# PETER KRÜGER (1580-1639) GDAŃSK SCIENTIST, PROFESSOR OF THE ACADEMIC GYMNASIUM

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He became famous as a mathematician, as he was the first person to separate the logarithms of numbers from the logarithms of the trigonometric functions in the tables. As a teacher he formed the mind of Johann Hevelius and pushed him onto the road of science. Those two facts alone would be enough to place Krüger (or Crüger, because his name has also been spelt like that) among the most prominent Gdańsk citizens. Yet in his industrious life he had many more achievements in the fields of mathematics, astronomy, physics, poetry and calendariography.

He was born on 20th October, 1580 in Königsberg. His father, Wilhelm, was a deacon of the Old-Town church, and his mother, Dorota neé Werner, came from Drengfurth, that is today's Srokowo, where her father was a mayor, and where little Piotr was brought up after he had lost his parents. From the age of 12 to 17 he was a treble in the Duke's band in Königsberg. He then joined the famous Pedagogium. In 1600 he visited Prague, where he came into contact with T. de Brahe and J. Kepler. In 1603 he became a preceptor of two young noblemen, and they together came to Gdańsk to study in the Academic Gymnasium under the famous B. Keckermann. After two years he went to Wittenberg, where after public disputes he received the title of Master of Science. After returning in 1607 he settles down in Gdańsk and is appointed by the City Council as a professor of mathematics and poetry in the Academic Gymnasium and as a sworn surveyor and a proof-reader of the mathematical books to be published. He also had the unique right to prepare the calendars in the city, and a title of calendariographer connected with the function, which was certified in 1623 by the Sigismund III privilege. In the years 1627-1630 his student in the Gymnasium was Johann Hevelius, who devoted a grateful remembrance to him.

In 1608 he married Elisabeth Reutorff, with whom he had 3 sons and 2 daughters. After her death in 1625 he got married again to Ursula Remus, with whom he had 3 sons and 2 daughters. Of all the numerous family only one son and a daughter from the second marriage outlived him. He died on 6 June 1639. He was pompously buried at the Holy Trinity church, probably under the tombstone number 147. Already on his deathbed he obliged Hevelius to observe the Sun eclipse (1 June), which he was too weak to do himself.

Krüger left over 20 scientific publications. The most worthy ones are his mathematical works. The first of them (1607) was an unsuccessful attempt to solve the problem of the quadrature of a circle. Yet the very next one "Sinopsis trigonometriae" (1612), which was a gift to J. Brozek on his stay in Gdańsk, shows the author's great erudition and profound knowledge. It contains the basic theoremata concerning triangles, the names of trigonometric functions, value charts and examples of solving flat and spherical triangles. The treaty "Logistica sexagenaria" (1616) is interesting as well, yet the most important was "Praxis Trigonometriae Logarithmicae", published in 1634 and then re-edited in 1648 and 1654 in Amsterdam. After presenting in it the basis for the theory of logarithms as seen by Neper, Krüger makes up the most detailed logarithmic tables that have ever been elaborated before. The first table contains the logarithms of integers from 1 to 10000, the second one - logarithms of sinuses and tangents of angles for every minute, with proportional parts every 10 seconds. The third table presents logarithms of the sinuses of angles from 0 to 90, every second. The author added the fourth table, introduced by J. Bartsch (Kepler's son-in-law), with the logarithms of angles every 2 seconds, from 0 to 1 41'. The adoption of the less convenient Neper's system, although the Brigg's logarithms had already been known, he explained by the fact that in the Rudolphine tables only the Neper's logarithms were used. It should be added that the first of the tables (Tabula logarithmica prima) contained among others the law of cosines expressed as: $2ab:(a^2+b^2-c^2) = \sin 90^\circ:\sin(90-C)$, where a,b,c are the sides of the triangle, and C is its angle opposite to side c.

