



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

ART. XIV.—*Brief Notes on the Age and Authenticity of the Works of Āryabhaṭa, Varāhamihira, Brahmagupta, Bhaṭṭotpala, and Bhāskarāchārya.* By Dr. BHĀU DĀJĪ, Honorary Member R.A.S.

[Communicated by F. HALL, Esq., July 4, 1864].

### I. ĀRYABHAṬA.

THE name of this celebrated astronomer is written either Āryabhaṭa or Āryabhaṭṭa, but generally with one ṭ only. In an old manuscript of the Brahma Sphuṭa Siddhānta of Brahmagupta, copied in Samvat 1678, or A.D. 1621, the name occurs about thirty-three times,<sup>1</sup> and is invariably written Āryabhaṭa; and a double ṭ cannot be introduced without violating the Āryā metre. Bhaṭṭa Utpala, in his commentary on the Vārāha Sanhitā, cites a passage from Varāha Mihira as follows:—

लङ्कार्धरात्रसमये दिनप्रवृत्तिं जगद् चार्यभटः ।

Here the word has only one ṭ, and would not scan with two. This scholiast almost always writes, when quoting Āryabhaṭa, तथा चार्यभटः. In a commentary by Someṣvara on the Āryabhaṭīya Sūtra, of which the manuscript in my possession was copied about three hundred years ago, the name is spelt with only one ṭ:

आचार्यार्यभटोक्तसूत्रविवृतिः ।

In a copy of the Mahā Āryasiddhānta, dated Śaka 1676, A.D. 1598, is the following line:—

इत्यार्यभटप्रोक्तान्तिज्ञान्ताद्यन्महाकालात् ।

Bhaṭṭa Utpala and Someṣvara sometimes call him Āchāryabhaṭa or Āchārya Āryabhaṭa; Brahmagupta, in his Siddhānta, chap. x. 62, Āryāḥ, and in chap. xxi. 40, Āchāryabhaṭa. In his Khaṇḍa Khāḍya Karaṇa, copied Samvat 1783, he is called

<sup>1</sup> Colebrooke states that Brahmagupta cites Āryabhaṭa "in more than a hundred places by name." Misc. Ess. vol. ii. p. 475. He evidently includes citations or allusions by the learned commentator Chaturveda Pṛthūdaka Svāmin, whose commentary I regret I do not possess.

Âchârya Âryabhata or Âryabhata. In a commentary on it by Âmarâja, he is simply called Âchâryabhata. Hence it appears to me clear that the proper spelling of this name is Âryabhata.

The works attributed to Âryabhata, and brought to light by European scholars, are :—

An Âryasiddhanta (Mahâ Ârya Siddhanta), written, according to Bentley, in the year 4423 of the Kali Yuga, or A.D. 1322.<sup>1</sup>

Another Âryasiddhanta, called Laghu, a smaller work, which Bentley supposed was spurious,<sup>2</sup> and the date of which, as stated in the text, was interpreted to mean the year of the Kali Yuga 3623, or A.D. 522. Of both these works Mr. Bentley possessed imperfect copies. He assumed a comparatively modern work, attributed to Âryabhata, and written in A.D. 1322, as the genuine Âryasiddhanta, and, reasoning on this false premiss, has denounced as spurious the real and older work, and has, further, been led into the double error of condemning the genuine works of Varâha Mihira, Brahmagupta, Bhatâta Utpala, and Bhâskarâchârya, containing quotations and references to the older work, as modern impostures, and of admitting as genuine a modern treatise (the Jâtakâr-*ṇava*) as the work of Varâha Mihira.

Colebrooke, not having the works of Âryabhata before him, suggested that the older work might be a fabrication, but, from citations and references to Âryabhata in the works of Brahmagupta and Bhatâta Utpala, came to a singularly accurate conclusion as to the age of Âryabhata, whose works he thought were different from either treatise in the possession of Bentley. "We shall, however," writes Colebrooke, "take the fifth [century] of Christ as the latest period to which Âryabhata can, on the most moderate assumption, be referred."<sup>3</sup> In one place, indeed, Colebrooke correctly guesses that the Laghu Ârya Siddhanta is either the Âryâshṭaṣata or the Daṣagitikâ.<sup>4</sup>

<sup>1</sup> A Historical View of the Hindu Astronomy. London, 1825, p. 128

<sup>2</sup> Ibidem, pp. 168, 169.

<sup>3</sup> Colebrooke's Misc. Ess. vol. ii. p. 477.

<sup>4</sup> Ibid. p. 467.

The following passage in the Mahā Āryasiddhānta explains itself:—

इत्यार्थभट्टप्रोक्तात्सिद्धान्ताद्यन्महाकालात् ।  
पाठैर्गतमुच्छेदं विशेषितं तन्मया स्वीकृत्या ॥

“That (knowledge) from the Siddhānta, propounded by Āryabhāṭa, which was destroyed, in recensions, by long time, I have, in my own language, thus specified.”

In another copy, the verse commences differently, having *Vṛddha* for *iti*; i.e. the first Āryabhāṭa is called *Vṛddha* or old, whilst himself is the modern Āryabhāṭa.

Strange to say, the date corresponding to A.D. 1322, mentioned by Bentley, is not to be found in my copies. But I believe he was here, for once, correct.

In the first volume of the Transactions of the Madras Literary Society, a paper was published by Mr. Whish, evidently founded on the works of Āryabhāṭa senior. But, although Mr. Whish's paper is not available to me, I am positive he did not recognize his Āryabhāṭīya Sūtra as the work of Āryabhāṭa senior.

Professor Lassen has some admirable remarks on Āryabhāṭa.<sup>1</sup> He observes: “Of Āryabhāṭa's writings we have the following. He has written a short outline of his system, in ten strophes, which composition he therefore called *Daṣāgitaka*; it is still extant.<sup>2</sup> A more extensive work is the *Āryāshṭaṣata*, which, as the title informs us, contains eight hundred distichs, but has not yet been rediscovered. The mean between these works is held by the *Āryabhāṭīya*, which consists of four chapters, in which the author treats of mathematics in one hundred and twenty-three strophes.<sup>3</sup> In it he teaches the method of designating numbers by means of letters, which I shall mention again by and by. Besides, he has left a com-

<sup>1</sup> Indische Alterthumskunde, vol. ii., p. 1136.

<sup>2</sup> See Colebrooke's Misc. Ess. ii. p. 467. To the friendly offices of Mr. Gundert, a German missionary in India, I am indebted for a copy of this work, from a MS. in the possession of the Rājā of Kerkal, in Malabar. It is here called *Daṣāgitaka Sūtra*. I have also received from him a copy of the *Āryabhāṭīya*.

<sup>3</sup> C. M. Whish names this work in the first dissertation mentioned in note 1, p. 1134, as well as in the second: *On the Quadrature of the Circle*, etc., in Trans. of the Roy. As. Soc. iii. p. 509. Also *Masūdi* and *Albirūni* record it; see Reinaud's *Mémoire*, etc., pp. 321 and 322.

mentary on the Sûrya Siddhânta, which has been elucidated by a much later astronomer, and is, probably, the work called *Tantra* by Albîrûnî.<sup>1</sup> This may be the same which was communicated to the Arabs, with two other Siddhântas, during the reign of the Khalif *Almansûr*, (which lasted from A.D. 754 till 775), by an Indian astronomer who had come to his court, but of which only the book properly so called, *i.e.* that of *Brahmagupta*, had been translated into Arabic, by order of that Khalif, by *Muhammed bin Ibrâhîm Alfazâri*, and had received the title of the great *Sind-hind*. (See Colebrooke's Misc. Ess. ii. p. 504 seqq.) From this juxtaposition it appears that sufficient materials are at hand for investigating the doctrines of this founder of mathematical and astronomical science in India. Therefore it would be very desirable if a mathematician and astronomer, provided with a competent knowledge of Sanskrit, were to undertake to fill up this great gap in the knowledge which we have hitherto possessed of the history of both these sciences."

To my learned friend Dr. Fitzedward Hall we are indebted for the first and accurate statement that, "as reference is made, in the Ârya Siddhânta, to Vṛddha Âryabhaṭṭa, there should seem to have been two writers called Âryabhaṭṭa." This correct reference Dr. Hall was enabled to make from having possessed himself of "two copies of the Ârya Siddhânta, both imperfect, and very incorrect." "This treatise is in eighteen chapters; and I more than suspect it to be the same composition which Mr. Bentley also had seen in a mutilated form,"<sup>2</sup> [*i.e.* the Mahâ Ârya Siddhânta].

