.

11. PRAGUE-HRADČANY, Loretánská 180/IV (Trauttmansdorff Palace)

DIPTYCH SUNDIAL – FRAGMENT OF PART **I**

Ib

Ia

numeral 4 and 7

dekoration

photo © Labrys, o.p.s., M. Kuchařík

Research/Institution/Year	• ZIP, o.p.s., č. 099/15 + Labrys, o.p.s., č. 2424, (in AMČR č. C-201558699), supervised by R. Široký, 2015–2016
Stored	• Labrys, o.p.s., bag with finds 434 (probe 194, deposit 194002, bag 434)
Date	• around 1600
Origin	• Nuremberg, Germany
Author	• —
Signature	• —
Master mark	• —
Material	• ivory
Dimensions	• original w. = 35 mm, d. = 55 mm
Latitude	• 49°, by vertical dial measurement
Description	• **Ib** – The surface is framed by a single line with a double line only at the hinge. In the upper part is a dial of an Italian hours, the part in the range 14–24 is preserved. The borehole below it was used to insert the gnomon on an unpreserved horizontal plate. The lower part of the surface is filled with the vertical dial, its preserved part is in the XII–V range, divided only into whole hours. In the middle of the plate surface is a decoration – an eight-pointed star in a pair of circles with an inner touch. Above the decoration, a hole for stretching a string polos. **Ia** – In the upper half of the surface are three concentric circles, a remnant of a device of unknown function or incomplete. In the lower part, the remainder of the hinge.
Comment	• In terms of gnomonic content, dimensions, and decoration, the find is similar to the vertical plate of the following completely preserved find of a instrument by Hans Troschel Sr. (cat. No. 12).

12. PRAGUE (?)

DIPTYCH SUNDIAL – PARTS **I** + **II**

Ib

0 1 2 cm

IIa

IIb

Ia

dekoration on **Ib**

mark on **IIb**

dekoration on **IIa**

photo © Museum of the City of Prague

- Research / Institution / Year • Prague (?), gift from the Prague conservator arch. Antonín Wiehl, 1900
- Stored • Museum of the City of Prague, Inv. No. H 012735 (**II**) a H 012736 (**I**)
- Date • 1599–1612
- Origin • Nuremberg, Germany
- Author • Hans Troschel
- Signature • no signature
- Master mark • *thrush on a branch* on **IIb**
- Material • ivory
- Dimensions • w. = 30, d. = 53, th. of plate **II** = 8 mm, th. of plate **I** = 2 mm (total th. = 10 mm)
- Latitude • 51°, by vertical dial measurement
- Description • **Ib** – Two dials in a narrow double line frame. In the upper part of the dial of Czech (Italian) hours numbered 13–24, an unpreserved stylus was inserted in the upper hole. The hole under the stylus served to insert the gnomon from the horizontal plate. In the lower part in the frame is the vertical dial common hours numbered VI–XII–VI , with a hole at the top for the insertion of a string polos. Underneath, in a pair of circles with an inner touch, a stylized sun.
  IIa – In a narrow frame of double line, two dials. In the northern part, in a circular frame, the horizontal dial numbered 4–12–8, in the middle of the 6-6 line a hole to stretch the string polos. Three stars each stamped in the northern scrolls. The dial surrounds the compass bowl, nothing of its equipment (glass cover, wire ring and needle) has survived. In the southern part of the plate is the dial of the Czech (Italian) hours numbered 10–23. The hole closer to the edge of the plate was used to insert the stylus from the vertical plate after the instrument was folded.
  Ia – Surface empty. At the bottom of the peg of the unpreserved latch, two holes near the edge after the hinge.
  IIb – Surface empty. In the center, above the hole with the remains of a polos, a master mark and above it the letter *N*.
- Comment • The two ivory plates of roughly the same size, whose appearance suggests a long stay in unfavorable conditions. The plates, although they have different inventory numbers, formed and still form together one diptych. The thinner plate **I** (Inv. No. 12.736) with a vertical dial is 3 mm shorter for structural reasons, as its shorter edge must fit into the recess of the lower plate **II** when the sundial is opened. The diptychs were part of the private collection of arch. Wiehl, which he donated to the museum in 1900.

13. PRAGUE-HRADČANY, Loretánská No. 181/IV

DIPTYCH SUNDIAL – PART **I**

Ib

Ia

dekoration/suns

numeral 7

numeral 4

dekoration/suns

photo M. Müller

Research / Institution / Year	• ARÚ Prague, supervised by I. Herichová, 2005
Stored	• ARÚ Prague, Prague Castle worksite, ev. No. PHY181/30 (probe IB, layer 106)
Date	• 1st half of the 16th century
Origin	• Nuremberg, Germany
Author	• —
Signature	• —
Master mark	• —
Material	• ivory/bone
Dimensions	• w. = 27.5 mm, d. = 32 mm, th. = 3 mm
Latitude	• approx. 48°, determined by dial measurement
Description	• **Ib** – The surface is bordered on the sides by a single line, on the top and bottom by a triple line. The 7–12–5 dial is bordered on the top by a double, on the bottom by a triple quarter-circle. Remnants of red filling in the numerals.
Comment	• On the detail, apart from the numeral *7* in the shape of a canopy, we can also see three suns as a stamped decoration identical in size and appearance with the decoration on specimen cat. No. 10 (Prague, Staré Město, U Milosrdných), which could indicate its origin in a single workshop.

14. PRAGUE-HRADČANY, Nový Svět No. 79/IV

DIPTYCH SUNDIAL – FRAGMENT OF PART **II**

IIa

IIb

mark on **IIb**

photo and drawing M. Müller

Research / Institution / Year	• ARÚ Prague, supervised by J. Matiášek, 2007
Stored	• ARÚ Prague, Prague Castle, Inv. No. 680 (probe 4, layer 4107)
Date	• 17th century
Origin	• Nuremberg, Germany
Author	• —
Signature	• —
Master mark	• perhaps the letter “šin” from the Hebrew alphabet
Material	• ivory/bone
Dimensions	• original w. = 28 mm (maximum preserved w. = 15 mm), d. = 30 mm, th. = 7 mm
Latitude	• 45° by dial measurement
Description	• **IIa** – Surface framed by a single line, only at the hinge by a double line. Compass bowl 14 mm in diameter surrounds the dial in the range 5–12–7, division only on the hours. Without decoration. **IIb** – Surface blank, only near the hole for fixing the polos there appears to be a stamped letter “šin” from the Hebrew alphabet, 2 mm high.
Comment	• A simply made dial similar to the horizontal dial of specimen cat. No. 9 (Prague, Staré Město, U Milosrdných), it could be a workshop of one of the Karners.

15. PRAGUE-NOVÉ MĚSTO, Ostrovní No. 125/II

DIPTYCH SUNDIAL – PART **I**

Ib

Ia

detail of dial

photo © M. Frouz

- Research / Institution / Year • NPÚ ÚOP in Prague, research No. 6/98, supervised by J. Podliska a M. Wallisová, 1998
- Stored • given to the Municipal Museum of the City of Prague under the designation NPU 6/98-92 (pit – object V10)
- Date • around 1600
- Origin • Nuremberg, Germany
- Author • —
- Signature • —
- Master mark • —
- Material • ivory/bone?
- Dimensions • w. = 29, d. = 42 mm, th. = 2–3 mm
- Latitude • 49° by dial measurement
- Description • **Ib** – On the surface without border a circular dial of vertical hours VI–XII–VI, division only into whole hours. Hour lines drawn to the edges.
  Ia – Surface framed by three lines on the longer sides and four on the shorter sides, the interior empty. At the double hinge is a round-headed pin for hanging.
- Comment • The dial design is the same as on specimen cat. No. 3 (Pouzdřany). The instrument and its finding circumstances have been published (Podliska 2000).