From among Krüger's other mathematical works the following should be mentioned: the outline of spherical trigonometry entitled "Rechen-Buchlein", the popularity of which in Gdańsk is proved by the subsequent editions in 1631, 1635, 1642 and 1648. This small work is till today astonishing with the skill of expression, high didactic value and an accurate choice of examples. "Placing here many words about the usefulness of the art of counting would be like wanting to help the Sun at a bright noon by putting up a candle" - writes the author in the introduction. Further he refers to his 20-year-long teaching practice, both in schools and private. The next chapters are devoted to the 4 operations on the integer numbers and fractions and to the rule of three - straight, reverse and complex. Separately he discusses the money and the units of measure and weight used in those times, and some basic trade terms. The following example shows problems caused by the variety of units used in different cities: "Somebody buys 4 drums of wax in Vilna, Lithuania, which weigh there respectively: 33 stones 28 pounds, 12 stones 22 pounds, 15 stones minus 4

pounds, 17 stones 14 pounds; on calculating one stone at 6 Polish zlotys and brings them by sea to Gdańsk. The freight and other costs are at 56 zlotys. How much does one stone of Gdańsk weight cost? The Vilnaer stone is 36 pounds, and 40 stones correspond to 37 $\frac{3}{4}$ of Gdańsk stones. The result: 7 zlotys $11\frac{481}{1881}$ grosz of pfennigs (1 zloty had 30 grosz, 18 pfennigs each).

And here is another ingenuous problem: "A servant of a Polish lord has on him 800 zl, with which he is to buy red, blue and green cloth in equal quantities. One ell of the red cloth costs 5 $\frac{1}{2}$ zl, of the blue - $3\frac{3}{4}$, and of the green - half the price of the red one. How many ells of each kind will he get? The result: 66 $\frac{2}{3}$ ells." Then Krüger gives a hint which shows what a great mathematician and teacher he was: "It is not as difficult as it seems. Add up all the prices, and you get 12 zl, with which the servant will get 3 ells. So with 800 zl he will get 200 ells, which you have to divide into three parts." Even in the times of computers such a handbook would be useful!

Krügers achievements in other fields also cannot be denied importance. In the field of physics we should mention the experiments on the geomagnetism, to which he devoted the treaty "De Motu Magnetis" (1606 and 1615). Among others he describes measurements of magnetic declination, which were later continued by Hevelius who was the future discoverer if its variability. Because of these measurements Krüger became a co-author of the oldest in the world local curve of the declination changes, which was started in 1539 by J. Reticus. In astronomy he was distinguished by observing comets, which he started doing, being guided by Keckermann (dissertations from 1605 and 1618), and constructing instruments, for example the sextant admired by his contemporaries, and described by Ch. Ogier: "This is an instrument made of red bronze, ten or more feet tall, and about five feet wide, ended by a toothed wheel on which a movable eyepiece and a ruller fix on individual teeth." Krüger also used the armilar sphere and constructed sundials. We should also mention here his notes from 1627 on a preserved version of "De Revolutionibus" by Copernicus, which are a proof that he gave up the cautious ideas of his youth (dissertations from 1614 and 1615) and became a heliocentric theory supporter. A synthesis of his views concerning astronomy is included in the calendars published by himself in the years 1608-1639, and in "Cupediae Astrosophicae Crugerianae" (1631). His charted basis of geography "Geographiae methodice discendae Typus" (1635) are also of some importance.

As a professor of poetry he was also obliged to write poems for different occasions. He did that eagerly and with a certain dose of talent, showing his intelligence and familiarity with human problems. Every one of the preserved 20 German and Latin epigrams is different. Here is a sample of Krügers sense of humour in the epigram "Jokingly and seriously" (1625), written on the occasion of Kasper Zierenberg's (an elderly widower) wedding with young Barbara Rudiger: (own translation) "Look as this year Providence has an eye on the lucky tribe of the widowers, who before, as everyone could see, had to tread the land as bachelors. God

has decided today to give every one of them a wife they had dreamt of. A lady of such loveliness that knows no guest what strange will happen here." At the end of the second poem he warns the young to haste to get married, or else another widower will take away another girl from under their noses! We can imagine the guests laughing!

Being the city surveyor, Krüger also had to draw maps and plans. In 1615 he measured the Gross and Klein Bürgerwald, Neuendorf and Plehnendorf (today: Olszynka, Dobrowo and Płonia), belonging to the Wallgebäude (Construction Office). "Altogether 131 feuds, 20 morgs and 100 square perches with no springs, dams and dikes". In the Gdańsk archives there is preserved, among others, his plan of the Vorstadt (Old Suburb) made in 1617. In 1624 he measured gardens in so called Podlice in Tczew, "which has at the beginning been really difficult among the citizens, yet finally the difficulties were overcome and each of them had his allotment measured".

As Krüger was a hard working and modest man, he enjoyed a universal liking. His death brought mourning upon the city and sadness upon his friends. The most famous of them, a poet and the King's secretary, Martin Opitz honoured the dead with a beautiful poem.

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