Regnier Gemma Frisius

In 1530 the most influential Dutch mathematician of the 16th century was **Regnier (or Regner, Reiner) Gemma Frisius** (December 8, 1508 – May 25, 1555), a professor of medicine at Louvain. His interest in astronomy and astronomical instruments developed because of the astrological aspects of medicine then in practice. He constructed many maps, astronomical instruments, and his celestial globe is the oldest in the collection of the National Maritime Museum in London. It shows the northern stars in their familiar mythological constellations, but there are large gaps in the southern hemisphere, which was still largely unknown to European astronomers of the 16th century.

Gemma Frisius made many astronomical observations and his work on applying trigonometric methods to astronomical problems led to his correctly determining that comets displayed a proper motion against the background stars. He described the theory of trigonometric surveying and was the first to use triangulation as a means of locating places. He also proposed a method for finding the longitude of a place using a clock. The clock would be set on departure from a specific place and kept at absolute time during the journey to a destination and then compared with the local time at arrival. He gave precise instructions for translating difference in time in east/west distance traveled. Though his proposal was impractical as clocks of his time were not accurate enough, his method was later proved to be correct and eventually became the means to determine longitude at sea. In 1996, Sava Sobel wrote the bestseller *Longitude*, the story of 18th century watchmaker John Harrison, who spent 40 years building a timepiece, which could be used at sea to measure longitude.

Born in Dokkum, Friesland (Frisia), Netherlands, Gemma Frisius came from a poor family and was

orphaned as a youth. He began his studies in Groningen, attending the University of Louvain where he received his licentiate in 1528 and a medical degree in 1536. In 1541 he was appointed professor of medicine and mathematics at Louvain, where he earned a reputation as the leading theoretical mathematician in the Low Countries. Gemma Frisius used his mathematical abilities in the areas of geography, astronomy and map making. He produced a world map with lines and longitude and sophisticated variations on the astrolabe such as the "astronomical ring." The instrument is suspended by a piece attached to a split ring, allowing the outer meridian ring to slide and be set for a given latitude using two engraved quadrants, one for northern, one for southern latitudes. The self-orientating device avoids the use of a magnetic compass.

Gemma Frisius' *De Principiis Astronomiae & Cosmographiae* ("On the Principles of Astronomy and Cartography," 1530) was translated into several languages and reprinted many times. In his *Libellus de locurum* (1533), he described the theory of trigonometric surveying. The work is the first known source of using the method of triangulation as a means of accurately mapping areas. Triangulation uses the fact that the distance between two points and the bearings of a third point from the ends of this base line, provides the location of the third point. This method provided an accurate means of surveying using relatively few observations.

Gemma Frisius wrote *Tractatus de Ammulo Astronomicae* (1534*)*, in which he applied trigonometric methods to astronomical problems. He made numerous astronomical observations, particularly recording the motions of comets. Gemma Frisius' *Arithmeticae Practicae Methodus Facilis* (1540) went through fifty-nine editions, making it one of the most successful mathematical textbooks of the period. He was a pioneer in the use of the pinhole camera, which he used to study the solar eclipse of 1544. Light entering his closed darkened laboratory through a small hole in the door cast an image onto a screen or wall opposite the hole. Johannes Kepler first used the term "camera obscura" from *camera*,

Latin for “room” and *obscura,* Latin for “dark” to describe such instruments in the early 17th century. The camera obscura allowed astronomers to make solar observations without damaging their eyes.

Quotation of the Day: “… it is with the help of these clocks and the following methods that longitude is found. … observe exactly the time at the place from which we are making our journey. … When we have completed a journey … wait until the hand of the clock exactly touches the point of an hour and, at the same moment by means of an astrolabe … find out the time of the place we now find ourselves. … In this way I would be able to find the longitude of places, even if I was dragged off unawares across a thousand miles. … it must be a very finely made clock which does not vary with change of air.” – Regnier Gemma Frisius