16. PRAGUE-PRAGUE CASTLE, Zlatá ulička

DIPTYCH SUNDIAL – PART **I**

Ib

Ia

detail of dial

numeral 4

photo J. Žegklitz

Research / Institution / Year	• ARÚ Prague, supervised by J. Frolík a J. Matiášek, 2010
Stored	• ARÚ Prague, Prague Castle, ev. No. PHZU/2008 (probe VII E; layer 104)
Date	• 16–17th century
Origin	• —
Author	• —
Signature	• —
Master mark	• —
Material	• ivory/bone?
Dimensions	• w. = 25 mm, d. = 42 mm, th. = 3 mm
Latitude	• not measured
Description	• **Ib** – Pair of circles with inner contact, hour lines of the vertical dial coming from the outer circle in the range 8–12–4 only. **Ia** – Surface empty.

17. BRANDÝS NAD ORLICÍ – castle (district Ústí n. Orlicí)

DIPTYCH SUNDIAL – PART **II**

IIa

IIb

mark

analogy

photo © Regional Museum in Vysoké Mýto, E. Jílková

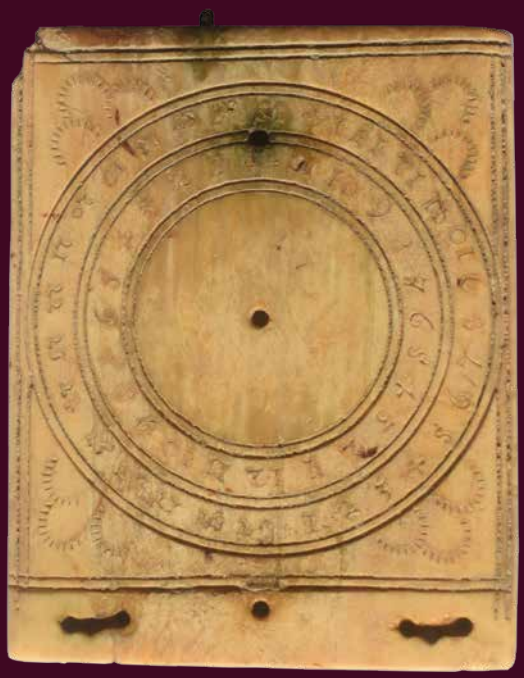
Research / Institution / Year • Regional Museum in Vysoké Mýto, supervised by D. Vích, 2017 (room 3, layer 104)
Stored • Regional Museum in Vysoké Mýto, archaeology sub-collection, Inv. No. 1-8758
Date • 1st half of the 16th century
Origin • Nuremberg, Germany
Author • —
Signature • —
Master mark • damaged mark of the Tucher family – *snake with a crown on its head*
Material • bone?
Dimensions • w. = 27.5 mm, d. = 34.5 mm, th. = 5.5 mm
Latitude • unmeasured
Description • **IIa** – The upper surface of the preserved plate is engraved with the horizontal dial numbered IIII–XII–VIII with embossed numerals in a horseshoe-shaped band, divided only into whole hours. In the middle of the plate is a 16 mm diameter compass bowl with a brass wire ring, the glass cover is missing. At the bottom of the bowl there is a clearly visible pivot for the needle, which has not survived, and a line marking the eastern magnetic variation of approximately 8°. Just below the center of the junction of the 6 a.m. and 6 p.m. there is a hole for threading a string polos. The south side bears a brass latch to close the instrument after it has been folded. Two holes with remnants of brass wire are visible on the northern edge with the hinge, behind which the surface is lowered. The width of the reduction of about 2.5 mm is indicative of the thickness of the unpreserved vertical plate. Below the edge is a loop for a latch, attached, if the instrument is complete, to the upper plate. The latch ensured the perpendicularity of the plates when opened. The decoration consists only of hatching in the drills and a pair of wider features at the south and north edges. **IIb** – The surface of the lower side of the plate is empty, only at the edge with the latch there is a master mark in the shape of a snake stamped next to the hole for threading the string, partly damaged by corrosion.
Comment • The finding has been published (Vích/Fomín 2022). According to the archaeological context, the diptych were archaeologized in the late 15th to (more likely) the first half of the 16th century; dating them to the younger part of the thus defined section seems most likely. With regard to the dating resulting from the archaeological context and historical reports, the author of the sundial could be Hans I, who became master in 1537 and died in 1550, or we can consider Jorg Tucher, who was a generation older and is mentioned at the end of the 15th century. However, none of their sundials are still known, so their master mark remains unknown.

18. ČEJKOVICE (district Hodonín), fortess/castle, Templářská No. 1

DIPTYCH SUNDIAL – PART **I**

Ib

Ia



dekoration
and numerals 3 aan 4

0 1 2 cm

photo © Museum of the Hodonín Region,
F. Kostrouch

F18. © History of Science Museum, University of Oxford, UK, No. OX 33324.

Research/Institution/Year • Museum of Hodonín Region, supervised by J. Tribula a J. Bednaříková, 1978

Stored • Masaryk Museum in Hodonín, inv. No. *sine*.

Date • 17th century

Origin • Nuremberg, Germany

Author • —

Signature • —

Master mark • —

Material • ivory

Dimensions • w. = 38 mm, d. = 47 mm, th. = 3.5 mm

Latitude • 49° by dial measurement

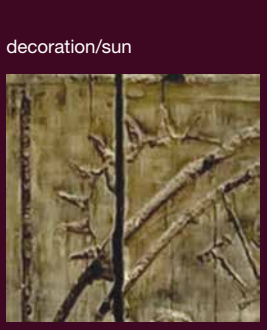
Description • **Ib** – Double line bordered surface filled with vertical dial VI–XII–VI, division only into whole hours. A circle 9 mm in diameter is engraved around the circumference of the hour lines, from which the hour lines emerge. Inside the circle a decoration (a sun with eight rays 2 mm wide) is stamped four times. Remains of a double hinge.

Ia – The area framed by a double line filled with a lunar volvelle; in the outer intercircle is a scale of the phase of the moon, in the inner one an hour dial 2 × 1–12, in the numerals remains of red filling. In the middle of the volvelle, the rotating brass disc is missing. Triple decoration in the scrolls.

Comment • The instrument could have come from the workshop of Jakob Karner (for comparison photo **F18**, J. Karner, No. OX 33324) or one of the other Karners. The existence of the find has been briefly mentioned (Tribula/Bednaříková 1980, 205, fig. 3), it comes from the backfilling of the fortress parkan with 15th and 16th century material.

19. IVANČICE (district Brno-venkov), Ve Sboru No. 3535

DIPTYCH SUNDIAL – FRAGMENT OF PART **II**


decoration/sun


decoration/sun and numerals 6 and 7

photo © Museum of the Brno Region in Ivančice, K. Sovová

Research / Institution / Year	• originally a fraternal congregation, complex of the former Šmeral factories
Stored	• research by the District Museum in Ivančice, supervised by J. Vaněk, 1980
Date	• Museum of the Brno Region in Ivančice, Inv. No. A5547
Origin	• 1st half of 16th century
Author	• Nuremberg, Germany
Signature	• —
Master mark	• —
Material	• small fragment outside possible mark
Dimensions	• ivory
Latitude	• w. when folded = 7 mm (original w. = 22 mm), d. = 23 mm, th. = 6 mm
Description	• **IIa** – Area framed by a single line, circular dial originally numbered 5–12–7 framed by a double line. In the dial a motif with a diameter of 3.5 mm, the same as on specimen cat. No. 10 (Prague, Staré Město, U Milosrdných). **IIb** – Empty surface.
Comment	• In the inner space of the defunct presbytery (in sector A), a coin from the last quarter of the 16th century minted in Nuremberg by Kilian Koch was found; a second coin (with Louis XIII) from a nearby well was also minted in Nuremberg. A fragment of a sundial plate was found in the filling of a brick building (about 18–20 m from the presbytery, 16 m from the well; Šebela/Vaněk 1982; Šebela/Vaněk 1985).

