HISTORICAL NOTES

THE DATE OF ĀRYABHAṬA — REFUTATION OF V. LAKSHMIKANTHAM'S UNTENABLE VIEW

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1.1. In his article "Was India Mathematically Illiterate until the Fifth Century AD?" (*Gaṇita Bhāratī,* 2008, vol. 30, pp. 85-90), V. Lakshmikantham (henceforth VL), Professor of Mathematics at the Florida Institute of Technology, attempts to radically revise Indian chronology, in particular, the chronology of Indian mathematics. Newspaper columns and internet blogs today are full of jingoistic attempts to "prove" that Indian civilization is much older than any other civilization by several centuries and that everything culturally valuable, especially the sciences and technology, emanated from India. Normally it is best to ignore such writings because it is impossible to argue with jingoists who believe that they alone are patriotic and objective and that all others with contrary views are motivated by monetary or other material considerations. But when such an exercise is published in the *Gaṇita Bhāratī,* the official bulletin of the Indian Society of the History of Mathematics, a journal that has consistently contributed towards an objective and rational study of the history of Indian mathematics, it is necessary to take issue with the assertion. Otherwise, there is the danger that historians of mathematics who are not well versed in Sanskrit may take VL's ill-founded claim about the date of Āryabhaṭa at its face value.

1.2. In his *Āryabhaṭīya* (Kālakriyāpāda, verse 10)*,* Āryabhaṭa mentions the time when he composed the work. At that time, says he, three quarters (namely Kṛta, Tretā, and Dvāpara) of the current Yuga have elapsed, and that in the fourth quarter, namely Kali, a certain number of years have elapsed. That the present Kaliyuga commenced in 3102 BC is generally accepted, even by VL. The question is about the number of years that have elapsed between the beginning

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of the Kaliyuga in 3102 BC and the time of the composition of the *Āryabhaṭīya*; whether it is 3600 (60 x 60) as is generally accepted or whether it is 360 (60 x 6) as VL would like us to believe.

1.3. VL's argument for an earlier date is presented in the following, rather convoluted, sentences. I cite from p. 87 of his article:

> In his book *Aryabhatteeyam,* Aryabhatta clearly provides his birth data. In the 10th stanza, he says that when 60 x 6 = 360 years elapsed in this Kali Yuga or Kali Era, he was 23 years old. The stanza of the sloka starts with 's*hastyabdanam Shadbhiryada Vyateetastra Yascha Yuga Padah.*" 'shastyabdanam Shadbhi'' means 60 x 6 = 360. This yields that Aryabhatta was 23 years of age in 3102 – 360 = 2742 BC and therefore, he was born 2742 +23 = 2765 BC (Lakshmikantham, 1990; Lakshmikantham, 2005; Lakshmikantham, 2006). Unfortunately, oriental scholars could not pronounce that Aryabhatta was a mythological figure since his book *Aryabhatteeyam* was available. Consequently, one way or other, they decided to push Āryabhaṭa into the Christian era. Therefore, while printing *Aryabhatteeyam*, the word '*shadbhi*'' is altered to '*shasti*'', to help the dilemma by Sudhakar Dvivedi, which yields 60 x 60 = 3600. Thus Aryabhatta's birth time was fixed as 3600-3102 = 498 – 23 = 475 AD. We should remember that all the useful important manuscripts were taken to Germany and London libraries and the rest were burnt in a continuous fashion for many years.

> T. N. Narayana Sastri, in his book "*Age of Sankara*" part I, 1917, edited, on page 161, offered the following challenge – "We challenge Sudhakar Dvivedi or any of his advocates to bring to our notice any genuine manuscript which has '*shasti*'' in place of '*shadbhi*,'' that we find in a number of old manuscript copies of *Ayabhatteeyam* in southern India" (Lakshmikantham 1990; Lakshmikantham, 2005; Lakshmikantham, 2006; Narayanasastri, 1917; Venkatachalam, 1950).[1]

1.4. In my critique of VL's view, I shall use the standard Roman transcription of Sanskrit words with proper diacritical signs and not the arbitrary Romanization of VL. His contention is that the original reading of *Āryabhaṭīya,* Kālakriyāpāda 10, is