<sup>1</sup> See Wilson's Mackenzie Coll. i. p. 119, No. v. The title is Sûrya Siddhânta-prakâsa, and it contains the Sûtras of the Sûrya Siddhânta, with Âryabhaṭṭa's commentary, and explanations of it by a later author of the sixteenth century. The work contains three chapters with the superscriptions: *Ganita*, *i.e.* Arithmetic, Algebra, and Geometry, *Kûlakryâ*, by which very likely the doctrine of the calculation of the great periods must be understood; the title *Gola* of the third chapter designates the Globe, but is intended to denote Astronomy. *Albîrûnî* mentions a *Tantra of Aryabhaṭṭa*; see Reinaud's *Mémoire*, p. 335. In the commentary of *Paramâdisvara* on *Aryabhaṭṭa's* explanation of the *Sûrya Siddhânta* (called Sûrya-Siddhânta-vyâkhyâna, and surnamed by the special title *Bhaṭṭiyadîpikâ*, the title of which Mr. Gunder has communicated to me, and which work is likely to be the same with the one adduced in the *Mackenzie Collection*, vol. ii. p. 121, named *Âryabhaṭṭa-vyâkhyâna*), the work of Âryabhaṭṭa is called *Tantra-Bhaṭṭiya*.

<sup>2</sup> On the Ârya-Siddhânta. By Fitzedward Hall, Esq., M.A. *Journal of the American Oriental Society*, vol. vi. p. 659.

In an "Additional Note on Âryabhaṭṭa and his Writings," by the Committee of Publication, appended to Dr. Hall's paper, the learned writer under the initials W. D. W. brings to light the contents of Bhûta Vishṇu's "Commentary on the Daṣagitikâ of Âryabhaṭṭa," from a manuscript of the Berlin Library, a copy of which was supplied to him by Prof. Weber.

From the nature of the contents given in Appendix A, it is clear to me that the treatise which is described as "a brief one, containing only about one hundred and fifty stanzas," consists not only of the Daṣagîti Sûtra, with a commentary by Bhûta Vishṇu, but also of the Âryâshtaṣata of Âryabhaṭa, which was hitherto believed to be unrecovered. The learned writer correctly remarks that the treatise is undoubtedly the same as Bentley's Laghu Ârya Siddhânta, and also that "the other Ârya Siddhânta, judging it from the account given of it by Bentley, appears to be, in comparison with this, a quite ordinary astronomical treatise, representing the general Hindu system with unimportant modifications." Yet he falls very nearly into the same error as Colebrooke, when he proceeds to remark: "Yet it seems clear that Brahmagupta and others have treated them as works of the same author, and have founded upon their discordances a charge of inconsistency against Âryabhaṭṭa."<sup>1</sup> The fact is, as we shall see, that Brahmagupta, Bhaṭṭa Utpala, and Bhâskara Âchârya know and cite only the elder Âryabhaṭa.

The next and last paper is on some fragments of Âryabhaṭṭa, by Dr. H. Kern in the Jour. Roy. As. Soc. vol. xx. pp. 371 seqq. After briefly noticing the works known to former writers as the works of Âryabhaṭa, and after alluding to the conclusion Dr. Hall arrived at, that there were two authors of the same name, he adds: "If the same course were adopted in regard to all the works ascribed to Âryabhaṭṭa, or to an Âryabhaṭṭa, if the contents were compared with the numerous fragments scattered in different works, chiefly commentaries, one might indulge the hope that the question of the authorship of Âryabhaṭṭa would be settled in a satisfactory manner."

<sup>1</sup> Journal of the American Oriental Society, vol. vi. pp. 561 and 564.

Dr. Kern proceeds "to contribute a small share towards solving the question," by giving extracts from the commentary of Bhaṭṭa Utpala on the Vârâhî Sanhitâ of Varâha Mihira. In an additional note, at the conclusion of the paper, the learned author states that he was enabled, "by the kindness of Prof. Weber, to ascertain that all the quotations of Utpala, with the exception of one half-stanza, occur in a manuscript of the Berlin Library." Some of the passages puzzle him, especially the date A.D. 475, about which he observes: "Unfortunately, it is not clear whether the date of Âryabhaṭṭa is meant, or that of Bhûtavishṇu."<sup>1</sup>

Adopting Dr. Kern's suggestion, I proceed to state briefly the result of an examination of the various works attributed to Âryabhaṭa. In a diligent and expensive search for old and rare Sanskrit, Prakrit, Arabic, and Persian manuscripts, noiselessly conducted for many years past, I have succeeded in procuring the following works whose authorship is attributed to Âryabhaṭa.

A. Three copies of what has been called the Vṛddha or Laghu Ârya Siddhânta, but, correctly speaking, Âryabhaṭiya Sûtra, consisting of the Daṣagiti Sûtra, or Daṣagîtikâ, and the Âryâshṭaṣata, or one hundred and eight couplets. These copies contain the following number of Âryâs:—

	Daṣagiti Sûtra.	Âryâshṭaṣata.
Copy <i>a</i> .....	13	108
" <i>b</i> .....	13	108
" <i>c</i> .....	13	108

There are two introductory stanzas at the commencement of copy *a*, evidently an after-addition, and not in the Âryâ metre. This is a copy of a manuscript written in Śaka 1760, or A.D. 1838.

Copy *b*. The date of the original manuscript is omitted.

Copy *c* is an old manuscript, without date; but, from the character of the letters, and from the worn-out paper, it appears to be more than three hundred years old. It has, in addition, a Bhâshya, or commentary, by Someṣvara, containing

about 64,000 letters. Unfortunately, portions are illegible or destroyed. The scholiast gives no information about himself, but adds that his commentary is founded upon one by Bhâskara. At the conclusion are the words *iti someṣvara-virachite âchâryabhaṭṭiyaṃ bhâshyaṃ samâptam iti*.

B. Of the Mahâ Ârya Siddhânta I have a copy from Gujerat, containing eighteen chapters, copied in Śaka 1676, or A. D. 1754.

Two others are fresh copies of one or two originals, one of which has the date Śaka 1762, or A. D. 1840.

The Aryâs are from 600 to 612. There is no commentary.

I hope soon to be in possession of fresh copies of both these Siddhântas, with commentaries.

C. The Brahma Sphuṭa Siddhânta, or Brahma Siddhânta, of Brahmagupta, from Gujerat; transcribed in Śaka 1544, or A. D. 1622. Of this I have sent a copy to my learned friend, Professor Whitney.

D. The Khaṇḍa Khâdya Karaṇa, of Brahmagupta, with a Bhâshya, by Âma Śarman, son of Paṇḍita Mahâdeva, of Ânandapura; copied in Samvat 1783, or A. D. 1726. (Ânandapura is the modern Wadanagara, in Katyawar). This manuscript was sent to me by a learned Pandit, of Benares, whose acquaintance I was glad to make at Delhi last year.

E. The Vârâha Sanhitâ, with the commentary of Bhaṭṭotpala. Another copy of the text only.

F. The Bṛhaj Jâtaka of Varâha Mihira; two copies, one lithographed in Bombay.

G. The Laghu Jâtaka of Varâha Mihira.

- |    |   |  |
|----|---|--|
| H. | { | The Vâsishṭha Siddhânta. Samvat 1810, or A. D. 1733.     |
|    |   | The Vyâsa Siddhânta.                                     |
|    |   | The Brahma Siddhânta.                                    |
|    |   | The Romaka Siddhânta. Copied Samvat 1727, or A. D. 1670. |
|    |   | The Sûrya Siddhânta, with the Vâsanâbhâshya.             |
|    |   | The Sârvabhauma Siddhânta.                               |
|    |   | The Tattva Viveka Siddhânta (imperfect).                 |
| {  |   | A commentary on the Siddhânta Śiromaṇi by Vâchaspati.    |
|    |   | The Sundara Siddhânta.                                   |



I am glad to announce that, in the Āryabhaṭīya, or Āryabhaṭīya Sūtra, we have got all the works of the elder Āryabhaṭa, at least all those which were known to Brahmagupta, Bhaṭṭa Utpala, and Bhāskara Āchārya.

My copies of the Āryabhaṭīya, or Laghu Ārya Siddhānta, are evidently identical with the one which Whish possessed, and with the Berlin manuscript; the latter containing about twenty-seven verses or Āryās more, in the shape of a commentary on the Daśagītikā, by Bhūtaviśṇu, which I have not.