20. POUZDŘANY (district Břeclav), No. 241/1

DIPTYCH SUNDIAL – PART **I+II**

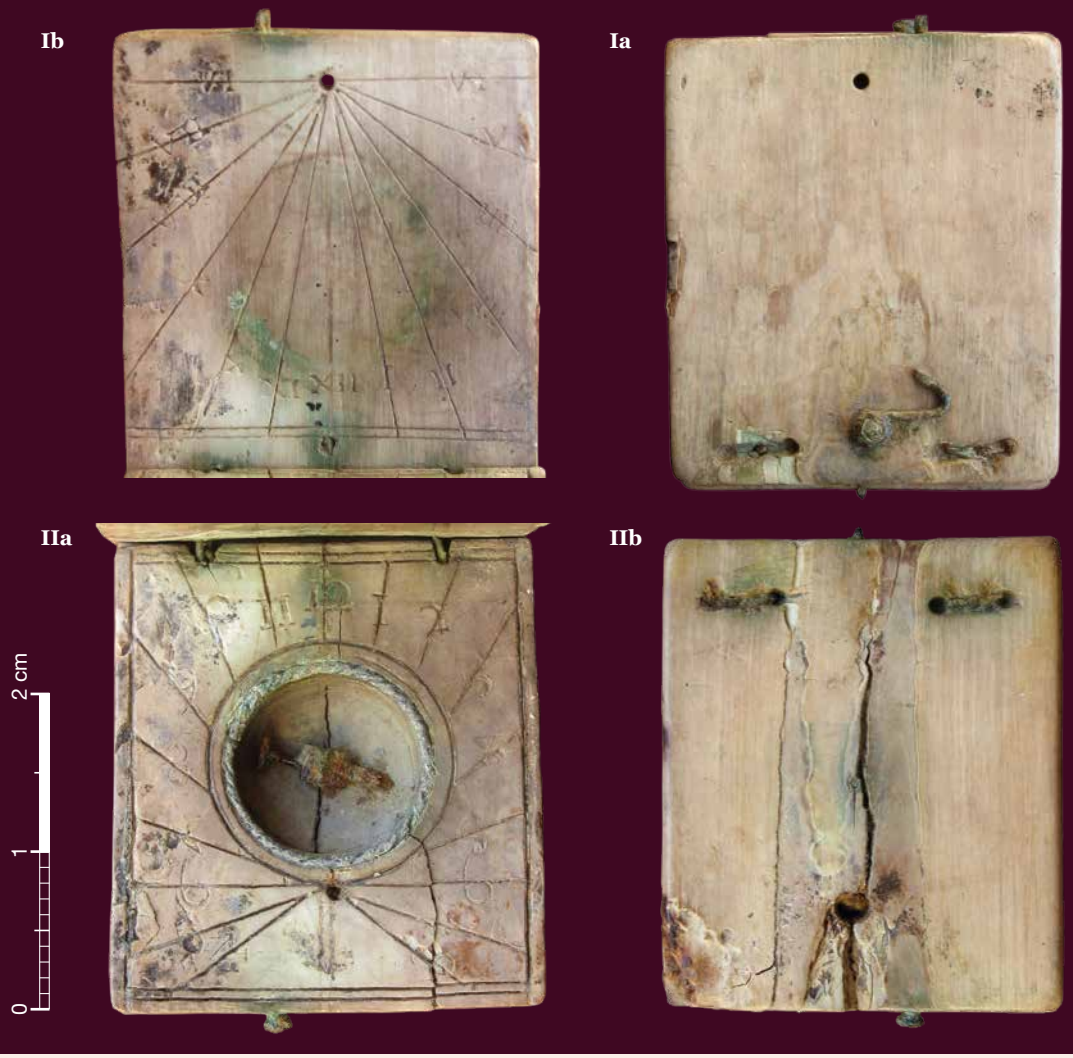


photo P. Klimeš

- Research/Institution/Year • National Institute of Folk Culture in Strážnice, supervised by J. Pajer, 1999; research of an early modern waste dump (preserved by P. Klimeš from No. 115)
- Stored • at the head of research, to be taken over by the Regional Museum in Mikulov
- Date • around 1600
- Origin • Nuremberg, Germany
- Author • —
- Signature • —
- Master mark • the place where the mark is usually found is disturbed and illegible
- Material • ivory
- Dimensions • w. = 27 mm, d. = 32 mm, th. = 8 mm
- Latitude • 49° by dial measurement
- Description • **Ib** – Unframed surface, with only a double line at the hinge, filled with the dial of vertical hours numbered VI–XII–VI, division only into whole hours. Hour lines drawn from the hole for the polos to the edges.
  IIa – In the middle of the surface is a compass bowl with a wire ring to press the unpreserved glass cover and a corroded needle, a simple frame around the bowle. The rest of the surface is filled with the dial of the horizontal hours numbered 4–12–8, subdivided into whole hours only. The surface is framed by a double line at the hinge and a single line at the sides. On the face of the plate is a pin after the missing latch to close the device.
  Ia – Surface empty, double hinge, latch to fix the perpendicular position of the plates.
  IIb – Surface empty, around the hole to stretch the polos where the mark might be located, very damaged.
- Comment • Finding circumstances are given for the New Baptist settlement in Pouzdřany (Pajer 2021, 115, map fig. 71 on p. 113). Mention of a sundial on p. 118 with antler as material.

21. STRACHOTÍN, No. 862

DIPTYCHSUNDIAL – FRAGMENT OF PART **I**

dekoration

numeral 4

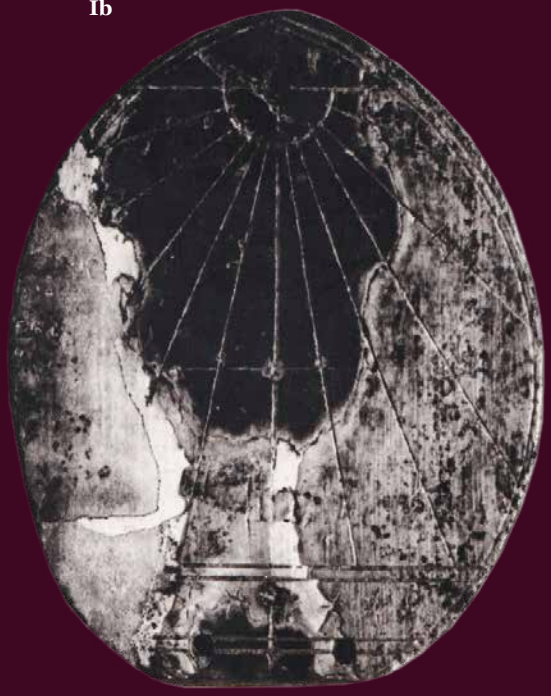
photo © Regional Museum in Mikulov, K. Piačková

- Research / Institution / Year • National Institute of Folk Culture in Strážnice, supervised by J. Pajer, 1983; research of an early modern waste dump
- Stored • Regional Museum in Mikulov, Inv. No. 17909
- Date • 1st half of the 17th century
- Origin • Nuremberg, Germany
- Author • unknown
- Signature • —
- Master mark • —
- Material • ivory
- Dimensions • original w. = 28 mm (fragment = 16 mm), d. = 37 mm, th. = 3 mm
- Latitude • 49° by dial measurement
- Description • **Ib** – Unframed surface, only two double lines at hinge, filled with dial vertical hours numbered 6–12–6, division only into whole hours. Sun stamped in a semicircle below the hole for stretching the polos, hour lines drawn from the semicircle to the edges.
  Ia – Surface framed by double line, twice on shorter sides.
- Comment • Framing of area **Ia** as on specimen cat. No. 15 (Prague, Ostrovní Str.). Finding circumstances are given for the New Baptist settlement in Strachotín (Pajer 2021, 146, map figs 94 and 95). A passing reference to “pocket sundials” on p. 154 (not illustrated).

