



Hindu astronomer Vaṭeśvara and his works *

1 Early references

The earliest references to Vaṭeśvara are found to occur in *Rasā'ilul' Bīrūnī*¹ and *Tārikh al-Hind*² of the Persian scholar Al-Bīrūnī (b. 973 AD) and in the *Siddhāntaśekhara*³ of the Hindu astronomer Śrīpati (1039 AD). Al-Bīrūnī has also quoted some passages from the *Karaṇasāra*, a calendrical work of Vaṭeśvara.⁴ According to Al-Bīrūnī, Vitteśvara (Vaṭeśvara) was a son of Mihdatta (Mahadatta) and belonged to the city of Nāgarapura.⁵ From the passages quoted by Al-Bīrūnī from the *Karaṇasāra*,⁶ we find that this work adopted the year 821 of the Śaka era (corresponding to the year 899 of the Christian era) as the origin of calculation, which shows that the *Karaṇasāra* was written in 899 AD, i.e. exactly four hundred years after the composition of the *Āryabhaṭīya* of Āryabhaṭa I. Śrīpati has mentioned the name of Vaṭeśvara amongst the first rate astronomers of India—Āryabhaṭa I, Brahmagupta, Lalla, and Sūrya. He has also utilised the *Vaṭeśvarasiddhānta* in writing his own *siddhānta*.

References to the *Vaṭeśvarasiddhānta*, the astronomical *siddhānta* written by Vaṭeśvara have also been noticed in Hindu works on astronomy. One passage ascribed to the *Vaṭeśvarasiddhānta*, consisting of four verses in *āryā* metre and dealing with the lunar correction corresponding to the modern "evection", was discovered by D. V. Ketkar⁷ in Yallaya's commentary (1480 AD) on the *Laghumānasa* of Mañjula (932 AD). But neither these verses nor the correction contained in them finds its occurrence in the manuscripts of the *Vaṭeśvarasiddhānta* available to us. Another set of three verses in *āryā* me-

* K. S. Shukla, *Gaṇita*, Vol. 23, No. 2 (December 1972), pp. 65–74.

¹See Mohammad Saffouri and Adnan Ifram, "Al-Bīrūnī on Transits", pp. 32, 142. "Al-Bīrūnī on Transits" is an English translation of the third treatise included in *Rasā'ilul' Bīrūnī* published by the Osmania Oriental Publications Bureau, Hyderabad-Deccan, in 1948.

²See Al-Bīrūnī's *India*, translated into English by E. C. Sachau, Vol. I, pp. 156, 392.

³xviii, 18.

⁴See Al-Bīrūnī's *India*, Vol. I, pp. 317, 392; Vol. II, pp. 54, 60, 79; and "Al-Bīrūnī on Transits", p. 32. Also see Al-Bīrūnī's "Exhaustive Treatise on shadows", ch. xxiii.

⁵Cf. Al-Bīrūnī's *India*, Vol. I, p. 156.

⁶Cf. Al-Bīrūnī's *India*, Vol. I, p. 392; Vol. II, p. 54.

⁷See *Ketakī-graha-gaṇitam*, pp. 127–128.

tre, ascribed to the *Paṭṭīśvara-siddhānta* (probably *Vaṭeśvarasiddhānta*) and dealing with the astronomical phenomenon *Pāta*, is found quoted in Mallikārjuna's commentary (1178 AD) on the *Sūryasiddhānta* from some commentary on the *Laghumānasa*, but these verses are not exactly the same as their counterparts found in the manuscripts of the *Vaṭeśvarasiddhānta* known to us. It is probable that the verses quoted by Yallaya and Mallikārjuna belonged to the *Karaṇasāra* and have been ascribed to the *Vaṭeśvarasiddhānta* by inadvertence; or they might have occurred in the *Golādhyāya* of the *Vaṭeśvarasiddhānta*, which is not available to us completely. The celebrated Bhāskara II, author of the *Siddhāntaśiromaṇi*, has made a reference to certain scholars who believed that eight and a half years of Brahmā's life had then elapsed.⁸ He is probably referring to Lalla and Vaṭeśvara who held this view.⁹