Lassen's Āryabhaṭīya is, undoubtedly, the same work. Brahmagupta having cited and controverted a work of Āryabhaṭa, as Āryāśṭaṣaṭa, Colebrooke understood and published that "Āryabhaṭa was the author of the Āryāśṭaṣaṭa (eight hundred couplets)."<sup>1</sup> That Āryāśṭaṣaṭa means eight hundred couplets is also assumed in the passage I have quoted from Lassen. None of the learned scholars who have written so ably on Āryabhaṭa have impugned the correctness of the translation. Professor Whitney goes so far as to state that Dr. Hall "has farther made it at least a probable supposition that the treatise in question (*i.e.*, the Mahā Ārya Siddhānta) is, in conformity with Colebrooke's earlier conjecture, to be identified with that so often credited to Āryabhaṭa by the name of Āryāśṭaṣaṭa."<sup>2</sup>

But Āryāśṭaṣaṭa, I venture to affirm, means a treatise of one hundred and eight couplets. Aṣṭādḥikam ṣaṭam Aśṭaṣaṭam.<sup>3</sup> The Āryā from Brahmagupta, referring to this Āryāśṭaṣaṭa, is as follows; it is in the Tantra Dūṣaṇādhyāya, Chapter xi. Āryā 8:—

आर्याष्टशते पाता भ्रमन्ति दशगीतिके स्थिराः पठिताः ।

मुक्तेन्दुपातमपमण्डले भ्रमन्ति स्थिरा नातः ॥

"In the Āryāśṭaṣaṭa, the Pātas (nodes) revolve; in the Daśagītikā, they are described as stationary."

These two statements, which led Brahmagupta to censure

<sup>1</sup> Colebrooke's Misc. Ess., vol. ii. p. 467.

<sup>2</sup> Journal of the American Oriental Society, vol. vi. p. 560.

<sup>3</sup> See the Siddhānta Kaumudī of Bhāṭṭoji Dixita. Calcutta, 1864, vol. i. p. 369.

Āryabhaṭa for inconsistency of doctrine, are to be found in my copies of the Āryabhaṭīya Sūtra. They are as follows :—

दशगी·आ·११ बुधभृगुकुजगुरुशनिववरषाः गत्वांशकान् प्रथमपाताः ।

सवितुरमीषां च तथा द्वात्रिंशत्सहस्रं मन्दोच्चम् ॥

गोलपाद आर्या २ ताराग्रहेन्दुपाता भ्रमन्त्यजस्रमपमण्डले ऋक्ष ।

अर्काच्च मण्डलार्धे भ्रमति हि तस्मिन्चित्च्छाया ॥

In the twenty-fourth chapter (Sandhyâdhyâya), Āryâ 10, of his Brahma Siddhânta, Brahmagupta tells us that—

भटव्रह्माचार्येण जिष्णुतनयेन गणितगोलविदा ।

आर्याष्टसहस्रेण स्फुटसिद्धान्तः कृतो ब्राह्मः ॥

“Bhaṭa Brahmâchârya, the son of Jishṇu, mathematician and astronomer, composed the Brahma Sphuṭa Siddhânta, in 1008 Āryâs.” The word Āryâsṭasahasreṇa means 1008, and not 8000; and my copy of Brahmagupta’s Siddhânta consists of the former number of couplets.

Analogous examples may be produced from the Smṛtis, where numbers are given. But, to set aside all doubt of the correctness of my translation of the word Āryâsṭasata, I produce nearly all the passages in the Āryabhaṭīya Sūtra which have been controverted by Brahmagupta :—

ब्रह्मगुप्तसिद्धान्त अध्याय १ आर्या ९ दशगीति. आर्या ५ का होम न  
युगपादानार्यभटश्चत्वारि समानि वोढमनुर्युगस्खगनास्ते च ।

कृतयुगादीनि । यद्भिहितवान्न

तेषां स्मृत्युक्तसमानमेकमपि ॥

ब्र. आर्या १२ मनुसंधियुगमिक्त्या-

र्यभटस्तन्मनुर्यतः स्खयुगः । कल्प-

श्चतुर्युगानां सहस्रमष्टाधिकं तस्य ॥

ब्र. आ. ६० अकृतार्यभटः शीघ्रग-

मिन्दूच्चं पातमल्पं स्वगतेः । ति-

थ्यंतग्रहणानां घुणाचरं तस्य सं-

वादः ॥

ब्र. अ. २ आ. ३३ आर्यभटस्याज्ञा-

नात् मध्यममंदोच्च शीघ्रपरिधी-

कालपाद आर्या ८ अष्टोत्तरसाहस्रं  
ब्राह्मो दिवसो ग्रहयुगानां ।

दशगीति आर्या ४ चंद्रोच्चर्जुषिख्-

धनुधसुगुशिथुनभृगुजषपिखुभृशे-

षार्काः । बुफिनचपातविलोमा बु-

धा.ह्यजाकोदयाच्च लंकायां ॥

दशगीति आ. १० झार्धानि मंद-

वृत्तं शशिनः ऋगृघदृयथोक्ते-

नां । न स्पष्टा भौमाद्याः स्पष्टा ब्र-  
ह्मोक्तमध्यादैः ॥

ब्र. अ. ६ आर्या. २१ आर्यभटः चित्रां-  
शैर्दृश्यादृश्याद्यदुक्तवांस्तदसत् । दृ-  
ग्गणितविसंवादात् दृग्गणितं स्व-  
कालांशैः ॥

ब्र. तंत्रद्रूपणाध्याय ११ आर्या ४  
आर्यभटो युगपादान्स्त्रीन् व्यती-  
तानाह कलियुगादी यत् । तस्य  
कृतांतर्यस्मान् स्वयुगाद्यंती न तत्  
तस्मात् ॥

ब्र. अ. ११ आ. ५ युगरविभगणाः  
ख्यघ्नितियत्प्रोक्तं तंत्रयोर्युगं स्पष्टं ।  
त्रिंशती रव्युदयानां तदंतरं हेतुना  
केन ॥

ब्र. अ. ११ आर्या ६ युगवर्षादीन्-  
वदचैत्रसितादेः समप्रवृत्तान् यत् ।  
तदसद्यतः स्फुटयुतं गं न स्थैर्यान्मंद-  
पातानां ॥

ब्र. अ. ११ आर्या ९ आर्यभटो जा-  
नाति ग्रहाष्टकगतिं यदुक्तवांस्तद-  
सत् । राजकृतं न ग्रहणं तस्यातो  
नाष्टमो राजः ॥

ब्र. अ. ११ आर्या ११ ओकारो दि-  
नचारे गुरुरोदयिकस्य भवति  
कल्पादी । न भवत्यार्का यस्मादी-  
कारे विस्वरस्तस्मात् ॥

ब्र. अ. ११ आ १२ सूर्योदयाच्चतुर्थान्  
दिनपान् यदुवाच तदसदार्यभटः ।  
लंकोदये यतो ऋक्षास्तमयं प्राह

भ्यः । ज्ञागुग्लज्ञूलदडत्तथा शनि-  
गुरुकुजभृगुवुधोच्च शीघ्रेभ्यः ॥

गोलपाद आर्या ४ चंद्रोशैर्द्वादश-  
भी रविलिप्तो कंतिरस्थितैर् । दृश्यः  
नवभिर्भृगुर्भृगोस्तीर्द्धाधिकैर्द्धाधिकैर्ष-  
थास्यक्षणाः ॥

दशगीति आर्या ५ कल्पादेर्युगपा-  
दागचगुरुदिवसाच्च भारतात् पूर्वं ।

दशगीति आर्या ३ युगरविभगणाः  
ख्यघृशशिचयगिथिडुशुक्लकुडि  
शिवुण्लषख् प्राक् । कालपाद आ-  
५ रविभगणारब्ध्वा ।

कालपाद आ १२ युगवर्षमासदि-  
वसाः समं प्रवृत्तास्तु चैत्रशुक्लादेः ।  
कालो यमनाद्यंतो ग्रहभैरनुमीय-  
ते चैत्रे ॥

गोलपाद. ४८ चित्तिरवियोगात्  
दिनकृत रवीदुंयोगात् प्रसाधि-  
तश्चेदुः । शतितारा ग्रहयोगास्तथैव  
तारा ग्रहाः सर्वे ॥

दशगीति आर्या ५ गचगुरुदिव-  
साच्च भारतात् पूर्वं ।

कालकियापाद. आर्या १६ सप्तैते  
होरेशाः शनैश्चराद्या यथाकमं शी-  
घ्राः । शीघ्रकमाच्चतुर्थो भवति च

सिद्धपुरे ॥

ब्र. अ. ११ आ. १९ गसगियियोजन-  
परिधिन्निभूव्यासं पुन्य लावदता ।  
आत्माज्ञानं ख्यापितमनिश्चयः स्व-  
मतिहतकल्पात् ॥

ब्र. अ. ११ आ. १७ प्राणैर्नैतिकलांभं  
यदि तत् क्व कुतो व्रजेत्किमध्वानं ।  
आवर्तनमूर्त्याश्चैत्र पतन्ति समुद्रयाः  
कस्मात् ॥

ब्र. अ. ११ आ. २२ उत्तरगोले या-  
यां विषुवज्यातो यदुक्तमूनायां ।  
सममंडलगस्तद् सत्क्रांतिज्यायां  
यतो भवति ॥

ब्र. अ. ११ आ. २३ व्यासाद्धैन विभ-  
क्ता दृग्गतिजीवा चतुर्गुणा लब्धं ।  
लंबननाड्यः पंचदशगुणितयात्रि-  
ज्यया भक्ता ॥