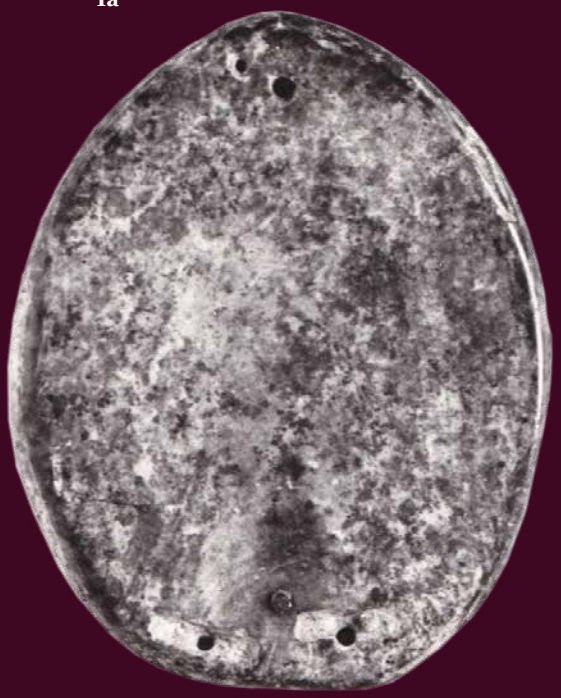
22. STRACHOTÍN, No. 862

DIPTYCH SUNDIAL – PART **I**

Ib



Ia



Author undetermined. Thanks to Dr. Jiří Pajer for kindly providing the black & white photograph.

Research / Institution / Year	• amateur find by J. Tým in 1979
Stored	• Regional Museum in Mikulov (sub-collection Archaeology), Inv. No. A/M 1053, currently unavailable
Date	• late 16th–17th century
Origin	• —
Author	• unknown
Signature	• —
Master mark	• —
Material	• ivory? (antler on museum card)
Dimensions	• on museum card not indicated
Latitude	• unmeasured
Description	• **Ib** – Double line bordered area filled with vertical dial numbered 6–12–6, division into whole hours only.
Comment	• Find in clay from excavated relief channel which intersected No. 862 with early modern waste dump. Find circumstances given for the New Christian settlement at Strachotín (Pajer 2021, 146, map figs 94 and 95). A passing reference to a "pocket sundial" on p. 154 (not illustrated).

Master marks

According to the Compass-Makers' Statute, each master was obliged to use a single mark and to mark only his products with it (Gouk 1988, 66). The master marks of all the masters were stamped together for inspection on a lead plate kept with other requisites in a guild chest. Unlike the plates of several other Nuremberg guilds, the plate with the *compass-makers'* marks[19] has not survived. The master's examination included the presentation of hand-made stamps of marks, numerals, letters, zodiac signs, and small decorations.

The marks were stamped into softened material (ivory, bone, etc.). On larger instruments, the master marks are usually found in several places on the horizontal plate: **IIa** at the bottom of the compass, near the front edge of the plate, and on **IIb**. In the vicinity of the marks, the letter *N*, 2–3 mm in height, was also stamped by the sworn masters until about 1610 as a confirmation of Nuremberg origin; in addition, it was certainly used to control sales and to calculate the subsequent taxes paid to the guild treasury. No marks were stamped on the vertical plates. On miniature sundials, only one mark is usually stamped on the lower surface of the **IIb** horizontal plate; for this reason, identification of the sundial is difficult, if not impossible, if only the vertical part of the diptych is preserved. The legibility of the markings is sometimes poor, which is due to the nature of the archaeological find preserved in unsuitable conditions or even the poor setting of the stamp. The size of the marks varies around 5 mm, so the identification and study of master marks requires a detailed photograph.

In addition to the mark, the master sometimes stamped the product with his name (signature), in the case of diptych stamped on the lower edges of pages Ib or IIa. The presence of the name allows the mark to be identified with the maker. The number of masters is not precisely known; about 75 names have been found in various archival sources (Gouk 1988, 64). However, this number is not definitive, as evidenced by the names of two watchmakers called back to Nuremberg from Prague (see above), which do not appear in the list (*cf*. Gouk 1988). Only for a part of the masters, which we cannot quantify in percentage terms, do we know their mark (Table **1**). For at least 35 masters whose names we know from archival sources, no product or mark is known.[20]

Most of the identified marks of the Nuremberg masters were described by Penelope Gouk (1988). Since 1988, the list of marks belonging to specific makers has expanded considerably. The subsequent updated list (Table **2**) includes 36 marks belonging to 27 Nuremberg masters. However, there are still marks that we cannot yet assign and, conversely, the marks of dozens of Nuremberg masters are not known. We know of no marks from masters active in the 15th and first half of the 16th century (Gouk 1988, 64). Only a few instruments (Rieger) or even a single one (Gressel) survive from some of the masters listed below (Table **2**). The most prolific families were the Reinmanns, Tuchers, Troschels, Millers, and Karners, after whom dozens of instruments survive, and in the case of the Karners, hundreds.

It is difficult to identify instruments in families where not only the watchmaking art/craft but also the first name was inherited, such as the Tucher family.[21] It is difficult to identify the instruments of two masters from this family. At least three of the family members, whose careers intertwined (Hans II, Hans III, Thomas Tucher), used four variations of the same marker – a snake with a crown on its head. While the instruments of Thomas Tucher can usually be identified by the frequent presence of a signature or initials and the characteristic style of decoration, the distinction between the instruments of Hans II (master *1557, †1615) and III (*1549–†1632) remains unresolved. In contrast, the existence of three variants of the Hans Troschel mark allows the approximate determination of the age of the specimens, due to the fact that the master evidently used each mark successively. Thus, it was possible to determine the age range of finding cat. No. 12 according to the 3rd variant of Troschel's mark as 1599–1612. The confusion of masters could have occurred in the case of the crown-shaped mark, a very similar variant of which was used by both Paul Reinmann and Michael Lesel, who took over the mark after Reinmann's death. Nikolas Miller marked his instruments with another variant of the crown, but with a distinctly more massive central part. Casper Milner and Leonard Miller are still known to have used two variations of the mark, otherwise the other masters made do with one variant throughout their careers.

19 In the sources, both names *kompastmacher* and *kompassmacher* appear for sundial makers.

20 From various archival sources, 7 masters are known from the 15th century, 23 masters from the 16th century and 5 masters from the 17th century for whom neither the mark nor the product is known.

21 For the history of the Tucher family, see *Das Große Tucherbuch* from 1590–1606. The book, based on the manuscript of Christopha Scheurl (*1481–†1542), see StAN FA Tucher.