The *Vaṭeśvarasiddhānta* seems to have been a popular work amongst the scholars of the *Dharmaśāstra*. References to this work have been found to occur in the *Kālanirṇaya*,¹⁰ in the *Kālasāra* of Gadādhara,¹¹ and in the works of Kamalākara Bhaṭṭa.¹²

2 Works of Vaṭeśvara: Existing manuscripts

No other work besides the *Karaṇasāra* and the *Vaṭeśvarasiddhānta* mentioned above has been ascribed to Vaṭeśvara. These are the only works coming from the pen of Vaṭeśvara now known to us. The *Karaṇasāra*, written in 899 AD, was his earlier work. The *Vaṭeśvarasiddhānta* was written five years later in 904 AD.

The *Karaṇasāra* is now lost and is known only through quotations in the writings of Al-Bīrūnī. The *Vaṭeśvarasiddhānta* has, however, come down to us, but we are aware of only two manuscripts of this work, both incomplete. Of these manuscripts, one belongs to the West Panjab University Library, Lahore (Pakistan). This manuscript begins as follows:

श्रीकृष्णाय नमः। ब्रह्मावनीन्दुबुधशुक्रदिवाकरारजीवार्कसूनुभगुरून् पितरौ च नत्वा।
ब्राह्मं ग्रहर्क्षगणितं महदत्तसूनुर्वक्ष्येऽखिलं स्फुटमतीव वटेश्वरोऽहम्॥

It breaks off in the course of the seventh *adhikāra* (chapter) and ends thus:

द्युचरास्फु समीरितं बुधैर्गणितस्कन्दविशेषभाजनैः दिनशेषविधूयासवस्सहितारात्रि-
गृतासवोप्यलम् रविवन्नरकर्णदीप्तयोर्मावन्दधमेणभुजादि च। प्राग्लग्रद्वचन्द्रमसौ वि-
लग्न

⁸*Siddhāntaśiromaṇi*, I, i (a). 26.

⁹According to both these writers $8\frac{1}{2}$ years and $\frac{1}{2}$ of a month of Brahmā's life had elapsed up to the beginning of the current *kalpa*.

¹⁰See P. V. Kane, "History of Dharmaśāstra", Vol. I, p. 376.

¹¹See P. V. Kane, *ibid.*, Vol. I, p. 617.

¹²See T. S. Kuppana Shastri, "The system of the *Vaṭeśvarasiddhānta*", *Indian Journal of History of Science*, Vol. 4, Nos. 1 & 2, p. 135.

The colophons at the ends of the chapters runs as follows:

1. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते मध्यगतिः प्रथमोधिकारः॥
2. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्फुटसिद्धान्ते स्वनामसंज्ञिते ... टगत्यधिकारो (द्वितीयः)॥
3. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविंदावतारिते त्रिप्रश्नाध्यायस्तृतीयः॥
4. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविंदावतारिते चंद्रग्रहणाधिकारश्चतुर्थः॥
5. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविंदावतारिते रविग्रहणाधिकारः पंचमः॥
6. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविंदावतारिते उदयास्तमयाधिकारः षष्ठः॥

Ram Swarup Sharma and Mukunda Mishra's edition of the *Vaṭeśvara-siddhānta* was based on this manuscript. A photostat copy of this manuscript was kindly procured for our use by the librarian of the Lucknow University Library.

