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(b. Ālattūr, Kerala, India, ca. 1380; d. ca. 1460), *astronomy*.

Parameśvara was born into a learned Nampūtiri Brāhṃa family of Kerala, which belonged to the Bḥugotra and followed the Āśvalāyanasūtra of the *gveda*. His father remains obscure, but his grandfather studied under the astrologer Govindabhata of Ālattūr (1236–1314). The family resided in an *illam* (“house”) called Vāśśeri (Vāśrei) in the village of Ālattūr (Aśvatthagrāma) on the north bank of the river Nilā at its mouth in Kerala. Parameśvara states that this place lies eighteen *yojanas* west of the meridian of Ujjain, and that the sine of its latitude is 647 (with  $R = 3,438$ ); its latitude, then, is  $10^{\circ}51'N$ .

Parameśvara names Rudra as his teacher. Nilakāha (b. 1444), the pupil of his son Dāmodara, states that Parameśvara studied under Nārāyaṇa and Mādhava; the latter was a well-known astronomer of Sāgamagrāma in Kerala who lived between ca 1340 and ca. 1425. Parameśvara’s dates are fixed not only by the epochs of his several astronomical works, but also by his eclipse observations which extended from 1393 to 1432 (see D. Pingree, in *Journal of the American Oriental Society*, **87** [1967], 337–339). His latest recorded observation was made in 1445, although he states in a verse cited by Nilakāha that he made observations for fifty-five years—that is, until 1448 if the observations commenced in 1393. Since Nilakāha, who was born in 1444, knew him personally, Parameśvara could not have died much before 1460.

Parameśvara’s greatest achievements were the revisions of the accepted parameters of planetary motions, the *parahita* that were based on the *Āryabhāya of Āryabhā I* (b. 476), and the accepted procedure of eclipse-computations on the basis of his observations. He called this new system the *ḍggāita* (see essay in Supplement). He was also active in the composition of commentaries on the standard astronomical texts that were in use in Kerala.

## BIBLIOGRAPHY

I. Original Works. Parameśvara’s works include the following. *Parameśvara* (ca. 1408), B. D. Apate, ed. (Poona, 1946), is a commentary on the *Laghubhaskariya* of Bhaskara I (ft. 629); *Grahanamandana*, K. V. Sarma, ed. (Hoshiarpur, 1965), is a treatise on eclipses, of which an earlier version contained 87 verses, and a later 100; the epoch is 15 July 1411. The *Drgganita* (1431), K. V. Sarma, ed. (Hoshiarpur, 1963), gives his new parameters, which modify those of the *parahita* system. The work contains new parameters of mean motions of the planets, of their mean longitudes at the beginning of the Kaliyuga, and of their two equations, and a table of their equations at intervals of  $6^{\circ}$  of argument. It also mentions the *Grahanamandana*. Nilakāha in the *Aryabhatiyabhasya* written after 1501 understood the fifty-five years of Parameśvara’s observations to antedate the *Drgganita*, but this would make him nearly a century old in Nilakāha’s own youth.

The *Siddhantadipika*, published by T. S. Kuppanna Sastri (Madras, 1957), is a commentary on the *Bhasya*, written by Govindasvamin (ft. ca. 800–850) on the *Mahabhaskariya* of Bhaskara I (ft. 629). In this work Parameśvara cites the series of eclipse observations (including one at Navaksetra in 1422 and two at Gokarna in 1425 and 1430), which extended from 1393 to 1432. The *Grahananyayadipika*, K. V. Sarma, ed. (Hoshiarpur, 1966), discusses eclipse theory in eighty-five verses and cites both the *Grahanamandana* and the *Siddhantadipika*. The first *Goladipika* (1443) contains four chapters that deal respectively with the armillary sphere, the motions of the planets, geography, and gnomon-problems. It was edited with Parameśvara’s own commentary, *Vivrti*, by K. V. Sarma (Madras, 1957). *Grahanastaka*, a short treatise in ten verses, gives the fundamental information required for the computation of eclipses. It was edited by K. V. Sarma, in *Journal of Oriental Research, Madras*, **28** (1958–1959), 47–60.

Other works include *Vakyakarana*, an unpublished treatise on the vakya system of astronomy (see essay in Supplement); *Bhatadipika*, H. Kern, ed. (Leiden, 1874), a commentary on the *Aryabhāya of Āryabhā I* (b. 476); *Vivarana*, an unpublished commentary on the *Lilavati* of Bhaskara II (b. 1115); and *Karmadipiks*, B. Apate, ed. (Poona, 1945), is a commentary on the *Mahabhaskariya* of Bhaskara I (ft. 629), in which Parameśvara mentions his *Siddhantadipika*, his *Vakyadipika* (= *Vakyakarana*), his (*Grahana*) *nyayadipika*, his *Goladipika*, and his *Bhatadipika*, and also two lost works: a *Muhurtastakadipika* on astrology and a *Bhadipika*.

*Vivarana* is a commentary on the *Suryasiddhanta*, K. S. Shukla, ed. (Lucknow, 1957), in which the amount of precession is reckoned for 1432. This *Vivarana* refers to his *Parameśvara* on the *Laghubhaskariya*, his *Siddhantadipika*, his *Lilativivarana*, and his *Kamadipika*. The *Parameśvara*, B. D. Apate, ed. (Poona, 1952), is a commentary on the *Laghumanasa* of Munjala (fl. 932). A second *Goladipika*, T. G. Sastri, ed. (Trivandrum, 1916), consists of 302 verses and discusses a number of problems that relate to the celestial spheres. In this work Parameśvara refers to his *Siddhantadipika*, to his first *Goladipika*, and to his *Karmadipika*, A *Jatakapaddhati*, K. S. Menon, ed. (Trivandrum, n.d.), is on horoscopes; and an

unpublished commentary, *Vrtti*, is on the *Vyatipatastaka*, which is a work on the *patas* of the sun and moon. A number of astrological works by Parameśvara exist in MSS in South India: *Acarasangraha*, a commentary on the *Muhurtaratna* of Govindabhatta (1236–1314), the teacher of Parameśvara’s grandfather; a commentary on the *Jatakapaddhati* of Sripati (*fl.* 1040); and a commentary on the *Satpancasika* of Prthuyasas (*fl. ca.* 575).

II. Secondary Literature. The best source of information on Parameśvara is in the introductions to K. V. Sarma’s works. Unfortunately, there is as yet no study of how Parameśvara’s observations affected his astronomy. A brief summary of what was then known about him is given by K. K. Raja, “Astronomy and Mathematics in Kerala,” in *Brahmavidya*, **27** (1963), 118–167, esp. 136–143.

David Pingree