The first casting of the second Kino equestrian statue by Julián Martínez was installed at the head of Tucson's newly completed Kino Parkway in 1988. (Photo by Charles W. Polzer; from the C. W. Polzer collection at the Office of Ethnohistorical Research, Arizona State Museum.)

Kino The Scientist

CHRISTOPHER CORBALLY, S.J., VATICAN OBSERVATORY

Kino's Star-taker

Are you familiar with the equestrian statue of Padre Kino, sculpted by Don Julián Martínez and of which three bronze casts were made? These three statues for three centuries, as they were called, were placed in each of Segno, Italy; Tucson, Arizona; and Magdalena, Sonora. A casual passerby might wonder what is represented by the round instrument resting on the left side saddlebag. It has what looks like a cross spanning its diameter. We don't clearly see the rotating sighting arm, the alidade, which would identify the instrument as an astrolabe. This is an early version of a sextant, combining features of a planisphere.

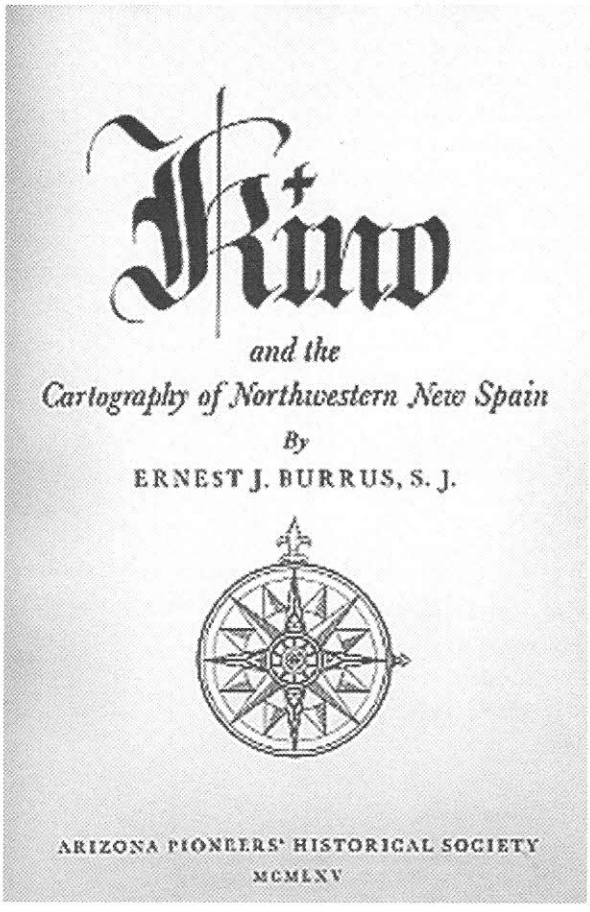
The alidade of Father Kino's astrolabe can be seen more clearly on the image sculpted by Baroness Suzanne Silvercruys for the National Hall of Statuary. (Photo by Arthur Vokes.)

An astrolabe, literally 'star-taker,' was used from classical antiquity through the Islamic Golden Age, and into the European Renaissance, for any purpose that involved the positions of the Sun, planets, and stars (Wikipedia 2010). This would include navigation, and hence we can understand the prime purpose of an astrolabe on Kino's travels. He would use it to sight the Sun at noon, determining its height above the horizon. With the help of correction tables for each day of the year, he would then calculate his geographical latitude.

A correction was needed since, when you think of the tilt of the Earth's axis in respect to its orbit around the Sun, the Sun's elevation at noon each day depends on the time of year. In winter the noon Sun is a lot lower than the noon summer Sun. It is precisely that difference which gives us our seasons. At the two equinoxes, and at a zero-point of longitude on the Earth, the noon Sun's elevation is exactly equal to your latitude. As you depart from that longitude zero and from an equinox, the correction increases. On one occasion, March 3, 1702, Kino described the process thus:

> At midday we took the altitude of the sun with the astrolabe, and found it to be fifty-two degrees, which, adding to it the six and a half of south declination of that day, made fifty-eight degrees and a half. The complement of ninety degrees is thirty-one degrees and a half, and this was the ... geographical latitude in which we found ourselves. [Bolton 1919: 341]

Kino was a skilled observer. Ives (1953) has checked against modern geodetic observations that Kino's error amounted to about only 1/60th of an inch on a 12-inch astrolabe. This also attests that he was a skilled instrument maker since he most likely made this astrolabe himself,[1] and as an instrument maker he knew how to care for it, and so preserve its accuracy, under desert travel conditions.



Rev. Ernest J. Burrus's 1965 publication includes a chronological list of Kino's maps and charts, and reproduces a number of them.

Kino's Cartography

All this skill with an astrolabe was poured into Kino's navigation and cartography. It is agreed (Ives 1960) that the most famous example of his maps is the "Passo por Tierra a la California." Drawn in 1707, it served even for a couple of centuries. On it were placed the missions and, most significantly, it showed that California, and so Baja California, was not an island but reachable across the Colorado River. This was a hunch of Kino's, first abandoned as a working hypothesis, and later confirmed by his explorations.

Ernest Burrus (1991) gathered a wealth of information about Kino's cartography. In his exposition I find two important points. The first is obvious: the quality of Kino's maps was progressive as a later version succeeded an earlier one. So his 1707 map was a result of careful work accumulated over successive expeditions. Kino was, in this sense, a perfectionist.[2] The second point concerns the goal of this perfectionism: Kino made maps not just so that he and others might get around the new territory of the Pimería, but that the maps might accurately show where the people lived (Burrus 1991:327). His maps are crowded with settlements; they are geographical in an ethnographic rather than physical sense. So his purpose in achieving cartographical excellence was to further the evangelization of the people to whom he and his Jesuit companions had been sent. There was a fire behind Kino's high level of skill, the flame of the Holy Spirit in religious terms, which had lit and driven his every step in becoming a missionary.

Kino's Astronomy and the Great Comet

This motivation seems important as we return to thinking about Kino as an astronomer. He did seem to have a natural curiosity about the world around him. He was also of a strong mathematical bent. We know this from his being offered the chair of mathematics at the University of Ingolstadt by the Duke of Bavaria. Kino's professorship was brief since he preferred to be a missioner. Still, we find that his natural curiosity prompted him to observe a comet while he was waiting for a ship to the New World.