The other manuscript of the *Vaṭeśvarasiddhānta* was discovered by me in the collection of the late Pandit Girish Chandra Awasthi of the Oriental Department, Lucknow University. It was later sold at my instance to the Lucknow University Library. This manuscript, though incomplete, is larger than the other one. It contains all the eight *adhikāras* of the *Kālakriyā* (or *Grahagaṇita*) Part. Besides that, there are four additional chapters written by Govinda, the copyist of the manuscript which are meant to serve as a supplement to the third *adhikāra* of the *Vaṭeśvarasiddhānta*. There are also a few opening chapters of the *Golādhyāya* which is incomplete in the manuscript available to me. It breaks off in the middle of the chapter entitled *Graha-gola-bandha*. This manuscript begins as follows:

॥ श्रीकृष्णाय नमः ॥ ब्रह्मावनीन्दुबुधशुक्रदिवाकरारजीवार्कसूनुभगुरून्पितरौ च नत्वा।
ब्राह्मं ग्रहर्क्षगणितं महदत्तसूनुर्वक्ष्येऽखिलं स्फुटमतीव वटेश्वरोहम्॥१॥

and ends thus:

प्रागपरकपालयोः कुफललम्भनं क्षयमतस्खमूभुदलपृष्टगनरयोर्दृक्साम्यालम्भनं न म-
ध्याह्ने उपपत्ति या प्रोक्ता प्रागपरे लम्भनेन तिथिविरहेलम्भने विरहेवनतेयाम्यो

The colophons at the ends of the chapters run as follows:

1. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते मध्यगतिः प्रथमोधिकारः॥
2. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्फुटसिद्धान्ते स्वनामसंज्ञिते ... टगत्यधिकारो (द्वितीयः)॥
3. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते त्रिप्रश्नाध्यायस्तृतीयः॥
4. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते चंद्रग्रहणाधिकारश्चतुर्थः॥
5. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते रविग्रहणाधिकारः पंचमः॥
6. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते उदयास्तमयाधिकारषष्ठः॥
7. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते शृङ्गोन्नत्यधिकारस्सप्तमः॥
8. श्रीमदानन्दपुरीयभट्टमहदत्तसुतवटेश्वरविरचिते स्वनामसंज्ञिते स्फुटसिद्धान्ते भट्टगोविन्दावतारिते समागमाधिकारोष्टमः॥॥ समाप्तं कालक्रियापट्टम्॥

The supplementary chapters of the copyist begin with the following opening remarks:

अनन्तरं त्रिप्रश्नाधिकारमध्ये दौरण्डीयभट्टवाह्निकसुतगोविन्दविरचिते स्थाननिर्देशशङ्का-
द्यानयनविधिः खसितमासीद्यः स लिख्यते।

The colophons at the ends of the chapters run as follows:

1. कालस्थाननिर्देशशंक्वाद्यानयनाध्यायः॥
2. कालनिर्देशशंक्वाद्यानयने सर्वकालशंक्वाद्यानयनाध्यायः॥
3. स्थाननिर्देशशंक्वाद्यानयने सर्वस्थानशंक्वाद्यानयनाध्यायः॥
4. स्थाननिर्देशशंक्वाद्यानयने कोणशंक्वाद्यानयनाध्यायः॥ श्रीदौरण्डीयभट्टवाह्निकसुतगोविन्दकृतो
वटेश्वरसिद्धान्ते त्रिप्रश्नाधिकारापरमध्येऽष्टमोऽध्यायः समाप्तः॥

The chapters of the *Golādhyāya* bear the titles: (i) *Gola-praśamsā*, (ii) *Gola-bandha*, (iii) *Chedyaka*, (iv) *Khagola-bandha*, (v) *Bhagola-bandha*, (vi) *Grahagola-bandha*, (vii) *Gola-vāsanā*, and (viii) *Bhūgolādhāya*. Of these chapters, those entitled *Gola-praśamsā*, *Gola-bandha*, *Chedyaka*, *Khagola-bandha*, *Bhagola-bandha*, and *Grahagola-bandha* are appended to the manuscript of the *Vateśvarasiddhānta* after the supplementary chapters of the copyist. The last chapter (*Grahagola-bandha*) is not complete and breaks off in the course of the

