SEBASTIAN MÜNSTER'S treastise on Sundials: *Horologiographia cioè descrittione de horologi composta per Sebastiano Munstero et da medesimo revista et arrichita di…* [*Horologiographia* which is the description of sundials composed by Sebastian Münster, revised and supplemented by the same], unique translation
In Latin and Italian, manuscript on paper with tables, diagrams, and illustrations
Northern Italy (Veneto?), 1540-1564 (after 1533)

ii + 116 + ii folios on paper, pagination in ink (3-235) top outer corner, watermark, angel of annunciation with branch and star, similar to Briquet nos. 628 (Reggio Emilia, 1545) and 630 (Salo, 1560), complete (collation i^4 ii-xv^8 xvi^4), quire signatures A-P, catchwords throughout, (justification, 180 x 120 mm.), written in a neat Italian humanistic cursive script in 27 long lines per page by one scribe, 78 diagrams, illustrations, and tables throughout closely imitating the 1533 Basel edition of Sebastian Münster's Horologiographia, *faint pencil sketches of Virgo and Libra can be seen on the final two folios, some staining in the top outer corner on pp. 27-40, otherwise good condition, CONTEMPORARY BINDING of vellum over pasteboards, "Orologi a Sole" written on spine. Dimensions 202 x 150 mm.*

This is a unique copy of an Italian translation of Sebastian Münster's treatise of sundials titled *Horologiographia*, which is likely the first work in Italian on sundials. The early date of the manuscript compared to printed treatises on sundials make it an important document in the history of mathematics, science, and technology during the Italian Renaissance. The neat humanist cursive and numerous detailed straight-edge and compass figures reveal the work of an experienced scholar and draftsman, probably working in the Veneto. Later in its history, the volume was redacted and Münster's name was removed, a fascinating example of self-censorship to make the volume acceptable to the Inquisition.

PROVENANCE

1. Internal and external evidence allows us to date this manuscript reliably to the middle of the sixteenth century in Northern Italy. First, the watermark can be compared with similar watermarks found in paper produced in Northern Italy in the middle of the sixteenth century. Secondly, the censored title page which obscured the name of Sebastian Münster suggests that the manuscript was copied sometime before Münster's name was added to the *Index librorum prohibitorum* in 1564 (or before 1554/55 when Münster was mentioned in a petition against a Venetian *Index*). Thirdly, the translator shows familiarity with the Veneto in a bracketed editorial clarification of the word *gnomone* on p. 13, *che come price al Valla significa la norma* ("which means the norm at Vallà").

   The author of this translation is unknown. However, the evidence of the watermark, the date suggested by the censorship of Münster's name, and the translator's familiarity with the Veneto, suggest the possibility that either Giovan Battista Benedetti (1530-1590) or his teacher Nicolo Tartaglia (1500-1557) may have been the translator. Of these two, Benedetti seems more likely. Tartaglia was the more established Venetian mathematician when Sebastian Münster's *Horologiographia* arrived in Venice (at some

point after 1533), but his interest in applied mathematics in his published works focused solely on ballistics. Benedetti, on the other hand, produced a Latin treatise on sundials, *De gnomonum umbrarumque solarium usu*, in 1574. The work mentions Münster by name, albeit polemically. It therefore seems possible that the translation described here could have been an early effort by Benedetti to popularize Münster's work.

Alternatively, the possibility that the author of our translation was Giovanni Battista Vimercato should be considered. Vimercatato published a popular work on sundials in Italian, the *Dialogo della descrittione teorica et pratica de gli horologi solari*, which went through nine editions in the sixteenth century (Houzeau and Lancaster, no. 11,367). Little is known, however, about Vimercato's life.

2. Sold at Hôtel des ventes d'Avignon, September 20th, 2018, lot 154.

TEXT

p. 1 [unnumbered; title page], incipit, "*HOROLOGIOGRAPHIA CIOE DESCRITTIONE DE HOROLOGI COMPOSTA PER SEBASTIANO MUNSTERO ET DAI MEDESIMO REVISTA ET ARRICCHITA DI…*";

The title page contains the same frontispiece as the 1533 edition of Münster's *Horologiographia* finely drawn in a brown ink. Sebastian Münster's name was originally covered by a strip of paper and two lines of text about Münster have been redacted. Booksellers and book owners during the Inquisition in the sixteenth century would erase, omit, and redact the names of authors in their books so that their wares and property would not be seized by Inquisitors (compare the 1533 edition of Münster's *Horologiographia* housed in the National Central Library of Rome) (Heintzelman). While the *Index librorum prohibitorum* was officially published in 1564, Venetian bookmen complained about censorship as early as 1548 in protest against the Council of Trent's decrees, and in 1554/55 petitioned against a local Venetian *Index* on the grounds that many of the banned authors produced works "non appartinenti alla fede" (not pertaining to faith). Sebastian Münster and his *Horologiographia* appear by name in the list given by the bookmen (Grendler, 1977, pp. 295-301).