ब्र. अ. ११ आ. २६ लम्बनमृणधन-

मूर्योदयात् दिनपः ॥ गोलपाद्-  
आर्या . १३ उदयो यो लंकाया  
सी-स्तमयः सवितुरेव सिद्धपुरे । म-  
ध्याह्नो यमकोव्यां रोमकविषये  
-धराचं स्यात् ॥

दशगीति. आर्या. ७ नृषियोजनं  
त्रिखभूव्यासः ।

दशगीति. आ. ६ प्राणैर्नैति कलां  
भंखयुगांशे यहजवो भवांशे -र्कः ।  
गोल. आ. ९ अनुलोमगतिर्नीस्थः  
पश्यत्यचलं विलोमगं यद्वत् । अच-  
लानि भानि तद्वत् समपश्चिमगानि  
लंकायाः ॥

गोलपाद्. आर्या ३१ सा विषुव-  
ज्योना चेत् विषुवदुदक् लंबकेन  
संगुणिता । विषुज्यया विभक्ता ल-  
ब्धः पूर्वापरः शंकुः ॥

गोलपाद्. आर्या. ३२ । ३३ । ३४ ।  
चित्तिजादुन्नतभागानां या ज्या स-  
परतो भवेत् शंकुः । मध्यान्नतभाग-  
ज्या क्राया शंकोस्तु तस्यैव ॥ मध्य-  
ज्योदयजीवा संवर्गे व्यासदलहते य-  
स्मात् । तन्मध्यज्या हृत्योर्विशेषमूलं  
स्वदृक्चेपः ॥ दृक्चेपकृतिविशेषित-  
स्य मूलं स्वदृग्गतेः कुवशात् । चिति-  
स्वमदृक्कक्षाया भूव्यासार्धं नभो म-  
ध्यात् ॥

गोलपाद्. आर्या. ३५ । ३६ विचे-

मुक्तं पूर्वापरस्तिथी दिनार्धस्य। यु-  
क्तो भावो यद्भवति तत् ऋणध-  
नयो स्तिथी कतरत् ॥

पगुणाच्चज्या लम्बकभजिता भवेत्  
ऋणमुदक्स्थे। उदये धनमस्तमये  
दक्षिणगेन्धनमृणं चन्द्रे ॥ विक्षेपाप-  
कममुत्क्रमणं विस्तरार्धकृतियुक्त-  
मुदगृणमुदगयनेदक्षिणगे धनमृणं  
चन्द्रे ॥

ब्र. अ. ११ आ. ३४ विक्षेपगुणाच्चज्या  
लम्बकभक्ता यषृणधनं यत्। उक्तमु-  
दयास्तमयोर्नम्रतिघटिकं तस्तद-  
सत् ॥

गो. आं. २९ विक्षेपगुणाच्चज्या लं-  
बकभजिता भवेत् ऋणमुदक्स्थे।  
उदये धनमस्तमये दक्षिणगे ध-  
नमृणं चन्द्रे ॥

ब्र. अ. ११ आर्या ४३ जानात्येकम-  
पि यतो नार्यभटो गणितकालगो-  
लानां। नमया प्रोक्तानि ततः पृथक्  
पृथक् दूषणान्येषां ॥

दश. आ १ आर्यभटस्त्रीणि गदति  
गणितं कालक्रियां गोलं।

These extracts are given as in the original, without any attempt at correction. Colebrooke quotes and translates the following passage as from Āryabhāṭa, cited by Pṛthūdaka :—<sup>1</sup>

भपञ्जरः स्थिरो भूरेवावृत्यावृत्य प्रातिद्वैसिकौ उदयास्तमयौ सपाद-  
यति नचत्रग्रहाणाम् ॥

“The sphere of the stars is stationary; and the earth, making a revolution, produces the daily rising and setting of stars and planets.”

With regard to this passage, Dr. Hall remarks that he has not sought it out in his manuscript of the Mahā Ārya Siddhānta. Nor would he find it there. The fact is, the Laghu Ārya Siddhānta is metrical; and the passage quoted is not so. This is observed by Dr. Hall; but he went in the wrong track in stating that “this extract might go to prove that Ārya, besides his works in verse, wrote others in prose.”<sup>2</sup>

I do not find the passage, literally, in either of the Siddhāntas; but I have no doubt that it is only a paraphrase of the follow-

<sup>1</sup> Colebrooke's Misc. Ess. vol. ii. p. 392.

<sup>2</sup> Journal American Oriental Society, vol. vi. p. 558.

ing line from Âryabhaṭa, in Pṛthûdaka's own words; Âryabhaṭiya, Golapâda, Âryâ ix. :

अनुलोमगतिर्नोऽस्यः पश्चत्यचलं विलोमगं यद्वत् ।

अचलानि भानि तद्वत्समपश्चिमगानि लङ्कायाम् ॥

“As a person in a vessel, while moving forwards, sees an immoveable object moving backwards, in the same manner do the stars, however immovable, seem to move (daily). At Lankâ (*i.e.* at a situation of no geographical latitude) they go straight to the west (*i.e.* in a line that cuts the horizon at right angles, or, what is the same, parallel to the prime vertical at Lankâ).”<sup>1</sup>

I have no doubt that, in the following passage, which has been a theme of fruitful discussion, the first line only is from Âryabhaṭa (it is the latter half of the fourth Âryâ of the Kâlapâda chapter, in my MS.); the second line is, in all likelihood, an addition by Bhaṭṭa Utpala :<sup>2</sup>

गुरुभगणा राशिगुणा आश्वयुगाद्या गुरोरब्दाः ।

गुरुभगणानां संख्या जिनयमवेदतुहव्यभुजतुब्धा ॥

“The revolutions of Jupiter, multiplied by the number of the signs (twelve), are the years of Jupiter, called Âṣvayuja, etc.; his revolutions are equal to the number of the Jinas, a couple, the Vedas, the seasons, the fires (*i.e.* 364,224).”

Âryabhaṭa having an alphabetical notation of his own, it was surprising to find him make use of our arithmetical notation, which the second line quoted above implies. But now the enigma is solved: the second line is not of Âryabhaṭa.

The Daṣagîti Sûtra, as the name purports, is composed of ten Âryâs; the three additional ones, in my copies, relating to— 1. invocation, 2. the alphabetical notation, and 3. the fruit or advantage of knowing the Daṣagîti Sûtra. The Âryâshtaṣata consists of three chapters, viz., 1. Gaṇita; 2. Kâlakriyâ; and 3. Gola. As the Âryabhaṭiya consists of the Daṣagîti Sûtra and Âryâshtaṣata, the treatise consists of four chapters,

<sup>1</sup> Journ. Roy. As. Soc. vol. xx. 1863, p. 376.

<sup>2</sup> Ibid. p. 378. The couplet in the Âryabhaṭiya is as follows:—

कालपाद आर्या ४ स्त्रीचभगणा स्वभगणैर्विशेषिताः स्त्रीचनीचपरिवर्ताः।

गुरुभगणा राशिगुणास्त्वाश्वयुजाद्या गुरोरब्दाः ॥

called pādas, of which the Daṣagiti Sūtra is the first, and the remaining three as above. This arrangement was not clearly perceived by the learned writer of the additional note to Dr. Hall's paper.<sup>1</sup>

Any one studying the Commentary of Munîṣvara, *alias* Viṣvarūpa, styled Marichi, on the Siddhānta Śiromaṇi of Bhāskarāchārya, and also his Sārvabhauma Siddhānta, cannot fail to remark that he clearly notices two Âryabhāṭas. He calls, however, the author of the so-called Mahâ Ârya Siddhānta, Laghu Âryabhāṭa, or Âryabhāṭa junior; and, in quoting from the senior, calls him simply Âryabhāṭa. Sometimes Âryabhāṭa junior appears only as plain Âryabhāṭa; in all likelihood, from the fault of copyists.

Gaṇeṣa, in his commentary on Bhāskarāchārya's Lîlāvati, had only to deal with Âryabhāṭa junior; and, accordingly, he speaks of only one Âryabhāṭa.

The Sundara Siddhānta of Jnânarāja also distinguishes a Laghu from a Vṛddha Âryabhāṭa. Besides the passages referred to by Brahmagupta, all those cited by Bhaṭṭa Utpala and Bhāskara Âchārya are found in my copy of the Âryabhāṭiya. There cannot now, therefore, possibly be any doubt of our having a correct copy of the works of Âryabhāṭa senior; and I shall take the earliest opportunity of publishing the original text, with the commentary of Someṣvara, for the gratification of learned orientalisists.