seventeenth verse. This chapter being incomplete, its name does not occur in the manuscript. We have called this chapter *Grahagola-bandha* because its subject matter agrees with that of the chapter of the same name in the *Śiṣyadhīvrddhida* of Lalla. The chapter entitled *Gola-vāsanā* and *Bhūgolādhāya* are found to occur in the midst of the third supplementary chapter of the copyist. The opening lines of the *Gola-vāsanā* are missing; only the concluding eleven verses are available; the chapter ends with the name of the chapter. In the case of the other chapter, the first 12 verses only are preserved. The name of the chapter is not given in the manuscript but the subject matter is similar to that of the *Bhūgolādhāya* of the *Śiṣyadhīvrddhida* of Lalla.

Both the manuscripts of the *Vaṭeśvarasiddhānta* available to us seem to be copies of the same manuscript and, as far as they go, agree very closely with each other.

3 *Vaṭeśvarasiddhānta*: An outline

The *Vaṭeśvarasiddhānta* is perhaps the largest work on Hindu astronomy. Whereas the *Āryabhaṭīya* contains 121 verses, the *Brāhmasphuṭasiddhānta* 1008 verses, the *Sūrya-siddhānta* 500 verses, the *Śiṣyadhīvrddhida* of Lalla 639 verses, the *Siddhāntaśekhara* of Śrīpati 890 verses, and the *Siddhāntaśīromani* of Bhāskara II 962 verses, the available manuscript of the *Vaṭeśvarasiddhānta* contains 1779 verses (approx). The first eight chapters of the *Vaṭeśvarasiddhānta* which deal with mathematical astronomy (*Kālakriyā* or *Grahagaṇita*) consist of 1308 verses.

The *Vaṭeśvarasiddhānta*, as available to us, may be divided into three parts:

1. *Kālakriyā* Part (dealing with mathematical astronomy).
2. Four additional chapters written by Govinda to supplement the *Tripraśnādhikāra* of the *Kālakriyā* Part.
3. *Golādhīyā*.

The *Kālakriyā* Part is divided into eight chapters (called *adhikāra*) and each of them is divided into sections. The headings of these chapters and sections and the number of verses comprising them are given in Table 1.

The four chapters appended to the *Kālakriyā* Part by the copyist run as follows:

Chapter No.	Chapter Name	No. of verses
1	कालस्थाननिर्देशशङ्काद्यानयनाध्यायः	111
2	कालनिर्देशशङ्काद्यानयने सर्वकालशङ्काद्यानयनाध्यायः	64
3	स्थाननिर्देशशङ्काद्यानयने सर्वस्थानशङ्काद्यानयनाध्यायः	75
4	स्थाननिर्देशशङ्काद्यानयने कोणशङ्काद्यानयनाध्यायः	125

Table 1: Contents of the *Kālakriyā* Part of the *Vaṭeśvarasiddhānta*.