> *ṣaṣṭyabdānāṃ ṣaḍbhir yadā vyatītāś trayaś ca yugapādāḥ |*
>
> *tryadhikā viṃśatir abdās tadeha mama janmano yātāḥ ||*

and that this means that Āryabhaṭa was 23 years old when 360 years have elapsed in the Kaliyuga. Since the Kaliyuga commenced in 3102 BC, the

Āryabhaṭīya was written in 3102 – 360 = 2742 BC. Āryabhaṭa was 23 years old at that time. Therefore he was born in 2765 BC. Oriental Scholars, that is, Europeans, could not tolerate the notion that there existed in India a great mathematician as early as 2765 BC. So they asked a pliant Sudhakara Dvivedi to change one single syllable ***ḍbhi*** to **ṣṭi** in Āryabhaṭa's verse. Thus by altering one single syllable with the connivance of an un-patriotic Indian pandit, the wily Europeans changed 2765 BC to 475 AD and deprived India of 3240 years of scientific glory.

However, unfortunately for VL, there are two strong reasons to reject his contention. First, what he regards as the original syllable does not fit into the syntax of the Sanskrit verse. Second, his proposed reading is not supported by the commentaries on the *Āryabhaṭīya.*

2.1. VL asserts that the original word is *ṣaḍbhi* and this was replaced by *ṣaṣṭi* to suit the villainous scheme of Westerners. It should be noted that the correct forms of the two words are *ṣaḍbhiḥ* and *ṣaṣṭiḥ* because there should be a *visarga* at the end of both words (*ṣaḍbhiḥ, ṣāṣṭiḥ*) and this *visarga* can change to *r, s, ś* etc. in accordance with the letter that follows. However, *ṣaṣṭyabdānāṃ ṣaḍbhir,* which VL asserts are the original words, will not yield the meaning he wishes to extract from them. The two words *ṣaṣṭyabdānāṃ* (genitive plural) *ṣaḍbhir* (instrumental plural) merely mean "of 60 years by six". This is as meaningless as the literal translation in Hindi (*sāṭh varṣon kā chah se*) or in Telugu (*aruvadi-saṃvatsaramula-yokka āru-ceta*), which appears to be the mother tongue of VL, would be. In order to be syntactically complete and to yield the meaning "sixty years multiplied by six", the first word must be in the nominative plural (*ṣaṣṭyabdāḥ*) and not in the genitive plural (*ṣaṣṭyabdānānāṃ*). Even *ṣaṣṭyabdāḥ ṣaḍbhiḥ* ("sixty years by six") will not be sufficient; there should be a word to specify the mathematical operation that needs to be performed "by six" (*ṣaḍbhiḥ*). The intended meaning "sixty years multiplied by six" can be obtained only by *ṣaṣṭyabdāḥ ṣaḍbhir guṇitāḥ* ("sixty years by six multiplied"). But then these three words will not fit into the Āryā metre in which the *Āryabhaṭīya* is composed. In sum, the reading proposed by VL as the original wording of Āryabhaṭa violates Sanskrit grammar and syntax, and does not yield the meaning VL wishes to derive from it. Had Āryabhaṭa really written in the manner suggested by VL, he would indeed have been illiterate in Sanskrit.

2.2. On the other hand, in the currently accepted version of the verse (*ṣaṣṭyabdānāṃ ṣaṣṭir yadā vyatītāś trayaś ca yugapādāḥ*), the word *ṣaṣṭiḥ* fits in grammatically and syntactically. Moreover, the expression *ṣaṣṭyabdānāṃ ṣaṣṭiḥ* is idiomatically and grammatically correct Sanskrit, meaning a sixty-group of sixty years, or "sixty times sixty years".

3.0. A legitimate method of testing the correctness of the reading of any text is to see how the commentators reproduced the wording at various periods. Luckily four commentaries on the *Āryabhaṭīya,* produced at different periods and in different regions of India, are now available in print. These were composed respectively by Bhāskara I at Valabhī in Gujarat in 629 AD, by Sūryadeva Yajvan (b. 1192) at Gaṅgaikoṇḍa-Colapuram in Tamilnadu in the first half of the thirteenth century, by Parameśvara at Ālattūr in Kerala after 1431 and by Nīlakaṇṭha Somayājin at Tṛkaṇṭiyur in Kerala after 1502. These commentaries are edited and published by scholars of impeccable credentials. All the four commentaries read *ṣaṣṭyabdānāṃ ṣaṣṭiḥ* as shown below and not the wording proposed by VL.