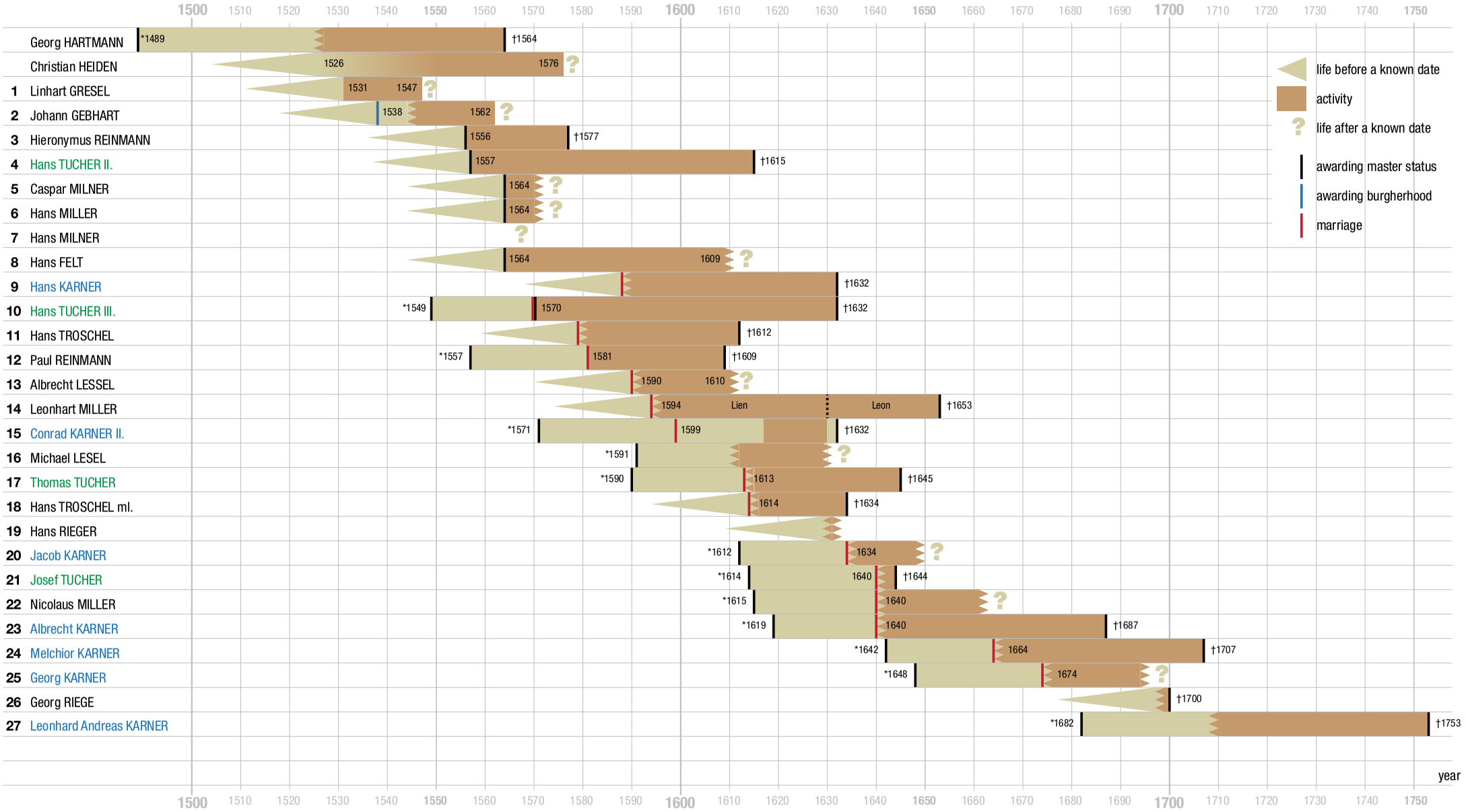


Table 1. We also know the master's mark for Nuremberg masters for whom we know their signature, with the exception of the first two masters; in chronological order.
Legend: **dark brown** – proven period of activity, **black line** – life dates and award of master status, **blue line** – acquisition of burgherhood, **red line** – marriage.

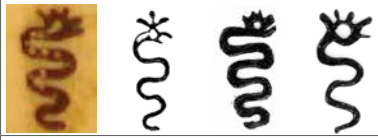
No.	Master mark driwing (scale 2 : 1) / photo to the right (scale 1 : 1)	Name of master	Born *	Burg-herism	Marriage oo	Master	Active	Died †
1	 	Linhart Gresel					1531–1547	
2	 	Johann Gebhart		1538			1546–1562	
3		Hieronymus Reinmann				1556		1577
4		Hans Tucher II.				1557		1615
5		Casper Milner				1564		
6	 	Hans Miller				1564		
7	 	Hans Milner						
8	 	Hans Felt				1564	1609	
9	 	Hans Karner			1588			1632
10		Hans Tucher III.	1549			1570		1632
11	 1586 1588, 1598 1600	Hans Troschel			1579			1612
12	 	Paul Reinmann	1557		1581		1579	1609
13	 	Albrecht Lessel			1590		1610	

Table 2. The marks of the Nuremberg masters with their life dates in chronological order.
Sources for the marker drawings: **1** – SML 1880-56; **2** – Adler DPW-21; **3** – Salz K 532-49; **4** – on many instruments; **5** – variant 1 (from right) Mik 17907, variant 2 (from left) private collection in Germany; **6** – Mik 17908; **7** – Adler W-29; **8** – Adler DPW-20; **9** – Adler W-13; **10** – on many instruments; **11** – mark 1 dat. 1586 OX 70006, mark 2 dat. 1588 Adler DPW-24, dat. 1598 NYMM 03.21.38, mark 3 dat. 1600 H 7537; **12** – Adler DPW-27; **13** – OX 42629, credit to Alexander Thekale; **14** – on many instruments; **15** – H 7539; **16** – H 7558; **17** – on many instruments, Adler T-10; **18** – H 7458; **19** – Mik 17910; **20** – NM 6118; **21** – H 7899; **22** – H 7570; **23** – UPM 65348; **24** – SML 1892-18; **25** – H 7525; **26** – Adler DPW-23; **27** – on many instruments.

No.	Master mark driwing (scale 2 : 1) / photo to the right (scale 1 : 1)	Name of master	Born *	Burg-herism	Marriage oo	Master	Active	Died †
14		Lienhart (od r. 1630 Leon-hart) Miller			1594			1653
15		Conrad Karner II.	1571		1599		1617–1630	1632
16		Michael Lesel	1591				1612–1629	
17		Thomas Tucher	1590		1613			1645
18		Hans Tro-schel ml.			1614			1634
19		Hans Rieger				1631		
20		Jacob Karner	1612		1634	1648		
21		Josef Tucher	1614		1640			1644
22		Nicolaus Miller	1615		1640		1661	
23		Albrecht Karner	1619		1640			1687
24		Melchior Karner	1642		1664			1707
25		Georg Karner	1648		1674		1694	
26		Georg Riege					1699	1700
27		Leonhard Andreas Karner	1682				1745	1753

Explanation of abbreviations: **Adler** – Adler Planetarium, Chicago, USA; **H** – Harvard University, Cambridge, Mass, USA; **Mik** – Regional Museum in Mikulov; **NM** – National Museum in Prague; **NYMM** – Metropolitan Museum of Art, New York; **OX** – History of Science Museum, Oxford; **SML** – Science Museum London; **Salz** – Salzburger Museum; **UPM** – Museum of Decorative Arts in Prague.

Conclusion

Only portable sundials made in Nuremberg have been proven from archaeologically verified Czech and Moravian sites. However, the provenance of one of the devices, the oldest, cannot be determined (catalogue No. 6 Uherský Brod). For archaeological finds, apart from the wooden exhibits (catalogue No. 2), it is difficult to determine the material, as it is difficult to distinguish bone from ivory stained by the placement of the object in the ground, and of miniature dimensions. The guild rules do not mention bone as a material for making sundials, but sundials made of bone and others made of ivory are mentioned in the will of the Prague craftsman Hanus Que, who died in 1590. Another Prague archival record from 1590 attests to the exclusivity of sundial production in Nuremberg at the time and the strict monitoring of compassmachers' movements in European cities by the guild there.

The makers identified themselves with master marks, which are found on the reverse of common archaeologically found goods. In the case of horizontal sundial (e.g. Prague – Thunovská) on the reverse of the plate, in the case of diptych (e.g. Prague – Vladislavsky Hall, etc.) on the underside of the horizontal plate (here marked **IIb** in the description). Judging by the absence of the master mark, it is not impossible that, despite guild regulations, manufacturers did not mark some products.

Archival records of the wills of two Prague merchants from around 1600 document the sale of sundials along with goods, mostly haberdashery. Judging by the significant share of goods of the very commercially savvy Tucher family in both of these wills, it seems that the Tucher family may have had a direct commercial presence in imperial Prague. Quite extraordinarily, we also learn from both wills the price ranges of the various categories of these instruments and the composition of the range, with the cheapest instruments constituting the majority. Given the prices quoted in the wills, it is clear that pocket sundials of ordinary size were affordable, not luxury goods. Also striking is the volume of instruments that both dealers had in stock at the time of their deaths – 177 and 636 pieces respectively. These figures indicate the huge volume of Nuremberg production and the fact that only a very small fraction of it survives and is thus known to us. Tracing the distribution of products of specific manufacturers across Europe and the world thus produces only haphazard results and cannot be statistically conclusive.