p. 2 [unnumbered], blank;

pp. 3-8, *TAVOLA DE TVTTI LI CAPITOLI Del presente libro delli horologi*, incipit, "Vna breve et utile Theorica che serve alla compositione da tutti li Horologi Cap. 1. a carta. 8…Breve declaratione della figura maggiore aggiunta nel fine del libro. a car. 231";

pp. 8-235, *HOROLOGIOGRAPHIA NOVAMENTE […] Revista et Aggiuntevi da esso molte descrittioni et Figure*, incipit, "Vna breve et utile theorica che serve alla compositione di tutti li horologi Capitolo primo…et la descrittione della quale di sopra non sia stata in molti modi trattata," *IL FINE*.

pp. 237-239, [unnumbered], [two sketches, one of the constellation Virgo on p. 237 and the second of the constellation Libra on p. 239]

These sketches in very light pencil match the 1533 printing. They may have been a light diversion for the author of the translation or a subsequent reader (Münster's discussion of the Zodiac is not included in this translation).

Sebastian Münster (1488-1552) was a Renaissance humanist and polymath who is best known for his geographical/historical *magnum opus*, *Cosmographia*, and his work on Hebrew philology. His work in both these fields earned him the titles of the "German Strabo" and the "German Esdras" (McLean, 2007, pp. 5-10). His interests in timekeeping and world history led him to the study of horology and gnomonics (i.e. the theory and construction of sundials). Münster published his first work on sundials in Basel in 1531, the *Compositio Horologiorum* (Burmeister, 1964, no. 49; Houzeau and Lancaster, 1882-1889, no. 11,349). A revised and expanded edition was published in Basel in 1533 by Heinrich Petri, the *Horologiographia* (Burmeister, 1964, no. 50; Houzeau and Lancaster, 1882-1889, no. 11,349; online at https://archive.org/details/horologiographia00muns/page/n5/mode/2up). The Italian translation found in our manuscript follows the text and visual program of the 1533 edition very closely, reproducing the division of the text into 51 chapters and translating the chapter headings, but omitting the Preface and Epistle to Henricus Billingus found in this edition.

The Italian translation assiduously reproduces the diagrams, figures, and tables from the 1533 edition, some of which have been attributed to Hans Holbein the Younger (1497/1498-1543); only the description and illustration of the 12 signs of the Zodiac found between chapters 31 and 32 in Münster's edition are omitted. (Two faint pencil sketches of Virgo and Libra are found at the end of the manuscript.). The tables follow the edition's numbers exactly and one provides astronomical data pertaining to the sun for the years 1530-1580 (p. 217). (For a fuller discussion, see below ILLUSTRATION).

To the best of our knowledge, the translation found in our manuscript is unique; we have found no trace of it in current bibliographies and catalogs. The translator adds a few, sparse comments to the translation, which are marked by square brackets in the main text. These include: p. 13, *che come piace al Valla significa la norma* (glossing *gnomone*, "which means the norm at Vallà"); p. 13, *che altro non sona che quella che contiene et abbraccia le due linee che fanno l'angolo retto del triangolo rettangolo* (glossing ὑποτείνουσα, "what else is it than that which contains and includes the two lines that make the right angle of a right triangle"); p. 13, *cioè ad angoli retti* (glossing πρὸς ὀρθάς, "i.e. to right angles"); p. 32, *cioè triangolo che habia due lati equali* (glossing *isoscele*, "i.e. a triangle that has two equal sides"); p. 39, *cioè di germania* (glossing, *nella regione nostra*, "i.e. from Germany"); p. 57, *hora chiamata Irlanda* (glossing *Hibernia*, "now called Ireland"); p. 77, *cioè squadro* (glossing *rettificatore*, "i.e. a square"); p. 162, *overo orlo* (glossing *limbo*, "or hem/side); p. 165, *il che imparerai nella propositione 24 del terzo libro delli elementi di Euclide* (glossing a geometrical construction, "which you will learn in proposition 24 of the third book of Euclid's *Elements*). These editorial additions show a scholar concerned with simply making the text clear at some points in the several *cioè* glosses, but also one eager to make the Greek intelligible to readers and to show the mathematical underpinnings of sundials in the reference to Euclid.