Chapters	Verses	Sections	Verses
1. मध्यमाधिकारः	358 vss. + 8 half vss.	1. भगणनिर्देशः	21
		2. मानविवेकः	14
		3. द्युगण-विधिः	25 + 2
		4. सर्वतोभद्रः	62
		5. प्रत्यब्दशुद्धि-विधिः	116 + 5
		6. करण-विधिः	10
		7. कक्ष्याविधान-ग्रहानयनविधिः	24
		8. देशान्तरविधिः	18 + 1
		9. प्रश्नविधिः	21
		10. तन्त्रपरीक्षाध्यायः	47
2. स्फुटगत्याधिकारः	261 + 4	1. स्फुटीकरणविधिः	102 + 3
		2. स्वाच्चनीचग्रहस्फुटीकरणविधिः	29
		3. प्रतिमण्डलग्रहस्फुटीकरणविधिः	21
		4. ज्याविधिना स्फुटीकरणविधिः	15
		5. फलज्यास्फुटीकरणविधिः	37
		6. तिथ्यानयनविधिः	42
		7. प्रश्नविधिः	15 + 1
3. त्रिप्रश्नाधिकारः	387 + 15	1. विषुवच्छायासाधनविधिः	33 + 3
		2. लम्बज्याक्षज्यानयनविधिः	27
		3. क्रान्तिज्यानयनविधिः	13
		4. द्युज्यानयनविधिः	8
		5. कुज्यानयनविधिः	15
		6. अग्रानयनविधिः	14
		7. स्वचरार्धज्याप्राणसाधनविधिः	22 + 5
		8. लग्नादिविधिः	25 + 1
		9. द्युदलभादिविधिः	47 + 1
		10. इष्टच्छायाविधिः	39 + 1
		11. सममण्डलप्रवेशविधिः	25 + 2
		12. कोणशङ्कुविधिः	29 + 1
		13. छायातोऽर्कानयनविधिः	29
		14. छायापरिलेखविधिः	26
		15. प्रश्नाध्यायः	35 + 1
4. चन्द्रग्रहणाधिकारः	40 + 1		
5. रविग्रहणाधिकारः	117 + 8	1. लम्बनविधिः	32 + 1
		2. अवनतिविधिः	6 + 1
		3. स्थित्यर्धविधिः	9 + 1
		4. परिलेखविधिः	28 + 3
		5. पर्वज्ञानविधिः	14
		6. लघूकरणविधिः	21 + 2
		7. छेद्यकविधिः	7
6. उदयास्तमयाधिकारः	29 + 2		
7. शृङ्गोन्नत्याधिकारः	53 + 1		
8. समागमाधिकारः	43 + 1	1. ग्रहयुतिविधिः प्रथमः	14
		2. ग्रहयुतिविधिः द्वितीयः	29 + 1

The *Golādhyāya* of the *Vaṭeśvarasiddhānta* is incomplete. Our manuscript contains the following chapters only:

Chapter No.	Chapter Name	No. of verses
1	गोलप्रशंसा	9
2	गोलबन्धः	18 + 1
3	छेद्यकः	18 + 1
4	खगोलबन्धः	4
5	भगोलबन्धः	6
6	ग्रहगोलबन्धः	17
7	गोलवासना	11
8	भूगोलाध्यायः	12

4 Sharma and Mishra's edition of *Vaṭeśvarasiddhānta*

Ram Swarup Sharma and Mukunda Mishra brought out Part I of the *Vaṭeśvara-siddhānta* containing the first three *adhikāras*. Their edition was based on the manuscript belonging to West Panjab University Library, Lahore. The following comparison will reveal that Sharma and Mishra's edition does not give the full text of the first three *adhikāras* of the *Vaṭeśvarasiddhānta*. A large number of verses which actually occur in the manuscript have been silently omitted by them. Some of the verses have received drastic emendation at their hands.

Chapter	No. of verses in the manuscript	No. of verses in Sharma-Mishra's edition
1	358 + 8	290
2	261 + 4	184
3	387 + 15	222
Total	1006 + 27	696

This shows that Sharma and Mishra's edition does not give the whole text but about two-third of it.

5 *Vaṭeśvara's* date and place

In the closing verse of Section 1, Chapter 1, of the *Vaṭeśvarasiddhānta*, *Vaṭeśvara* himself gives the time of his birth as well as the time of composition of the *Vaṭeśvarasiddhānta*. Writes he:

When 802 years had elapsed since the commencement of the Śaka era, my birth took place; and when 24 years had passed since my birth this *Siddhānta* was written by me with the grace of the heavenly bodies.

This shows that Vaṭeśvara was born in 880 AD and *Vaṭeśvarasiddhānta* was written in 904 AD. His work, *Karaṇasāra*, was written, as reported by Al-Bīrūnī, five years earlier in 899 AD.