It is interesting to note that of the seven known (the other two are not yet verified) Caspar Milner products in the world, three come from the Czech Republic. These seven pieces give a picture of the production program of the Nuremberg kompassmacher: from miniature horizontal sundial made of ivory (Prague, cat. No. 1) to wooden diptych measuring 32 × 44 mm (Florence) and 34 × 63 (Prague, cat. No. 2), ivory diptych oval 34 × 45 mm (Pouzdřany, cat. No. 3) or in the form of a book binding 35 × 50 mm (Kassel), rectangular with a lunar volvelle 44 × 60 (London), to luxury diptych measuring 70 × 118 mm (private collection in Germany).[22]

Hans Miler's instruments from archaeological sites have a remarkable geographical dispersion. Apart from the instrument found in South Moravia (cat. No. 4) another comes from a monastery in Flensburg, North Germany (miniature oval bone diptych of sandwich type, Witte/Gebhardt/Kristiansen 2003, 236–239), from an archaeological research in East Flanders (oval ivory diptych signed Hans Milner), from the Mijoka Shoal wreck in Croatia (rectangular signed diptych, Zmaić Kralj 2015), oval signed diptych from Svodín, Slovakia (Schewe 2019), and the signed horizontal portion of rectangular ivory diptych from Fort Jamestown, Virginia, USA (Historic Jamestown).[23] It should be noted here that its use in Virginia, with a local latitude of around 37°, must have been highly misleading, as the Jamestown sundial was designed for a latitude of 53° and was therefore intended for the English market.

The oldest portable sundial in the Czech lands was found in Uherský Brod (cat. No. 6) – a horizontal sundial from the first half of the 15th century of unknown provenance. The same type is also the oldest in the German lands (Schewe/Davis 2019). The oldest portable sundial in the Czech lands, dated 1543, comes from research at Landštejn Castle (cat. No. 7). The youngest sundial in the set, dating from the third quarter of the 17th century, was found in Prague (cat. No. 9). Within Europe, the last known large ivory diptych made in Nuremberg date from 1745 (stored in Budapest).[24]

22 Four diptychs by Casper Milner in the collections of: London Science Museum, inventory number 1938-371, ivory, 44 × 60; Kassel, Germany, Astronomisch Physikalisches Kabinett, inventory number B72, ivory, 50 × 35; Firenze, Italy, Museo Galileo Galilei, inventory number 2490, boxwood, 32 × 44; Private Collection, Germany, ivory, 70 × 118 mm.

23 *Sine* 2012 online.

24 *Cf*. note 18.

From the dislocation of archaeological finds of portable sundials in the area of interest (Fig. **17**), the accumulation of these products in Prague and South Moravia is striking, and their occurrence outside these two centers is quite rare. The high number of finds at Prague Castle and in the cities of Prague can be explained by the environment of scholars and educated courtiers in one of the leading cities of Europe at the time, for a time the seat of the emperor. The accumulation in South Moravia, however, is connected with a completely different environment. It can be considered to be linked to the community of New Christians expelled from Switzerland, southern Germany, Tyrol and northern Italy, who found a new refuge in the religiously tolerant environment of southern Moravia.[25] Mikulov became the first center of the Moravian New Christians, now also known as Habani, in 1526, followed by several other waves of migration. The New Christians brought to the Bohemian territory progressive procedures, more advanced technologies and production methods, which they further improved, and they were excellent doctors and pharmacists. Judging by the relatively high number of pocket sundials in the Habani environment, it can be deduced that they were accustomed to using these time-keeping devices quite commonly.

So far, 6 examples of portable (pocket) sundials made in Nuremberg in the 15–17th centuries have been found archaeologically in Bohemia and Moravia (most recently Vích/Fomín 2022). With the current contribution, the number has grown considerably, to 22 pieces, and the list is certainly not exhaustive. It can be assumed that the current collection will be gradually expanded as rescue archaeological excavations develop.

Translation by Bryce Belcher

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RESUMÉ

ARCHEOLOGICKÉ NÁLEZY NORIMBERSKÝCH CESTOVNÍCH SLUNEČNÍCH HODIN Z ČECH A MORAVY

Existence kapesních slunečních hodin vyvolává na tvářích mnohých současníků údiv, případně úsměv, neboť povědomí o slunečních hodinách bývá většinou spojeno s číselníky nacházejícími se na zdech budov (obr. **1**). Používání kapesních slunečních hodin však bylo v Evropě raného novověku běžnou součástí života, zejména městského obyvatelstva. Od 10. století sloužily k měření času přenosné sluneční hodiny výškové, u nichž časový údaj určuje výška Slunce. Nejčastěji šlo o sloupkové sluneční hodiny (obr. **5**), jejichž nevýhodou byla ovšem nedostatečná přesnost odečtu času zejména v zimních měsících. U počátku masového rozšíření nových, sofistikovanějších přenosných slunečních hodin v 15. století stál vynález polosu, ukazatele rovnoběžného se zemskou osou, jenž nahradil na vertikálních hodinách vodorovný stylus a umožnil zavést rovnoměrný čas. Možnost použití polosu na přenosných hodinách byla podmíněna zajištěním jeho orientace, což bylo vyřešeno zakomponováním kompasu do horizontální plochy (obr. **7**, **9**). Tak vznikly přenosné sluneční hodiny nového typu, u nichž časový údaj určuje směr slunečních paprsků – směrové sluneční hodiny. Nejvýznamnějším evropským centrem výroby nových přenosných slunečních hodin se stal v polovině 15. století Norimberk a své výsadní postavení si udržel po dvě století. Norimberské diptychové hodiny (diptychy podle anglického *diptychs*) – kapesní sluneční hodiny sestávající ze dvou destiček spojených závěsem, mezi nimiž se po otevření do kolmé polohy napne provázkový polos (obr. **8**, **16**) – se v 15., 16. a 17. století staly fenoménem.

V článku představené nálezy z českých a moravských lokalit mají kromě jediného exempláře jednoznačný původ v norimberských dílnách. Mistři byli sdruženi stejně jako jiní norimberští řemeslníci v samostatném cechu s vlastními stanovami a své výrobky označovali mistrovskými značkami. Identifikovatelné značky prezentuje tabulka ke konci článku (tab. **2**). V blízkosti mistrovské značky se vyskytuje písmeno *N* vyražené zástupcem cechu. Kromě značky někdy mistr opatřoval výrobek i svým jménem, jehož přítomnost umožňuje ztotožnění značky s výrobcem. Počty mistrů nejsou přesně známy, v různých archivních pramenech bylo nalezeno okolo 75 jmen (Gouk 1988, 64). Tento počet však není konečný, o čemž svědčí jména dvou hodinářů povolaných z Prahy zpět do Norimberka, která se ve výčtu neobjevují. Jsou známa jen z pražského archivního zápisu z roku 1590, který dokládá tehdejší exkluzivitu výroby slunečních hodin v Norimberku a tamním cechem přísné sledování pohybu jejich výrobců po evropských městech. Jen u části mistrů – dvaceti sedmi osob – známe jejich značku, ba i více značek (tab. **1**). Minimálně u 35 mistrů, jejichž jména se objevují v archivních pramenech, není znám žádný jménem signovaný výrobek ani značka. U běžného archeologicky nalézaného zboží se mistrovské značky vyskytují na rubu – u horizontálních hodin (např. Praha – Thunovská) na reverzu destičky, u diptychů (např. Praha – Vladislavský sál aj.) na spodní straně horizontální destičky.