Measuring time with sundials is an ancient practice that stretches back at least as far as the fifth century BCE. Plenty of ancient Greek and Roman models of sundials are still extant today. Medieval sundials, however, are much rarer and more sparsely attested. Much of the medieval theory and practice of celestial time keeping focused on the construction and use of astrolabes,

but the invention and use of mechanical clocks in European towns created a new demand for accurate sundials which could be used to divide a day into twelve equal hours (Turner, 1987, p. 312). These new types of sundials, first engineered in the generation before Münster, took advantage of magnetic compasses and were much more reliable than earlier models. By Münster's time, Southern Germany had become a manufacturing center for sundials, but there was still relatively little literature about the construction and use of dials. Münster's 1531 and 1533 editions, the first printed books dealing with sundials, thus performed a much-needed service for the expansion and dissemination of sundial technology. The success of Münster's efforts can be seen in the explosion of interest in sundials in the second half of the sixteenth century, when 39 new titles appeared in 66 editions (Turner, 1987, 313).

The *Horologiographia* provides explicit instructions for the construction of several different types of sundials, which could be fixed or portable, built on planes or concave surfaces. Constructing these sundials was not merely an exercise in technical skill, a thorough knowledge of mathematics and especially conic sections was required. The burgeoning interest in dialing in Italy led to the construction of many large-scale public sundials and other time keeping devices like meridian lines, some of which were built by Egnazio Danti in Florence (at Santa Maria Novella) and the Vatican (in the Tower of the Winds). Danti's meridian lines, essentially large-scale sundials used to track the yearly movement of the sun, were instrumental in providing empirical and scientific evidence for the Gregorian calendar reform of 1583 (Lunardi, 2018).

This manuscript is therefore a critical and unique link between the fledging science of horology and gnomonics in the first half of the sixteenth century and its significant development in the second half of the century. The manuscript was most likely written close to the middle of the Cinquecento, shortly after Münster's book arrived at Venetian book markets, but before Münster's name was branded anathema by the Inquisition. Thus, the manuscript is perhaps the earliest text on sundials written in Italian. It is also an early example of self-censorship by an early owner, used to evade the even harsher censorial penalties of the Inquisition.

ILLUSTRATION

p. 1, Title page with several figures of truncated sundials on different surfaces; p. 14, Sundial construction, triangular figure; p. 21, Semidiameters of sundials; p. 23, Equinoctial sundial; p. 26, Horizontal sundial; p. 30, Quadrant's composition; pp. 36-37, Two figures for construction of quadrantal sundial; p. 39, Mural sundial; p. 40, Mural sundial; p. 43, Equinoctial sundial (sundial under the equator on a concave, upright, and horizontal surface); p. 45, Equinoctial sundial (parallel of Basel); p. 46, Horizontal sundial; p. 47, Two figures for construction of mural sundials; p. 49, Semidiameters of mural and horizontal sundials; p. 53, Mural sundial; p. 56, Mural sundial; p. 58, Horizontal sundial; p. 64, Mural sundial; p. 65, Mural sundial on surface; p. 68, Mural sundial; p. 70, Mural sundial on surface; p. 73, Mural sundial; p. 76, Mural sundial with geometrical figure; p. 78, Truncated sundial; p. 80, Equinoctial sundial in the trunk; p. 83, Horizontal sundial in the trunk; p. 84, Perpendicular sundial in the trunk; p. 86, Perpendicular mural sundial; p. 88, Western mural sundial; p. 89, Eastern mural sundial; p. 91, Eastern sundial; p. 93, Truncated sundial circle on various surfaces; p. 94, Truncated sundial on various surfaces; pp. 96-97, Several figures of truncated sundials on different surfaces; pp. 97-99, Several forms of sundials on a plane, on a perpendicular surface, at the pole's elevation or the equinoctial; p. 102, Mural sundial, constructed with an instrument; p. 104, Mural sundial with twelve zodiac signs; p. 107, Parallels of zodiac signs; p. 117, Sundial with zodiac signs; p. 119, Composition of

horizontal sundials with zodiac signs; p. 120, Horizontal sundial with a description of zodiac signs; p. 122, Mural sundial with zodiac signs; p. 124, Horizontal sundial with zodiac signs; p. 126, Zodiac for eastern and western sundials; p. 129, Eastern sundial with daytime hours and western sundial; p. 133, Sundial with the description of unequal hours ; p. 154, Eastern and western sundials with twelve zodiac signs; p. 158, Eastern and western sundials with twelve zodiac signs; p. 161, Equinoctial plane sundial with twelve zodiac signs; p. 171, Hour parallelogram; p. 175, Hour ring; pp. 180-181, Composition of the columnar trunk; p. 182, Columnar trunk; p. 185, Composition of the concave sphere; p. 186, Composition of the concave sphere; p. 190, Concave sphere; p. 195, Concave hemispherical sundial; p. 198, Sundial on a convex surface; p. 204, Composition of an instrument for determining the time at night; p. 208, Nocturnal sundial; p. 224, Calculation of the semidiameter; p. 228, Division of lines; p. 230, Division of lines; p. 237, pencil sketch of Virgo; p. 239 pencil sketch of Libra.