3.1. Bhāskara I: ***ṣaṣṭyabdānāṃ ṣaṣṭiḥ*** / *ṣaṣṭiḥ abdāḥ ṣaṣṭiguṇā ity arthaḥ* /[…] *anyac ca "**ṣaṣṭyabdānāṃ ṣaṣṭir**" ity asyābhidhāne prayojanam abhidhāsyate* |[2]

3.2. Sūryadeva: *iha vartamāne 'ṣṭāviṃśe yuge yugacaturthabhā-gatrayaṃ* ***ṣaṣṭyabdānāṃ ṣaṣṭiś*** *ca yadā gatāḥ, tadā mama janmanaḥ prabhṛti tryadhikāḥ viṃśatir abdāḥ gatāḥ vartamānayugacaturthapādasya kalyākhyasya* ***ṣaṭchatādhikasahasratraya****sammiteṣu sūryābdeṣu gateṣu trayoviṃśativarṣeṇa mayā śāstraṃ praṇītam ity arthaḥ* |[3]

Note that Sūryadeva not only reproduces *ṣaṣṭyabdānāṃ ṣaṣṭiś* but adds that it amounts 3600 solar years (*ṣaṭchatādhika-sahasratraya*).

3.3. Parameśvara: *iha vartamāne 'ṣṭāviṃśe caturyuge caturbhā-gatrayaṃ* ***ṣaṣṭyabdānāṃ ṣaṣṭiś*** *ca yadā gatā bhavanti* |[4]

3.4. Nīlakaṇṭha[5] writes a long commentary on the verse (pp. 12-18); here "sixty times sixty years" is mentioned as many as five times**.**

i. *vaivasvatamanor aṣṭāviṃśayugasya caturthe pāde 'pi* ***ṣaṣṭyabdā nāṃ ṣaṣṭir*** *yadā gatā tad e(va?ha) mama janmanas tryadhikā viṃśatir adbā atītā ity arthaḥ* / (p. 12).

ii. *"yugapādā ga ce"ti gītikāpādoktasyehāpy uktiḥ **ṣaṣṭyabdānāṃ ṣaṣṭes** tadūrdhvabhavakālatva-pradarśanāya* /(p. 12).

iii. *itarathā kuto 'vadheḥ **ṣaṣṭyabdānāṃ ṣaṣṭir** gatety ākāṅkṣā syād iti tadavadhipradarśanāyaivedānīm api tat smāritam* | (p. 12).

iv. *etad uktaṃ bhavati — mayedānīm etasmin granthe kriyamāṇe kaler ārabhya **ṣaṣṭyabdānāṃ ṣaṣṭir** gatā, trayoviṃśati-vayaskena mayā granthaḥ kriyate ca* | (p. 13).

v. ***ṣaṣṭyabda-ṣaṣṭi**-mitaṃ ca divyābdadaśakaṃ, ṣaṣṭyabdānāṃ prabhavādīnāṃ mānuṣatvāt* | *tasmād divyābda-ṣaḍaṃśānāṃ ṣaṣṭyabdānāṃ daśakena eko rāśiś ca labhyaḥ* | (p. 13).

Thus, according to these commentators, the correct reading is *ṣaṣṭyabdānāṃ ṣaṣṭiḥ* and not what VL proposes.

4.0. Just as mathematics requires rigorous proof, history of mathematics too requires rigorous and impeccable proof—not just heresies and prejudices. Where is the proof that Sudhakara Dvivedi tampered with the text? Where is the proof that Sanskrit manuscripts "were burnt in a continuous fashion for many years"? Where is the proof that "*ṣaḍbhiḥ*" occurs in "a number of old manuscript copies of *Ayabhatteeyam* in southern India"?

