

Biographical Encyclopedia of Astronomers

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Bürgi, Jost [Joost, Jobst]

Born Died Lichtensteig, St. Gallen, Switzerland, 28 February 1552

Died Kassel, (Hesse, Germany), 31 January 1632

Jost Bürgi was a clockmaker, astronomer, and applied mathematician. His father was probably a fitter. Very little seems to be known about his life before 1579. It is probable that Bürgi acquired much of his knowledge in Strasbourg, one of his teachers being the Swiss mathematician Konrad Dasypodius. An indication that he did not receive a systematic education is the fact that Bürgi did not know Latin, the scientific language of his time. Nevertheless, he made lasting scientific contributions that prompted some biographers to call him the "Swiss Archimedes." Bürgi was married first to the daughter of David Bramer, then in 1611, to Catharina Braun

Bürgi developed a theory of logarithms independently of his Scottish contemporary John Napier. Napier's logarithms were published in 1614; Bürgi's were published in 1620. The objective of both approaches was to simplify mathematical calculations. While Napier's approach was algebraic, Bürgi's point of view was geometric. It is believed that Bürgi created a table of logarithms several years before Napier, but did not publish it until later in his book *Tafeln arithmetischer und Geometrier Zahlenfolgen mit einer fröhlichen Erläuterungen, wie sie zu verstehen sind und gebraucht werden können* (Tables of Arithmetic and Geometric Number Sequences with a Thorough Explanation of How They Can Be Understood and Used). Indications that Bürgi knew about logarithms earlier in 1588 can be obtained from a letter by the astronomer Nicholaus Bär (Raimarus Ursus), who explains that Bürgi had a method to simplify his calculations using logarithms

Logarithms paved the way for slide rules because the identity $\log(a \cdot b) = \log(a) + \log(b)$ allows one to compute the product of two numbers a and b as an addition. Bürgi also computed sinetables. These tables, called Canon Sinuum, seem, however, to have been lost. The sinetables were used in a method called prosthaphaeresis, known to many astronomers in the 16th century. In this method, trigonometric formulas like $\sin(x) \sin(y) = [\cos(x-y) - \cos(x+y)]/2$ are used to reduce multiplication to addition. Bürgi is considered one of the inventors of that method; other identities were used by Ursus, Johannes Werner, and Paul Wittich

Another indication that Bürgi's discovery of logarithms was independent of Napier's is the fact that Johannes Kepler, who admired Bürgi as a mathematician, states in the introduction to his Rudolphine Tables (1627): "...the accents in calculation led Justus Byrgius on the way to these very logarithms many years before Napier's system appeared; but being an indolent man, and very uncommunicative, instead of rearing up his child for the public benefit he deserted it in the birth." Although the two discoveries are today believed to be independent, Napier definitely enjoyed the right of priority in publication Both methods were mainly computational. It seems that the first clear and theoretical exposition of the equation $\log(x \cdot y) = \log(x) + \log(y)$ can be found in Kepler's *Chilias logarithmorum*.

In 1579, Bürgi entered the employ of Landgrave Wilhelm IV of Hesse-Kassel, observing with the court mathematician Christoph Rothmann at the excellent Kassel Observatory. Some denote it as the first stationary observatory in Europe. Bürgi, who also knew Tycho Brahe and was a friend of Kepler, made many instruments for the observatory. One of the instruments was

the reduction compass, another the triangularization instrument, both of which had military applications. Bürigi's famous celestial globe from 1594 can be seen on some Swiss stamps

Bürigi is credited with the invention of the minute hand on clocks in 1577. His invention was part of a clock he constructed for Brahe, who needed precise time for observing. Bürigi is also known in the history of time measurement for a clock he made in 1585 that would run for three months. He introduced the idea of adding an independent system to the traditional wheel-train, which was wound in short periods by the mainspring, giving a more constant flow to the escapement. This was later perfected, eventually leading to an autonomy of several months. In 1604, Bürigi became court watchmaker to Emperor Rudolf II. He returned to Kassel the year before his death.

Oliver Knill

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