

“But now, in consequence of the practice of morality on the part of king Dēvānāmpriya Priyadarśin, there has arisen the sound of (*celestial*) drums, proclaiming morality (*and*) showing the people apparitions of aerial chariots, apparitions of (*celestial*) elephants, balls of fire, and other heavenly signs.”

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THE KATAPAYADI SYSTEM OF EXPRESSING NUMBERS

In this Journal, 1901. 121, Dr. Barnett brought to notice some Pāli chronograms from Burma, based on a certain use of the letters of the alphabet. The system is one which is popularly known as the Katapayādi system. It has been described by Professor Bühler in his *Indian Paleography*, § 35, B.¹ But, like some other published notices of it, that one is imperfect; particularly in not stating what value attaches to initial vowels, —a detail which Dr. Barnett consequently found not clear. It may be useful, therefore, to give a note on the system here.

The verse which defines this system was given by Mr. Whish, from some unspecified source, in the Transactions of the Literary Society of Madras, part I (1827), p. 57, in the following form :—

Nanyāvacaṅca xūnyāni sankhyāḡ katapayādayah
misrētuvandyahalsankhyana ca cintyō halaswarah

In this we recognize :—

Na-ñāv = achas = cha sūnyāni saṅkhyāḡ katapay-ādayaḥ |
miśrē tv = ēv = āntya-hal = saṅkhyā na cha cintyō hal =
asvaraḥ ||

“N and ñ and the vowels are ciphers; the numbers are k, etc., ṭ, etc., p, etc., and y, etc.: in a conjunct consonant it

¹ Grundriss der Indo-Arischen Philologie und Altertumskunde, vol. 1, part 11: English version in the *Indian Antiquary*, vol. 33 (1904), appendix.

is the last consonant which is the number ; and no attention is to be paid to a consonant which has no vowel."

To the definition thus given we must add that in accordance with a certain rule *Āṅkānām vāmatō gatih*, which applies rigorously to this system and to that of numerical words,¹ the numbers must be stated with the lowest figure, the unit, on the left, but are to be applied in the opposite direction, with the unit on the right. It must also be noted that, as intimated by Dr. Barnett, the Pāli alphabet, having only one sibilant, requires a different arrangement of the last row of letters, and that there is sometimes a confusion between *l* and *ḷ*. The results are as shown in the table on page 791 below.

This system of expressing numbers being used in the astronomical work known as the Second Ārya-Siddhānta, we shall be better able to estimate its general utility when that work has been edited, and perhaps may then carry back the use of it to an earlier time than is known for it now.² Meanwhile, the earliest published instances of the use of it seem to be as follows :—

Shaḍguruśishya gave the date of the completion of his Vēdārthadīpikā thus :—

Khagō = ntyān = Mēsham = āp = ēti Kaly-ahargaṇanē sati |
 Sarvānukramaṇī-vṛittir -jātā Vēdārthadīpikā ||
 Lakshāṇi pañchadaśa vai pañchashashṭi-sahasrakam |
 sa-dvātriṅśach-chhataṁ ch=ēti dina-vāky-ārtha iritaḥ ||

This statement, quoted and explained by Professor Kielhorn in *Ind. Ant.*, 21. 49, No. 4, tells us that Shaḍguruśishya finished his work when the *ahargaṇa*

¹ That is, the system which uses, e.g., the word *bhūmi*, 'earth', to denote 'one', *nayana*, 'eyes', to denote 'two', and so on.

² Bentley said that the work in question is dated in its first chapter in Kaliyuga 4423 (expired), A.D. 1322: see his *Hindu Astronomy* (1825), p. 138. But Sh. B. Dikshit said that its date is not given, and expressed the opinion that it belongs to about A.D. 950: see *Indian Calendar*, p. 6, note 4.

or sum of days of the Kaliyuga era was 1,565,132. The *ahargana* is given twice. (1) By the clause—

kha(2)-*gō*(3)-*ntyā*(1)-*nmē*(5)-*sha*(6)-*mā*(5)-*pa*(1).

In addition to giving the number, this says :—“The sun passed on from the last (*sign*) to Mēsha”; by which it marks the day as the day of the Hindū vernal equinox. (2) In ordinary words, as “fifteen lakhs, sixty-five thousand, one hundred and thirty-two”: this statement is added as giving “the meaning of the *dina-vākya*, the sentence for the day”, that is, the clause *khagō*, etc. In this instance, the number gives the current day, not the elapsed day: and it takes us to 24 March, A.D. 1184, on which day the Hindū true sun entered Mēsha. Professor Kielhorn was of opinion, however, that Shadguruśishya simply took the number of the day from some almanac which presented it as giving the initial day of the solar year, and meant that he finished his work, not actually on that day, but at some time during the year which then began.