O masovém používání diptychových hodin vypovídá jejich počet v inventářích pražských kramářů, v nichž se jich nacházejí stovky. V článku jsou uvedeny dva posmrtné inventáře, jeden z roku 1590 (po Hanuši Que s krámem ve Vladislavském sále, 177 slunečních hodin na skladě) a druhý z roku 1606 (po Kateřině Milderbergerové s krámem na Starém Městě pražském, 636 kusů slunečních hodin na skladě). Zcela mimořádně, i v evropském kontextu, se z obou inventářů dovídáme také cenové relace různých kategorií těchto přístrojů a skladbu sortimentu, kde většinu tvořily přístroje nejlevnější. Vzhledem k uvedeným cenám je zřejmé, že kapesní sluneční hodiny běžné velikosti byly přístupným, nikoli luxusním zbožím. Zámožní zákazníci si mohli pořídit rozměrné slonovinové diptychy s řadou indikací a bohatou dekorací, ti nejchudší se museli spokojit s nejlevnějšími dřevěnými diptychy miniaturních rozměrů. V inventářích nejpočetněji zastoupené nejlevnější dřevěné sluneční hodiny se do současnosti zachovaly velmi vzácně, jednak kvůli nedostatečné odolnosti materiálu v nepříznivých podmínkách, jednak kvůli láci, která nenutila jejich majitele k opatrnému zacházení. O tom svědčí přítomnost pouze jediných dřevěných diptychových hodin v českomoravském souboru nálezů (Praha – Vladislavský sál), který podává obraz levnější části výrobního sortimentu norimberských „kompassmacherů“. Na rozdíl od muzejních sbírek, v nichž se většinou nacházejí luxusní slonovinové přístroje zasluhující pečlivé zacházení.

Druhou část příspěvku tvoří kompletní katalog exemplářů přenosných slunečních hodin dosud nalezených při archeologických průzkumech v Čechách a na Moravě. Dosud publikovaný počet šesti kusů archeologicky nalezených přenosných, tzv. kapesních, v Norimberku vyrobených slunečních hodin z 15.–17. století (naposled Vích/Fomín 2022) byl předloženým příspěvkem rozšířen na 22 exemplářů. Nápadná je kumulace nálezů v Praze a na jižní Moravě, výskyt mimo tato dvě centra je zcela ojedinělý (obr. **17**). Kromě popisu jsou u každého exempláře uvedeny identifikační údaje a místo uložení. Nejstarší přenosné sluneční hodiny v českých zemích byly nalezeny v Uherském Brodě (katalogové číslo 6) – horizontální hodiny z 1. poloviny 15. století nejednoznačné provenience. Stejný typ je nejstarším také v německých zemích (Schewe/Davis

2019). Nejstarší přenosné sluneční hodiny v českých zemích datované letopočtem nesou rok výroby 1543, pocházejí z výzkumu na hradě Landštejn (kat. č. 7). Nejmladší hodiny souboru, ze 3. čtvrtiny 17. století, byly nalezeny v Praze (kat. č. 9). Po vrcholu řemeslného a uměleckého zpracování norimberských diptychů na přelomu 16. a 17. století v dílech zejména Paula Reinmanna, Hanse Troschela st. nebo obou Hansů Tucherů následoval zhruba od poloviny 17. století pozvolný úpadek způsobený hlavně zpustošením střední Evropy třicetiletou válkou. V rámci Evropy pocházejí poslední známé velké slonovinové diptychy vyrobené v Norimberku z roku 1745 (uloženy v Budapešti).

Seznam v katalogu popsaných archeologických nálezů přenosných slunečních hodin:

kat. č.	lokalita
1	Praha-Malá Strana, Thunovská čp. 192/III
2	Praha-Pražský hrad, Vladislavský sál
3	Pouzdřany, ppč. 241
4	Strachotín, ppč. 862
5	Strachotín, ppč. 862
6	Uherský Brod, zaniklé čp. 2158
7	hrad Landštejn
8	Praha-Pražský hrad, II. nádvoří
9	Praha-Staré Město, U Milosrdných, ppč. 909/1
10	Praha-Staré Město, U Milosrdných, ppč. 906

kat. č.	lokalita
11	Praha-Hradčany čp. 180/IV
12	Praha
13	Praha-Hradčany čp. 181/IV
14	Praha-Hradčany čp. 79/IV
15	Praha-Nové Město, Ostrovní čp. 125
16	Praha-Pražský hrad, Zlatá ulička
17	Brandýs nad Orlicí – hrad
18	Čejkovice, čp. 1
19	Ivančice, ppč. 3535
20	Pouzdřany, ppč. 241/1
21	Strachotín, ppč. 862
22	Strachotín, ppč. 862 či okolí

Obr. 1. Skalica, Slovensko, farní kostel sv. Michaela, konec 14. století. Vertikální sluneční hodiny, původně se stylem (foto J. Žegklitz, 2018).

Obr. 2. Dingle, Irsko, Kilmalkedar Church. Kanonické hodiny, stáří hodin určeno na dobu před 10. stoletím. ***Nona*** vyznačena trojitou ryskou (foto J. Žegklitz, 2001; kresba z 19. století převzata z Gatty 1900, 83).

Obr. 3. Přenosné kanonické hodiny z 10. století nalezené v Canterbury; rozměry stříbrné destičky 61 × 16 mm (*cf*. Bassermann-Jordan 1961, 99; uloženo: chrámový poklad Canterbury Cathedral 01513; dostupné na <https://www.burlington.org.uk/archive/exhibition-review/anglo-saxon-kingdoms-art-word-war-british-library-london>).

Obr. 4. Portsmouth, Velká Británie, 1545. Jedny z hodin z vraku Mary Rose potopené roku 1545 u Portsmouthu. Číselník dělený pouze na celé hodiny, po stranách paty mosazného sklopného polosu rostlinná dekorace, u některých dalších nálezů z vraku je dekorace figurální. Průměr 33 mm. Uvnitř víčka chránícího polos po sklopení se nachází zrcadélko, které s funkcí hodin nijak nesouvisí, je to zřejmě pouze obchodní záležitost (uloženo: Mary Rose Trust, PORMR 80A1669, foto © Mary Rose Trust).

Obr. 5. Sloupkové sluneční hodiny stolní, Čechy, 1745. Celková výška 310 mm, výška mosazného válce 191 mm, průměr válce 91 mm. Hojně používané sloupkové hodiny cestovní měly rozměry zhruba poloviční a při měření se držely zavěšené (uloženo: UPM v Praze, inv. č. 79462; foto © UPM v Praze, O. Kocourek).

Obr. 6. Heinrich Seus, kolem roku 1450: rukopis *Horologium Sapientiae*, výřez. Uprostřed detailu ilustrace můžeme na stole vidět stroj mechanických hodin a dvoje směrové sluneční hodiny (**vzadu nahoře** horizontální, **napravo** rovníkové). Pod hranou stolu jsou zavěšeny výškové sluneční hodiny (**vlevo** sloupkové a **vpravo** kvadrant; *cf*. Fléchon 2012, 120–121; dostupné na <https://commons.wikimedia.org/wiki/File:Instruments_horaires_XVe.jpg>).

Obr. 7. Hieronymus Reinmann, 1575: miniaturní diptychové sluneční hodiny pro běžného zákazníka; šířka 26, hloubka 31 mm (uloženo: Salzburg Museum, K 532-49, foto © Salzburg Museum). Na výřezu **vlevo** detail plochy **IIb** s mistrovskou značkou a písmenem *N*.

Obr. 8. Schéma značení stran diptychových slunečních hodin, destičky svírají pravý úhel.