I shall now proceed to an examination of Âryabhāṭa's age. Âryabhāṭa was born in A.D. 476. This date is given, by himself, in the Âryâshṭaṣata, as follows:—

षष्ठ्यब्दानां षष्टिर्यदा व्यतीतास्त्रयश्च युगपादाः ।

अधिका विंशतिरब्दास्तदेह मम जन्मनो -तीताः ॥

Dr. Kern quotes a corrupt version of it from the Berlin manuscript. The correct translation is: "When three of the four Age-quarters and 60 × 60 [= 3600] years are past, then are past upwards of twenty-three years from my birth." This gives, for the birth of Âryabhāṭa, the year A.D. 476; as the

<sup>1</sup> Journal of the American Oriental Society, vol. vi. p. 561.

fourth Age-quarter, or Kali Yuga, commenced 3101 years before Christ.

Strange to say, the commentator Someṣvara understands the verse to mean that 3623 years had elapsed of the Kali Yuga at the birth of Âryabhata. The commentator whom Mr. Whish consulted fell, perhaps, into the same error; as Mr. Whish does not appear to have given the exact date, but refers Âryabhata simply to the beginning of the sixth century of the Christian era. Âryabhata calls himself a native of Kusumapura, or Pataliputra. Beyond a doubtful allusion to the Brahma Siddhanta, he never mentions any previous author, and rather prides himself on his originality. His work is written with great attention to conciseness. His system of notation is quite original. The account given of it by Lassen is not altogether correct. In the invention of a new system of notation, the Indian Âryabhata may be compared to the Grecian Archimedes. The ratio of the diameter to the circumference was given, by Archimedes, in his book *De dimensione circuli*, as seven to twenty-two; while that of Âryabhata is as one to 3.1416. Âryabhata has the following notice of the Buddhist system of measuring time:—

कालपाद त्रया ए उत्सर्पिणी युगार्धं पञ्चादवसर्पिणी युगार्धं च ।  
मध्ये युगस्य सुषमा चादावन्ति च दुःषमेदूच्चात् ॥

This arrangement is different from that of Hemâchârya and other Jaina authorities. (See Appendix A).

## II. VARÂHA MIHIRA,<sup>1</sup>

as we have already seen, cites Âryabhata by name in the passage given by Bhaṭṭa Utpala from Varâha's Pancha Siddhântikâ Karaṇa, quoted in his commentary on the Vârâhî Sanhitâ.<sup>2</sup> The Pancha Siddhântikâ Karaṇa I have

<sup>1</sup> Varâha Mihira calls himself the son of *Âdityadâsa*, under whom he studied and obtained the highest gift from the Sun in Kapitthaka (a grâma, according to Bhaṭṭotpala), and an Âvantika, or native of Ujjayinî. Bhaṭṭotpala calls him a Mâgadha brâhmana, or dvijavara (best of Brâhmanas), and Âvantikâchârya. Varâha's son was Pṛthuyâsas, who composed the *Shatpanchâṣikâ*, on which also Bhaṭṭotpala has a commentary.

<sup>2</sup> The passage is given by Dr. Kern, *Jour. Roy. As. Soc.* vol. xx. p. 383.



as yet failed in recovering. Colebrooke<sup>1</sup> assigned to him the close of the fifth century of the Christian era, from a calculation of the position of the colures affirmed as actual in his time by Varāha Mihira. Since then no further solid data have been discovered to fix the era of this celebrated astronomer. I have failed to find out the date of his birth, but am glad to have discovered that of his death in a commentary on the Khaṇḍa Khāḍya of Brahmagupta, by Āmarāja :—

नवाधिकपंचशतसंख्यशकके वराहमिहिराचार्यो दिवं गतः

“Varāha Mihira Āchārya went to heaven in the 509th [year] of the Śaka Kāla, *i.e.* A.D. 587.”

There is no reason to doubt the correctness of this statement.

The following passage, quoted by Bhaṭṭa Utpala, in his commentary on the Vārāhī Sanhitā, from a Tantra by Varāha Mihira, shows that he flourished after Śaka Kāla 427, *i.e.* after A.D. 505 :

यथाचाहर्गणानयनं

सप्तश्रिवेदसंख्यं शककालमपास्य चैत्रशुक्लादी ।

अर्धास्तमिते भार्गी यवनपुरे भीमदिवसाख्ये ॥

मासीकृते समासे द्विष्टे सप्ताहतेष्टयमपत्तैः ।

लब्धिर्युतो धिमासीस्त्रिंशद्व्यक्तस्त्रियुतो धस्यः ॥

रुद्र \* समनुशरो नो लब्धो नो गुणखसप्तभिर्व्युगणः ।

रोमकसिद्धांतो च नातिचिरं पीलिशे ध्येवं ॥

The astronomers of Ujjayinî place Varāha Mihira in the beginning of the fifth century. It is not unlikely that they have mistaken the Śaka Kāla for that of the Vikrama Samvat, or fallen into the same error as Albîrûnî.

Albîrûnî states that 526 years had passed up to his own date, A.D. 1031, from the date of the composition of the Pancha Siddhāntikā of Varāha Mihira ;<sup>2</sup> which event must, therefore, be placed in A.D. 505. But in this he is evidently in error. Varāha Mihira adopted the epoch of the Romaka Siddhānta, for finding the number of civil or natural days (Ahargana) ;

<sup>1</sup> Colebrooke's Misc. Ess., vol. ii. p. 482.

<sup>2</sup> Journal Asiatique, tome iv. 1844, p. 285.

and Albîrûnî or his informants have assumed this to be the date of Varâha's Pancha Siddhântikâ, which adopts the epoch of the Romaka Siddhânta.

Varâha Mihira, as we have seen, on the authority of Âmarâja, died in A.D. 587, *i.e.* a century and eleven years after the birth of Âryabhata.

The so-called Khaṇḍa Kaṭaka of Albîrûnî is evidently Brahmagupta's Khaṇḍa Khâdyâ; and Arcand is a corruption of Karaṇa.

From various considerations, the middle of the sixth century has been allotted to Varâha by Colebrooke, and by the learned American translator and commentator of the Sûrya Siddhânta. The passage I have quoted from Bhaṭṭotpala confirms these conjectures.

This calculation, it proceeds to tell us further, is that of the Romaka Siddhânta; and, judging by similar calculations and other Siddhântas, it appears to me highly probable that the Romaka Siddhânta was composed in Śaka 427, or A.D. 505. Varâha Mihira founded his Pancha Siddhântikâ Karaṇa on the Romaka Siddhânta and four others. It is clear, therefore, that Varâha could not have lived before A.D. 505. In all likelihood, his birth was twenty or thirty years subsequent to this date; which would make Varâha Mihira about fifty or sixty years old at the time of his death in A.D. 587. In an essay on Kâlidâsa,<sup>1</sup> I have attempted to show that the nine gems of Indian celebrity flourished at the Court of Harsha-Vikramâditya, at Ujjayinî, in the sixth century of the Christian era. As we have now established the date of Varâha Mihira beyond a doubt, my hypothesis that Mâtrigupta is identical with the celebrated Kâlidâsa gains further support.

The authors of the Pauliṣa, Romaka, Vâsishṭha, Saura, and Paitâmaha Siddhântas being noticed by Varâha Mihira, it follows that they flourished before A.D. 505. Brahmagupta affirms that Śrîsheṇa, the author of the Romaka Siddhânta, bases his calculations on those of Lâṭa, Vasishṭha, Vijayanandin, and Âryabhata, and that Vishṇuchandra, following the same guides, wrote the Vâsishṭha Siddhânta. As we have the date

<sup>1</sup> Journal Bombay Branch Royal Asiatic Society, 1862, vol. vi.

of A.D. 508 for the Romaka Siddhânta, it is evident that Lâta, Vijayanandin, and Vasishṭha flourished before that time. I presume that the Romaka Siddhânta was composed in accordance with the work of some Roman or Greek author; just as the Pauliṣa Siddhânta was composed from the work of Paulus Alexandrinus. Is not Lâtâchârya also a foreign author? Bhaṭṭa Utpala notices also a strange author, of the name of Sphujidhvaja or Asphujidhvaja, as a Yavaneṣvara, who composed a new Śâstra before the Śaka era. His works appear, from the following passage,<sup>1</sup> to have been consulted by Bhaṭṭa Utpala, who remarks that Varâha Mihira consulted the works of other Yavana authors not available to himself. I believe the word Sphujidhvaja is a corruption of the Greek name Speusippus. Diogenes Laertius mentions two authors of this name, one of whom was a physician called Hierophileus Alexandrinus, and may, possibly, be the astronomer whose works were translated and studied in India.