4.1. It is outrageous that LV, with his insufficient grasp of Sanskrit language, spreads the canard that Sudhakara Dvivedi altered the text of the *Āryabhaṭīya* at the behest of his English masters. It is a grave insult to the great contributions made by Sudhakara Dvivedi,[6] and an equally grave insult to the historiography of Indian mathematics. In fact, Sudhakara Dvivedi had nothing to do with the publication of the *Āryabhaṭīya*. The text was published for the first time in 1874 by the Dutch scholar H. Kern,[7] but it was known to the European scholars some decades earlier.

4.2. It is true that many important Indian manuscripts were taken away to England, France and Germany, but it is also equally true that the colonial government systematically collected large numbers of manuscripts in the three presidencies of Bengal, Bombay and Madras and deposited these respectively in the Asiatic Society of Calcutta, Bhandarkar Oriental Research Institute, Poona, and Government Oriental Manuscripts Library, Madras. Since then the manuscripts in foreign libraries as well as in the three Indian collections have been well catalogued

and are accessible to scholars. The colonial government was no doubt guilty of many crimes but not of destroying India's manuscript wealth. In fact, almost all modern research is based on the artifacts and manuscripts collected and preserved by the colonial government. VL's contention that in India manuscripts "were burnt in a continuous fashion for many years" by Englishmen has no basis. If he knows of such cases, he should mention them with full evidence.

4.3. VL contends that a certain T. N. Narayana Sastri challenged Sudhakara Dvivedi to bring to his "notice any genuine manuscript which has '*shasti*' in place of '*shadbhi*,'" that we find in a number of old manuscript copies of *Ayabhatteeyam* in southern India." The unstated implication is that Sudhakara Dvivedi did not take up the challenge as he was guilty of tampering with the text. But the fact is that Sudhakara Dvivedi passed away in 1910 and the challenge was made by T. N. Narayana Sastri in his book which appeared in 1917, i.e. seven years after Sudhakara Dvivedi's death!

5.0. Since VL repeatedly endorses Narayana Sastri's challenge in his own publications, it is incumbent upon him that he himself publishes facsimile reproductions of the relevant folios of genuine manuscripts of the *Āryabhaṭīya* which contain "*ṣaḍbhiḥ*", if there are any such, instead of propagating ill-founded claims in intemperate language. Will VL take up the challenge?

END-NOTES

1. The Bibliography at the end of the article does not explain what "Lakshmikantham 1900" stands for. The other two works of VL cited there are as follows: Lakshmikantham 2005 = V. Lakshmikantham, S. Leela & J. V. Devi, *Origin and History of Mathematics,* Cambridge Scientific Publishers, Cambridge 2005; Lakshmikantham 2006= V. Lakshmikantham, S. Leela & J. V. Devi, *What India Should Know,* Bharateeya Vidya Bhavan, Bombay 2006.

2. *Āryabhaṭīya of* Āryabhaṭa *with the Commentary of Bhāskara I and Someśvara,* critically edited with introduction and appendices by Kripa Shankar Shukla, Indian National Science Academy, New Delhi, 1976, p. 202.

3. *Āryabhaṭīya of* Āryabhaṭa *with the Commentary of Sūryadeva Yajvan,* critically edited with introduction and appendices by K. V. Sarma, Indian National Science Academy, New Delhi, 1976, pp. 92-93. Grateful thanks are due to Professor Michio Yano for suggesting the inclusion of Suryadeva Yajvan's commentary and for providing the relevant pages to me.

4. *The Āryabhaṭīya, with the Commentary Bhaṭadīpikā of Paramādīṣvara,* edited by Dr. H. Kern, Leiden, E. J. Brill, 1874, pp. 58-59. This edition is accessible online at http://www.wilbourhall.org .

5. *Āryabhaṭīya of* Āryabhaṭa, with the Commentary of Gārgyakerala-Nīlakaṇṭha-Somasut, vol. 2: Kālakriyāpāda, ed. K. Sambasiva Sastri, Trivandrum Sanskrit Series 110, Trivandrum 1931, pp. 12-18.

6. On his contributions to the history of Indian mathematics and astronomy, see Radha Charan Gupta, "Sudhākara Dvivedī (1855-1910), Historian of Indian Astronomy and Mathematics," *Gaṇita Bhāratī* 12 (1990) 83-96.

7. See n. 4 above.