Obr. 9. Michael Lesel, 1. třetina 17. století: luxusní diptychové hodiny, kompletně dochovaný exemplář. Slonovina, 60 × 100 mm (uloženo: soukromá sbírka, Německo). **Ia** – 32směrná větrná růžice s otočnou ručičkou. Po sklapnutí přístroje do vodorovné polohy se do otvoru v centru růžice vsadí ***korouhvička***. Kruhový otvor slouží při orientaci růžice jako průhled na špičku střelky. Po ustálení pohybu korouhvičky se ztotožní s jejím směrem otočná ručička, ukazující na směr větru. Tato část diptychů plní funkci meteorologického přístroje. Dvě západky zajišťují kolmost destiček po otevření přístroje. **Ib** – v horní části jednoduché ***kalendárium*** s křivkami zvěrokruhu a údaji o délce světlého dne; údaje ukazuje konec stínu jehlovitého stylu. Uprostřed na vertikále čtyři otvory označené 45, 48, 51 a 54 k nastavení polosu na zeměpisnou šířku. Ve spodní části tabulka měst s jejich zeměpisnými šířkami. **IIa** – uprostřed severní poloviny ***kompas***, na jeho dně kromě označení světových stran mistrovská značka – korunka. Kolem kompasu čtyři soustředné ***číselníky*** horizontálních hodin pro čtyři hodnoty zeměpisných šířek. V jižní polovině konkávní dvojitý číselník: **červeně** číselník babylonských hodin, **okrově** číselník italských hodin. Údaje určuje konec stínu ***gnómonu***. Na západním boku destičky za mosaznou otočnou krytkou vydlabán prostor pro uložení korouhvičky. Na čele destičky dvě západky k uzavření přístroje. **IIb** – nezřetelná mistrovská značka u závěsu. Střed plochy zaujímá ***volvela*** měsíčních hodin sloužící k přepočtu časového údaje získaného na slunečních hodinách za měsíčního svitu na občanské hodiny. K přepočtu je potřeba znát fázi Měsíce, jež se nastavuje indexem mosazné otočné části volvely na prostřední stupnici 1–29. Na otočném disku se poté vyhledá naměřený údaj

a na sousedící pevné stupnici se přečte odpovídající sluneční čas. Čas lze odečíst v hodinách a minutách ve dvou stupnicích při obvodu volvely. Jednodušší měsíční hodiny pouze s jednou hodinovou stupnicí se vyskytují i na malých hodinách (*cf.* exemplář kat. č. 18), kde se ovšem nacházejí na ploše **Ia** (uloženo: soukromá sbírka, Německo; foto majitel).

Obr. 10. Aegidius Sadeler, 1607: *Prospekt Vladislavského sálu* – výřez. Rytina, 562 × 616 mm (The Metropolitan Museum of Art, New York, Drawings and Prints, inv. č. 53.601.10(1); dostupné na <https://www.metmuseum.org/art/collection/search/409008>).

Na detailu vidíme zcela vlevo dole samotného autora prodávajícího tisky. V sousedním krámci jsou na prodej např. dózy, poháry nebo lesní rohy. Následuje krámec s hodinami na policích. Je obsazen ženou, pravděpodobně Zuzanou Solisovou, v roce 1607 již vdovou po Erasmu Habermelovi (nejvýznamnějším pražském výrobci přístrojů), nebo její švagrovou Lidmilou Glocknerovou, které zde v té době společně provozovaly obchod s hodinami (Fomín 2022, na s. 72–73 rodokmen manželů Habermelových a příbuzenské vazby).

Obr. 11. Hans Tucher, 2. polovina 16. nebo 1. polovina 17. století: signované mosazné diptychy v kruhové dóze o průměru 42 mm.

A – strana **Ia** – volvela měsíčních hodin; **B** – strana **IIb** s mistrovskou značkou na dně dózičky; **C** – otevřené hodiny vcelku; **D** – mistrovská značka Hanse Tuchera (uloženo: soukromá sbírka, Německo; foto majitel).

Obr. 12. Lienhart Miller, 1. polovina 17. století: sluneční hodiny v podobě houslí; 26 × 73 mm.

A – rozevřené hodiny; **B** – mistrovská značka L. Millera na spodu destičky – strana **IIb** (uloženo: The Collection of Historical Scientific Instruments Harvard, Cambridge, Massachussets, inv. č. 7348; foto © Historical Scientific Instruments Harvard).

Obr. 13. Pravděpodobně Lienhart Miller, 1. polovina 17. století: sluneční hodiny v podobě loutny; 27 × 63 mm (uloženo: Kunsthistorisches Museum Wien, Kunstkammer 763; foto © Kunsthistorisches Museum Wien).

Obr. 15. Lienhart Miller, 1631: horizontální sluneční hodiny na prstenu; 38 × 30 × 28 mm, monogram L.M. (převzato z Kern 2010, obr. 28, popis 496–497).

Obr. 14. Paul Reinman, kolem 1600: horizontální sluneční hodiny se slonovinovým číselníkem v mosazné schránce. Zlacená mosaz, slonovina a email, š. 35, hl. 42, tl. 14 mm. Na dně kompasu mistrovská značka (uloženo: History of Science Museum Oxford, UK, inv. č. OX 38669; foto © University of Oxford).

Obr. 16. Hans Tucher III. ve věku 84 let ve své dílně 12. září 1631. Na stěně visí přesýpací hodiny, mistr drží v ruce ***cirkl***, na stole jsou mezi ***diptychy*** pohozené ***střelky*** a nezbytné mistrovo nářadí – ***cirkl*** a ***rydlo***. (V inventáři Milderbergerové je uvedena cena mosazného cirklu 4 krejcary, menšího přibližně 2 krejcary.) Za povšimnutí stojí obarvení polosu ve shodě s barvou číslic. Výřez z rukopisu *Hausbuch der Mendelschen Zwölfbrüderstiftung*, Nürnberg, Mendel II, Stadtbibliothek im Bildungscampus Nürnberg, kolem 1670–1677, Amb. 317b.2°, fol. 108v, dostupné na <https://online-service.nuernberg.de/viewer/image/0f5e1d20-0f54-473b-9516-8cf87c93689a/222/>.

Obr. 17. Situování jednotlivých lokalit s nálezy přenosných slunečních hodin na území Čech a Moravy (do podkladu z veřejných zdrojů vložila S. Babušková). Čísla 1–22 odpovídají řazení v katalogu.

Tab. 1. Norimberští mistři, u nichž známe signaturu, s výjimkou prvních dvou mistrů známe i mistrovskou značku; v chronologickém pořadí.

Legenda: **tmavě hnědě** – prokázané období činnosti, **černá linka** – životní data a udělení mistrovství, **modrá linka** – získání městského práva, **červená linka** – sňatek.

Tab. 2. Značky norimberských mistrů s jejich životními daty v chronologickém pořadí.

Zdroje podkladů pro kresby značek: **1** – SML 1880-56; **2** – Adler DPW-21; **3** – Salz K 532-49; **4** – na mnoha přístrojích; **5** – varianta 1 (jdoucí doleva) Mik 17907, varianta 2 (jdoucí doprava) soukromá sbírka Německo; **6** – Mik 17908; **7** – Adler W-29; **8** – Adler DPW-20; **9** – Adler W-13; **10** – na mnoha přístrojích; **11** – značka 1 dat. 1586 OX 70006, značka 2 dat. 1588 Adler DPW-24, dat. 1598 NYMM 03.21.38, značka 3 dat. 1600 H 7537; **12** – Adler DPW-27; **13** – OX 42629, poděkování Alexander Thekale; **14** – na mnoha přístrojích; **15** – H 7539; **16** – H 7558; **17** – na mnoha přístrojích, Adler T-10; **18** – H 7458; **19** – Mik 17910; **20** – NM 6118; **21** – H 7899; **22** – H 7570; **23** – UPM 65348; **24** – SML 1892-18; **25** – H 7525; **26** – Adler DPW-23; **27** – na mnoha přístrojích.

Vysvětlivky zkratek: **Adler** – Adler Planetarium, Chicago, USA; **H** – Harvard University, Cambridge, Mass, USA; **Mik** – Regionální muzeum v Mikulově; **NM** – Národní muzeum v Praze; **NYMM** – Metropolitan Museum of Art, New York; **OX** – History of Science Museum, Oxford; **SML** – Science Museum London; **Salz** – Salzburger Museum; **UPM** – Uměleckoprůmyslové museum v Praze.

Plný text příspěvku v českém jazyce je dostupný na web stránce časopisu:
<https://staletapraha.cz/magno/pha/2024/mn2.php>
<www.staletapraha.cz>, záložka Archiv, 40 – 2/2024

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