Varâha Mihira's knowledge of Greek technical astronomical terms and doctrines has been fully treated of by Weber and others. The verse in which he gives the Greek terms for the Sanskrit names of the signs of the Zodiac, has hitherto been presented to us, except by Mr. Whish, in a corrupt form;<sup>2</sup> as the following will show that the last puzzling word is the veritable Greek *Ἰχθύες*, or *Pisces* :—

क्रियतावुरुजुतुमकुलीरलेयपार्थीनजूककोर्ष्याख्याः ।

तौक्षिक आकोकेरो हद्रोगश्चेत्यसिः क्रमशः ॥

I have failed, as yet, to discover the Pauliṣa and Romaka Siddhântas. I have two old copies of a Romaka Siddhânta; but it is, evidently, a modern production, taken from some Arabian author, and having nothing in common with the citations and references to the older Romaka Siddhânta preserved in the works of Varâhamihira, Brahmagupta, and Bhaṭṭotpala.

<sup>1</sup> यवनेश्वरेणास्फुजिध्वजेनान्यत् शास्त्रं कृतं शककालस्य प्राक् ज्ञायते  
अनुयवनाचार्यैः पूर्वैः कृतमिति तदस्फुजिध्वजोऽप्याह ।

<sup>2</sup> See Journal As. Soc. Bengal, 1845, p. 810.

## III. BRAHMAGUPTA

has given his own date in the *Brahmasphuṭa Siddhânta*. I gave this extract in my *Essay on Kâlidâsa*, three or four years ago; but it has escaped the attention of one of our ablest and most accurate scholars.<sup>1</sup>

श्रीचापवंशतिलके श्रीव्याघ्रमुखे नृपे शकनृपालात् ॥ पंचाशत्संयुक्तेर्वर्षश-  
तैः पंचभिरतीतैः ॥ १ ॥ ब्राह्मःस्फुटसिद्धांतः सज्जनगणितगोलवित्प्रीति  
॥ त्रिंशद्वर्षेण कृतो जिष्णुसुतब्रह्मगुप्तेन ॥ २ ॥ अध्याय २४ आर्या ७ - ८

“In the reign of Śrī Vyâghramukha, of the Śrī Châpa dynasty, five hundred and fifty years after the Śaka King (*i.e.* Śâlivâhana, or A.D. 628) having passed, Brahmagupta, the son of Jishṇu, at the age of thirty, composed the *Brahmagupta Siddhânta*, for the gratification of mathematicians and astronomers” (chap. 24. *Āryâs* 7-8).

## IV. BHATTA UTPALA'S

age has been quoted from his work by Colebrooke and others :

फाल्गुनस्य द्वितीयायामसितायां गुरोर्दिने ।  
बख्ष्टाष्टमिते शाके कृतेयं विवृतिर्मया ॥

## V. BHÂSKARA ÂCHÂRYA

has stated, in his *Siddhânta Śiromaṇi*, the date of the composition of his work as follows :—

रसगुणपूर्णमहीसमराब्द नृपसमये भवन्ममोत्पत्तिः ॥  
रसगुणवर्षेण मया सिद्धांतशिरोमणी रचितः ।

This date has been singularly confirmed by an inscription which I discovered, some years ago, in the neighbourhood of the railway station of Chalisgam, about seventy miles beyond Nassik. This inscription gives also the names of several of Bhâskarâchârya's descendants, who taught his works in a college endowed in the neighbourhood of Chalisgam, at the foot of the hills which contain the Peetulkhora caves. (See Appendix B.)

<sup>1</sup> Professor Max Müller, *Preface to the Rigveda*, iv. pp. xiv. f.

Remarks on the inscription referred to in p. 410, and given at length in Appendix B.

In this inscription we have the names of the following kings of the Yadu dynasty: Bhillama, Jaitrapâla, and Singhaṇa. Under this dynasty is the following genealogy of subordinate chiefs of the solar race: Kṛshṇarâja, his son Indrarâja, his son Govana, and his son Sonhadeva. This last makes a grant of certain privileges, in the shape of perquisites, or first-gifts, to a college established by Changadeva, (within six miles of the railway station at Châlisgâm, and at the foot of the Pitalkhorâ caves), now entirely deserted and in ruins, in the year 1128 Śaka-kâla, *i.e.*, A.D. 1206, on the occasion of a lunar eclipse.

Changadeva was the son of Lakshmîdhara, who was patronized by Jaitrapâla, as the chief of his Pandits. Lakshmîdhara's father was the celebrated Bhâskarâchârya. His father was Kaviṣvara Mâheṣvarâchârya; and his father was Manoratha; his father, Prabhâkara; his father, Govinda Sarvajna; his father, Bhâskara Bhaṭṭa, to whom Bhoja gave the title of Vidyâpati. His father was Trivikrama. This learned family, we are further told, belonged to the *gotra* of Śaṅḍilya.

The names of Bhillama, Jaitrapâla, and Singhaṇa occur in two copper-plate grants, Nos. 9 and 10 of Mr. Wathen's series (*Journal of the Royal Asiatic Soc.* v. pp. 178, 183). In these grants we have also the names of the successors of Singhaṇa, *i.e.*, Kṛshṇa, Jaitrapâla (Singhaṇa's son), his younger brother Mahâdeva, who succeeded him, and Râmachandra, the son of Kṛshṇa, the dates of whose grants are Śaka 1212 and 1194. The donor, Sonhadeva, in our inscription, dated Śaka 1128, is a contemporary and subordinate of Singhaṇa, whose third lineal descendant was Râmachandra, in whose reign the grants of Śaka 1212 and 1194 are dated.

These dates, therefore, are perfectly compatible with, and confirmatory of, the accuracy of that of the inscription.

Bhâskarâchârya, the author of the *Siddhânta Śiromaṇi*, gives the date of his birth as follows :

रसगुणपूर्णमहीसमशकनृपसमये ऽभवन्ममोत्पत्तिः ।

रसगुणवर्षेण मया सिद्धन्तशिरोमणी रचितः ॥

“ In the year 1036 of the Śaka king, I was born ;  
And at the age of 36, I composed the Siddhânta Śiromaṇi.”

This date is quite in accordance with that of the inscription.

The following lines, in praise of Bhâskarâchârya's accomplishments, are sometimes to be found added to MSS. of the *Lilâvatî* :

अष्टौ व्याकरणानि षट्च भिषजां व्याचष्टयः संहिताः षट्कर्तव्याः गणितानि पञ्च चतुरो वेदानधीते च यः ॥ रत्नानां चितयं द्वयं च बुबुधे मीमांसयोरन्तरं सत् ब्रह्मैव जगद् गाधमहिमा सोऽस्त्राः कविर्भास्करः ॥

An important fact to be noticed is, the bestowal of the title of *Vidyâpati* on Bhâskara Bhaṭṭa, an ancestor of Bhâskarâchârya, by Bhoja.

This Bhoja is, undoubtedly, the monarch of Dhârâ, whom it is the fashion to speak of as distinguished for his patronage of learning.

In the *Râja Mṛgânka Karaṇa*, attributed to Bhoja, a copy of which was brought to me, by my Pandits, from Jessulmere, whither I sent them in search of Jaina MSS. two years ago, its author recommends 964 to be subtracted from the Śaka era to find the *Ahargana*, *i.e.* “ the sum of days,” in civil reckoning.

Bhoja, therefore, it follows, flourished in  $964 + 78 = 1042$  A.D. At the end of the work he is called *Raṇa Ranga Malla*, a title also to be found in the *Pâtanjala Yoga Sûtra Vṛtti*.

My pandits have succeeded in getting a very imperfect copy of the *Tilaka Manjarî* of Dhanapâla, who is said by Merutunga, the author of the *Prabandha Chintâmaṇi*, to be the author of that work, and to have been a favourite of Bhoja. Merutunga adds that from *Vikrama Samvat* 1076, or A.D. 1019, Bhîmarâja reigned. He was succeeded by Karṇa in 1028. At the time the Châlukya Bhîma reigned in Gujerat, Bhoja says Merutunga ruled in Mâlava. According to this Jaina hierarch, Munja was imprisoned by Tailapa, the Châlukya, who commenced his reign in Śaka 895, or A.D. 973, according to the copper-plate grants of Mr. Wathen. Dhanapâla was a Brâhmaṇa, but, evidently, a Jaina by faith. He composed the *Jina Stavana*, or *Gâthâs* in *Mâgadhî*, in praise of Jina,

of which a complete copy was brought me from Jessulmere. The Jainas are loud in the praises of Dhanapāla.

Mr. Bentley speculated that Bhâskarâchârya flourished after Akbar the Great. Our inscription furnishes a new proof that the unfavourable opinion of Hindu veracity which led to this conclusion was utterly unfounded.