The illustrations focus primarily on the construction and design of a wide range of sundials, including horizontal, equinoctial, mural, and truncated sundials. Many detailed diagrams depict the geometric principles involved behind sundial creation, such as the division of lines, semidiameters, and zodiac signs. Several figures focus on the integration of zodiac signs into sundial designs, to show how these elements interact with timekeeping across various surfaces, including concave, convex, and perpendicular planes. Additionally, there are depictions of specialized instruments for determining the time at night, as well as examples of sundials designed for specific latitudes and regions. Many of the figures require considerable skill with the use of straight-edge and compass; the execution of the hand on p. 204 demonstrates artistic skill as well.

LITERATURE

Aked, Charles Kenneth, and Nicola Severino. *International Bibliography of Gnomonica*, Middlesex, 1997.

Burmeister, Karl Heniz. *Sebastian Münster: eine Bibliographie mit 22 Abhandlungen*, Weisbaden, 1964.

Cigola, Michela, ed. *Distinguished Figures in Descriptive Geometry and its Applications for Mechanism Science: From the Middle Ages to the 17th Century*, Heidelberg, 2016.

Grendler, Paul F. *The Roman Inquisition and the Venetian Press, 1540-1605*, Princeton, 1977.

Hantzsch, Viktor. *Sebastian Münster: Leben, Werk, wissenschaftliche Bedeutung*, Leipzig, 1898.

Houzeau, J.C., and A. Lancaster. *Bibliographie générale de l'astronomie jusqu'en 1880*. 2 vol. Brussels, 1882-89.

Lunardi, Roberto. *Il Cielo in Terra: Storia delle linee meridiane e degli strumenti astronomici de Egnazio Danti*, Florence, 2018.

McLean, Matthew. *The* Cosmographia *of Sebastian Münster: Describing the World in the Reformation*, Aldershot, 2007.

Omodeo, Pietro Daniel, and Jürgen Renn. *Science in Court Society: Giovan Battista Benedetti's* Diversarum speculationum mathematicarum et physicarum liber *(Turin, 1585)*, Berlin, 2019.

Peters, John Durham. *The Marvelous Clouds: Toward a Philosophy of Elemental Media*, Chicago, 2015.

Rohr, Reneé R.J. *Sundials: History, Theory, and Practice*, New York, 1996.

Savoie, Denis. "The Development of Sundials: Fourteenth to Twentieth Centuries," in *A General History of Horology*, eds. Anthony Turner, Jonathan Belts, and James Nye, Oxford, 2022, pp. 231-52.

Settle, Thomas B. "Egnazio Danti as a builder of gnomons an introduction," in *Musa Musaei*, ed. Marco Beretta, Paolo Galluzzi, Carlo Triarico, Florence, 2003, pp. 93-115.

Turner, Anthony J. "Dialling in the Time of Giovan Battista Benedetti," in *Cultura, Scienze e Tecniche nella Venezia del Cinquecento*, ed. Antonio Manno, Venice, 1987, pp. 311-22.

ONLINE RESOURCES

"Benedétti, Giambattista"
Treccani, https://www.treccani.it/enciclopedia/giambattista-benedetti/

Bianca, Concetta. "COMMANDINO, Federico," *Treccani*, originally published 1982, https://www.treccani.it/enciclopedia/federico-commandino_(Dizionario-Biografico)/

Fiore, Francesco Paolo. "DANTI, Egnazio (al secolo Carlo Pellegrino)," *Treccani*, originally published 1986, https://www.treccani.it/enciclopedia/egnazio-danti_(Dizionario-Biografico)/

Heintzelman, Matthew Z. "Sandwiching a Forbidden Text," *HMML*, September 2022, https://hmml.org/stories/series-books-sandwiching-a-forbidden-text/

Münster, Sebastian. *Horologiographia*, Basel, 1533, https://archive.org/details/horologiographia00muns/page/n5/mode/2up

Nenci, Elio. "TARTAGLIA, Niccolò," *Treccani*, originally published 2019, https://www.treccani.it/enciclopedia/niccolo-tartaglia_(Dizionario-Biografico)/

O'Connor, J.J., and E.F. Robertson. "Giovanni Battista Benedetti," *MacTutor Index*, July 2009, https://mathshistory.st-andrews.ac.uk/Biographies/Benedetti/

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