In the opening verse of the *Vaṭeśvarasiddhānta*, Vaṭeśvara has called himself “a son of Mahadatta”. The colophons at the ends of the various chapters of the *Vaṭeśvarasiddhānta* go a step further and declare him as being “the son of Bhaṭṭa Mahadatta resident of Ānandapura.” This shows that Vaṭeśvara was the son of Bhaṭṭa Mahadatta and belonged to the place called Ānandapura.

Ānandapura has been identified by Cunningham and Dey with the town of Vadnagar in northern Gujarat situated to the south-east of Sidhpur (lat. 23.45 N, long. 72.39 E).¹³ “Ānandapura or Vaḍnagar,” writes Dey, “is also called Nāgara which is the original home of the Nāgara Brāhmaṇas of Gujarat. Kumārapāla surrounded it with a rampart. Bhadrabāhu Svāmī, the author of the *Kalpasūtra*, composed in 411 AD, flourished at the court of Dhruvasena II, King of Gujarat, whose capital was at this place.”¹⁴ That Vaṭeśvara's Ānandapura was the same place as Vadnagar or Nāgara is confirmed by the testimony of Al-Bīrūnī who has written that Vaṭeśvara belonged to the city of Nāgarapura. Nāgara and Nāgarapura are obviously one and the same.

Ānandapura seems to have been a great seat of Sanskrit learning. Āmarāja (c. 1200 AD), a commentator of the *Khaṇḍakhādyaka* of Brahmagupta, and Mādava (1263 AD), a commentator of the *Ratnamālā* of Śrīpati, also belonged to this place. According to both these writers the equinoctial midday shadow at this place was 5 *aṅgulas* and 20 *vyāṅgulas* and the hypotenuse of the equinoctial midday shadow, 13 *aṅgulas* and 8 *vyāṅgulas*,¹⁵ which shows that the latitude of Ānandapura was 24° north approximately. The latitude of Vadnagar is also approximately the same.

In the closing verse of Section 9, Chapter 3, Vaṭeśvara has mentioned Daśapura which seems to suggest that he had some association with that place. This Daśapura was probably the same place as has been identified with Mandasor (lat. 24.03° N, long. 75.08° E), which is situated in Madhya Pradesh and is not far from Vadnagar. What kind of association Vaṭeśvara actually had with this place is difficult to say.

¹³ Cf. Sir Alexander Cunningham, “The Ancient Geography of India,” p. 416; Nundo Lal Dey, “The Geographical Dictionary of Ancient and Medieval India,” p. 6.

¹⁴ Cf. Nundo Lal Dey, *ibid.*

¹⁵ See Āmarāja's commentary on *Khaṇḍakhādyaka*, iii. 1, p. 87, and *Bhāratīya Jyotiṣa Śāstra* (Marathi) by S. B. Dikshit, Second Edition, p. 471.

6 Govinda, copyist of the manuscript

We conclude this paper with a note on Govinda, the copyist of the second manuscript of the *Vaṭeśvarasiddhānta*.¹⁶ As already pointed out, he has added four chapters by way of supplementing the third chapter, entitled the *Tripraśnādhikāra*, of the *Vaṭeśvarasiddhānta*. This shows that Govinda was a good astronomer who had the capability of saying something which did not occur even to such a great astronomer as *Vaṭeśvara*. The contents of the chapters written by him definitely add to the value of the *Vaṭeśvarasiddhānta*. A number of rules given by him are quite new and do not occur in any other work on Hindu astronomy.

We know of more than one Hindu astronomer who bore the name Govinda but our Govinda is quite different from them. From the colophons occurring at the end of his four chapters it appears that he was the son of *Bhaṭṭa Vāhnikā* or *Vahnika* who lived at the place called *Dauraṇḍa*.

¹⁶There are reasons to believe that the manuscript available to us was not actually written by Govinda. It seems to have been transcribed from the copy originally made by Govinda or from another copy thereof.