#### APPENDIX A.

“ We will now proceed to inquire how far the doctrines of our treatise correspond with what has elsewhere been handed down as taught by Āryabhaṭṭa. The peculiar division of the Great Age (*mahâyuga*) and constitution of the Æon (*kalpa*), described by Brahmagupta (see Colebrooke, as above) as Āryabhaṭṭa's, are here given. The treatise begins the Æon with sunrise at Lankâ, a tenet which distinguished the school of Āryabhaṭṭa from that of Puliṣa (see Colebrooke, as above; also Essays, ii. 427, et al.) It affirms the revolution of the earth on its axis, and the non-reality of the apparent daily motion of the stars, comparing this to the effect of riding in a chariot when fixed objects seem to be moving in a direction contrary to that in which the chariot is proceeding (see the reference to this point in Mr. Hall's paper). It declares the moon, planets, and stars to be naturally dark, and only illuminated upon the side which is turned toward the sun (see Colebrooke, Hind. Alg., note G; Essays, ii. 467). The variability of dimensions of the epicycles of the planets is recognized, although the agreement between this treatise and the Sûrya Siddhânta herein is not so close as Colebrooke (As. Res. xii. 236; Essays, ii. 401) seems to have understood it to be: perhaps Colebrooke's reference here belongs rather to the other Ārya Siddhânta. The passage repeated by Colebrooke (Hind. Alg., note I; Essays, ii. 473) from Bhaṭṭa-utpala on Varâha-mihira is almost precisely represented by the first verse of our third *śloka*: its evidence, however, is of little account, as it relates to a matter so general that it might occur in nearly equivalent terms in almost any treatise; Colebrooke is mistaken in attributing it to any necessary connection with the doctrine of the precession: the position of the equinoxes would be described by a Hindu astronomer as in the first of Aries and of Libra, whatever his theory respecting the important fact of their movement along the ecliptic. The doctrine respecting the precision attributed to Āryabhaṭṭa by

Muniṣvara and others (see Colebrooke, As. Res. xii. 213; Essays, ii. 378, et al.), namely, that the equinoctial points librate 578,159 times in an *Æon* (*kalpa*) through an Arc of 48°, appears from Bentley (Hind. Ast. p. 140, etc.) to belong to the more extended treatise, and not to the *Laghu Ārya Siddhānta*. In connection with the latter, Bentley makes no mention of the precession, nor have we as yet succeeded in discovering anything about it in our treatise, although we would not venture to say with entire confidence that it is not there. It seems, then, altogether probable that Colebrooke's suggestion (as above) is well-founded, to the effect that the libration of the equinoxes may be taught in the *Āryāśṭaṣṭa*, and not in the *Daśagītikā*, although we cannot regard as of force the particular reason he assigns for it, since the equinoxes are by no means likely to have been treated as nodes by the early astronomers. A scholiast upon the *Vârâhī Sanhitâ* ascribes to *Āryabhaṭṭa* (Colebrooke, As. Res. xii. 244; Essays, ii. 410) the determination of Jupiter's revolutions in a Great Age (*mahadyuga*) as 364,224; this is the number given in our treatise, and in Bentley's *Laghu Ārya Siddhānta*; that found in his *Ārya Siddhānta* is 364,219,682."—*Journal of the American Oriental Society*, vol. vi. pp. 562-3.

## APPENDIX B.

१ नमो गणाधिपतये सिद्धि—सुधाकरभूमि

ख्य—दू च संरक्षणानि गगनेचरवास्तोतः उद्भटबुद्धिर्भाट्टे सांख्ये संख्यः  
 स्वतंत्रधीस्तत्रे । वेदे नवदविद्यो नल्पः शिल्पादिषु कलासु ॥ १ ॥ स्वकं-  
 दो थ कंदसि शास्त्रे वैशेषिके विशेषज्ञः । यः श्रीप्रभाकरसमः प्राभाकर-  
 दर्शने कविः काव्ये ॥ २ ॥ बज्रगुणगणितप्रभृतिस्कंधचितये चिनेत्रसमः ।  
 विबुधाभिवंदितपदो जयति श्रीभास्कराचार्यः ॥ ३ ॥ श्रीमददुवंशाय  
 स्वस्त्यस्तु समस्तवस्तुसहिताय । विश्वं यत्र चातुं जातो विष्णुः स्वयंचस्तु ॥  
 ४ ॥ गर्जन्नृंरकुंजरोत्कटघटासंघट्टकंठीरवो लाटोरस्ककपाटपाटन-  
 पटुः कर्णाटहृत्कंटकः । श्रीमान्भिल्लमभूपतिः समभवद्भूपालचूडामणिः  
 त्रस्तार्तांध्रपुरंधिकांत सुखहृच्छ्रीजैत्रपालो भवत ॥ ५ ॥ लक्ष्मीकांतलवः  
 प्रतारितभवः श्रीजैत्रपालोद्भवः संग्रामांगणसंचितातिविभवः शास्ता  
 भुवः सिंघणः । पृथ्वीशो मथुराधिपो रणमुखे काशीपतिः पातितो येना-  
 सावपि यस्व भृत्यबटुना हम्मीरवीरो जितः ॥ ६ ॥ अत्रततार पुरा पुरुषो-



त्तमो यदुकुले जगतीहितहेतवे । जयति सोऽयमिमां सकलामिलामव-  
 ति मामसिद्धमहीपतिः ॥ ७ ॥ अथ भृत्यान्वयवर्णनं ॥ श्रीमद्भास्करवं-  
 शाय भव्यं भूयात्स भूपतिः । निकुंभो यत्र संभूतो रामो यस्यान्वयेऽभवत्  
 ॥ ८ ॥ तत्रासीन्नृपतिर्जितचित्तिपतिर्ध्यातैकलक्ष्मीपतिर्देवब्राह्मणवंदने त-  
 तमतिः श्रीकृष्णराजाह्वयः । शीर्यीदार्यविवेकविक्रमगुणैस्तुल्यो न ये-  
 नापरः प्रीत्या पांडवपुंगवार्जितपदं तद्वर्मराजिति यत् ॥ ९ ॥ प्राप्तां-  
 गप्रभवस्ततस्ततमतिः प्राप्तप्रतापोन्नतिर्वीरो वैरिवधूविधूनितशिरा यः  
 श्रीन्द्रराजाह्वयः । तस्यासीत्तनयः सतां सविनयः सामंतसीमंतिनी-  
 वैधव्यव्रतसद्गुरुर्गुरुगुणः सत्पुण्यपण्यापणः ॥ १० ॥ चतुरसुरगारूढो रे-  
 वंत इव गोवनः । सौन्दर्यदर्पः कन्दर्पो यं दृष्टानंगतां गतः ॥ ११ ॥ श्रीगो-  
 वनाद्रलसिंधोरुञ्जितमूर्तिसतपुण्यकीर्त्तिः । जितारिचक्रः चित्तिपाल-  
 शक्रः श्रीसोन्हेदेवः सुतवासुदेवः ॥ १२ ॥ शरणागतवज्रपंजरः परना-  
 रीषु सदा सहोदरः । व्रतसत्यपथे युधिष्ठिरः सततं वैरिवधूभयज्वरः ॥  
 १३ ॥ स षोडशशतग्रामदेशं दुर्गपुरान्वितं । सोन्हेदेवे दिवं याति शास्त्रि  
 तस्यानुसंभवः ॥ १४ ॥ त्यागे सूर्यसुतोपमोऽर्जुनसमः शीर्ये निकुंभान्वये  
 विख्यातः चित्तिपालभालतिलकः श्रीगोवनस्यात्मजः । श्रीमत्सिंघणदे-  
 ववैरिकरटी कंठीरवो यत्करो नद्यान्नंदसुनंदने ततमतिर्हेमाडिदेवश्चिरं  
 ॥ १५ ॥ शांडिल्यवंशे कविचक्रवर्ती त्रिविक्रमोऽभूत्तनयोऽस्य जातः । यो  
 भोजराजेन कृताभिधानो विद्यापतिर्भास्करभट्टनामा ॥ १६ ॥ तस्मान्नो-  
 विंदसर्वज्ञो जातो गोविंदसन्निभः । प्रभाकरः सुतस्तस्मात् प्राभाकर  
 इवापरः ॥ १७ ॥ तस्मान्मनोरथो जातः सतां पूर्णमनोरथः । श्रीमान् म-  
 हेश्वराचार्यस्ततो जनि कवीश्वरः ॥ १८ ॥ तत्सूनुः कविवृंदवंदितपदः स-  
 द्वेदविद्यालताकंदः कंसरिपुप्रसादितपदः सर्वज्ञ (विप्रासदः) । यच्छिथिः  
 सह कोऽपि नो विवदिसुंदचो विवादी क्वचित् । श्रीमान् भास्करकोविदः  
 समभवत् सत्कीर्त्तिपुण्यान्वितः ॥ १९ ॥ लक्ष्मीधराख्योऽखिलसूरिमुख्यो  
 वेदार्थवित्तार्किकचक्रवर्ती । क्रतुक्रियाकांडविचारसारो विशारदो  
 भास्करनंदनोऽभूत् ॥ २० ॥ सर्वशास्त्रार्थदक्षोऽयमिति मत्वा पुरादतः ।  
 जैत्रपालेन यो नीतः कृतश्च विवुधायणीः ॥ २१ ॥ तस्मात्सुतः सिंघणचक्र-  
 वर्त्ती दैवज्ञवर्योऽजनि चंगदेवः । श्रीभास्कराचार्यनिबद्धशास्त्रविस्तार-

हेतोः कुरुते मठं यः ॥ २२ ॥ भास्कररचितग्रंथाः सिद्धांतशिरोमणिप्र-  
मुखाः । तद्वंशकृताश्चान्ये व्याख्येया मन्मठे नियतम् ॥ २३ ॥ श्रीसोन्हदे-  
वेन मठाय दत्तं हेमादि (ना किंचिदिहापरैश्च) भूम्यादि सर्वे परिपाल-  
नीयं भविष्यभूपैर्बहुपुण्यवृद्धी ॥ २४ ॥ स्वस्ति श्रीशके ११२८ प्रभवसंव-  
त्सरे श्रीश्रावणे मासे पौर्णमास्यां चंद्रग्रहणसमये श्रीसोन्हदेवेन सर्व-  
जनसन्निधौ हस्तोदकपूर्वकं निजगुरुरचितमठायायस्थानं दत्तम् ॥ त-  
द्यथा

इयां पाटणी जे कणे उघटे तेहाचा जो सिंदू जो राउला होता योहका  
पासीं तो मढा दिन्हला ब्राह्मणजिंदिकहे ब्रह्मोत्तरतं ब्राह्मणीदिन्हले ॥  
याहकापासिं दामाचा वीसोवा असु पाठी गिधवयाहकापासि ॥ पंचपो-  
फलीयाहकापासि पहिवहिले आधणे आदाणा चीलो मठा दिन्हला  
जेतिघाणे वाहति तेतियां प्रतिपलि पली तेला । जेमविजेने मढीचे नमाय  
नवावे मापा उगठा अर्द्ध अर्द्ध मापाचे हारिभूपाचे स्तूक तथा भूमिः चतु-  
राघाटविसुद्ध ३०६ याम — बाले कामतामध्यत्र था कल पंडिता-  
कालतु मीचउरा धामोजीचीसोढीआ ॥

## TRANSLATION.

Obeisance to the god of wisdom (Gaṇādhīpati)—four or five syllables lost—perfection—four syllables lost—moon and earth—about twenty-five syllables lost. Stha—two syllables lost—dû—one syllable lost—tra—preservations—the planets and stars<sup>1</sup>—three syllables not well made out.

Glory to Bhāskarāchārya, eminently skilled in Bhāṭṭa,<sup>2</sup> estimable in Sāṅkhya, original in the Tantra, deeply conversant in the Vedas, great in the mechanical arts, independent in poetical metre, intimate with the Vaiṣeṣhika Śāstra, like Prabhākara<sup>3</sup> in the Prābhākara system, a Kavi in poetry, like the three-eyed god (Śāmba) in the three subtle sciences, such as mathematics,<sup>4</sup> whose feet are bowed to by the learned.

Peace to the prosperous Yadu dynasty, with everything appertaining to it; (a dynasty) in which, for the preservation of the world, the independent Viṣṇu assumed being.

<sup>1</sup> Gaganechara.

<sup>2</sup> The Mimāṃsā as propounded by Bhāṭṭa Kumārila.

<sup>3</sup> In the Mimāṃsā Śāstra. Prabhākara and Murāri Miśra were the founders of two other schools, besides Kumārila Bhāṭṭa.

<sup>4</sup> The three sciences (Skaudhas) are Gaṇita, Horā, and Sanhitā.

In it the illustrious King Bhillama flourished, who was a lion attacking the furious masses of noisy Gurjara King-elephants, who was skilful in bursting the powerful breasts of the Lâṭas, a thorn in the heart of the Karṇâṭas, and a crown-jewel among kings; Jaitrapâla flourished, who was the destroyer of the happiness of the Ândhra females with their husbands.

A portion of the Lord of Lakshmi, who escaped (or saved himself), from the world, descended from Jaitrapâla, (and) who gained the utmost power on the field of battle, a controller of the earth, —Singhaṇa; who in the van of battle threw down the lord of Mathurâ, the king of Benares; a young child of whose servant defeated the warrior Hammira. Formerly Purushottama (Vishṇu) for the benefit of the world became personified in the Yadu family. Ho (Purushottama) conquers all the world and protects me. Now the description of the subordinates. May blessings attend the illustrious solar race, in which the king Nikumbha was born, whose descendant was Râma. Of this race was the king Kṛshṇarâja, a conqueror of kings, devoted solely to the Lord of Lakshmi; whose mind is expanded in revering gods and Brâhmaṇas, who has no equal in the qualities of bravery, liberality, discrimination, and prowess; and who by love (gained) the title of Dharmarâja, possessed by the best of the Pâṇḍavas. From him (Kṛshṇarâja) Indrarâja obtained his bodily descent, who was of large intellect exalted by prowess, a hero who filled the heads of the wives of his enemies with terror. His son, discreet among the virtuous, and a high-priest to give the vow of widowhood to the wives of feudatories, whose qualities are exalted, a store-house of merit, clever on horseback like Revanta, was Govana; on seeing whom, Cupid, who is proud of his beauty, abandoned his bodily form.

From Govana, the ocean of jewels, issued Sonhadeva, the praise of whose merit is wide-spread, who conquered the circle of enemies, an Indra among kings, who praises Vasudeva, a castle<sup>1</sup> of adamant to those who sought his protection, who looked upon others' wives as his sisters, a Yudhishtira . . . in vows and in the path of truth, and ever a fearful fever to the wives of his enemies.

His younger brother, Hemâḍideva, rules a country of 116 villages,<sup>2</sup> with forts and towns, since Sonhadeva went to heaven;<sup>3</sup> in liberality like the son of the Sun (Karṇa), in bravery like Arjuna, celebrated in the race of Nikumbha, the mark on the forehead of kings (*i.e.* chief among kings?), the son of Govana, whose hand is a

<sup>1</sup> Cage, in the original.

<sup>2</sup> Or 1600 villages.

<sup>3</sup> The following adjectives are equally applicable to the brothers Sonhadeva and Hemâḍideva.

lion to the elephant enemies of Singhaṇa, whose mind is expanded in the good son of Nanda (Kṛshṇa), may he be happy for a long time.

In the Śāṇḍilya family was Trivikrama, best of poets. His son was Bhâskara-bhaṭṭa, to whom Bhojarâja gave the title of Vidyâpati. From him was Govinda-sarvajna, like Govinda. From him was a son Prabhâkara, as if he was another sun. From him was Manoratha, a fulfiller of the wishes of the virtuous; from him was the great poet Maheṣvarâchârya, whose feet are embraced by assemblages of poets, a bulb of the excellent creeper of the science of the Vedas, who obtained the favour of the feet of the enemy of Kansa (Kṛshṇa), who has a seat among (or who has conquered) the Brâhmaṇas with universal knowledge, with whose disciples there is nowhere any person to dispute. Full of good fame and merit was Bhâskara. The learned Bhâskara's son was Lakshmidhara, the first among the learned; acquainted with the meaning of the Vedas, the first among metaphysicians, and skilful in the knowledge of sacrificial ceremonies. Jaitrapâla, having recognized him as well-versed in the meanings of all the Śâstras, took him from this pura (town) and made him the chief of Pandits. His (Lakshmidhara's) son was Changadeva, the best of the astronomers and astrologers at the court of Singhaṇa Chakravartin. He (Changadeva) constructs the college (Maṭha) for the spread of the treatises composed by Bhâskarâchârya. The works composed by Bhâskarâchârya, the chief of which is the Siddhânta Siromani, and the works of his ancestors and descendants, ought to be duly studied in my college. Sonhadeva granted ground, with gold, etc., to the college; others have also made some grants (?). Future kings ought to protect this, for the increase of merit. The syllable *ṣa* between two syllables follows *svasti*. In the year 1128 Śaka in the year Prabhava, in the Śrâvaṇa month, full moon, on the occasion of a lunar eclipse, Sonhadeva, in the presence of the people, having thrown water into the hands, granted<sup>1</sup> to the college of his preceptors as follows. (The succeeding portion is mostly written in a form of old Marathî, corresponding to the Khândeṣî. This is more difficult to make out than Sanskrit; but the purport appears to be :) certain rates were levied on the oil-mills, sugar manufactories, on the total revenue collected (?) and on the corn, for the support of the college. (Again in Sanskrit :) in the same way, ground distinguished by the four boundaries 306 (?). Villages (again Khândeṣî)—two syllables lost—some letters have not been made out . . . Pandits . . . chauras of ground . . . Dhâmoji's ground (?).

<sup>1</sup> A syllable lost: the word means a place, but here is evidently intended to mean the first gifts, Agradâna.