An inscription at the Aruḷāla - Perumāl temple at Conjeeveram¹ tells us that the Kēraḷa king Saṃgrāma-dhīra-Ravivarman was born—

Dēhavyāpya-Śak-ābda-bhāji samayē.

This means “in the time which had the Śaka year *dē*(8)-*ha*(8)-*vyā*(1)-*pya*(1)”: i.e. in Śaka 1188 (expired), A.D. 1266-67. Here, the composer of the verse evidently selected the expression *dēha-vyāpya*, “which should be pervaded by a body”, to suit the event which he was recording, as well as to mark its date.

The two instances given above, and others, indicate that it was the custom to use, at any rate for civil dating, not a mere jumble of artificial syllables, but real words having a meaning, and to select, if practicable, words

¹ Kielhorn's Southern List of Inscriptions, *Epi. Ind.*, vol. 7, appendix, No. 939.

Values of the consonants, etc.

1	2	3	4	5	6	7	8	9	0
k	kh	g	gh	ñ	ch	chh	j	jh	ñ
t	th	ḍ	ḍh	ṇ	t	th	d	dh	n
p	ph	b	bh	m					
y	r	l	v	ś	sh	s	h	ḷ	
<i>For Pāli :—</i>									
y	r	l	v	s	h	ḷ			

Rules.

1. Initial vowels, *a* to *au*, are ciphers.
2. In a conjunct consonant, only the last member of the combination has value.
3. A consonant without a vowel—that is, a final consonant at the end of a formula or a sentence; e.g., the *t* of *āsīt* and the *m* of *puram*—has no value. This applies to also Visarga and Anusvāra.
4. The numbers are to be applied in the opposite direction to that in which they are stated.

giving a meaning suitable to the particular idea. But it is not always easy to see how the words are to be translated in individual instances. And still less easy is it to realize that practice permitted the use of even the cardinal numeral words in this manner. Such, however, was the case; since Mr. Whish quoted from a work entitled Jaiminisūtra an astrological passage beginning (loc. cit., p. 58):— *Atha svānśō grahānām pañcha mūshikamārjārāh*; in which *pañcha* means, not ‘five’, but 61.

On these lines we may have *ekam* as meaning, not ‘one’, but 10; *daśa* in the sense of 58; *śatam* in the sense of 65; *sahasram* in the sense of 287; and so on; with results which might easily be very confusing if we should not be on our guard.

It was supposed that this method of expressing numbers was confined to Southern India. It is therefore interesting to find Dr. Barnett adducing instances of its use from Burma. He has obliged me with the full texts of two of them, from which he gave in his note only the words themselves which express the numbers.

One —apparently the oldest that he can cite— is from the *Saddasāratthajālīnī*, a grammatical work by Nāgita : it runs thus :—

Chakkē pattē guṇaggaraṃ Sakkē pana alappāyaṃ |
Māghē māsē su-niṭṭhitō taṃ sādhaṃ vichārentu ||

Here, the figures for the Buddhist era show that the figures for the other reckoning must be, not 0311 (i.e. 1130), but 0711 (i.e. 1170), and that *alappāyaṃ* must be amended into *alappāyaṃ*. With this correction, the verse tells us that the work was finished in the month Māgha, when the Jinachakka, the reckoning from the death of Buddha according to the later treatment, had reached the year *gu(3)-ṇa(5)-gga(3)-ra(2)*, i.e. 2353, and the Sakkarāj, the common Burmese era, had reached the year *a(0)-la(7)-ppā(1)-ya(1)*, i.e. 1170. In Sakkarāj 1170 the said month Māgha, i.e. Tabodwè, began in Burma on 16 January, A.D. 1809.¹

The other is from the *Samvēgavatthudīpanī*, a religious work by Jāgara : it runs thus :—

Sabba-khattiya-dhammēna Dhammarājēna yāchitō |
māpita-Ratanapunnēna katā Samvēgadīpanī ||
Niṭṭhitō ēsō sampattē Sakkarājē raṭṭhakkhayaṃ |
bhānuvakkhaṃ Jinachakkē Phagguna-māsa-pañchamē ||

This tells us that the work was finished on the fifth day of Phālguna, when the Sakkarāj had reached the year

¹ It is to be noted that the equation between the two eras differs here by one year from the equation used in the next date.

It may also be noted that the *Sāsanavaṃsa* says (p. 89) that Nāgita, otherwise known as Khaṇṭakakhippathēra, wrote the *Saddasāratthajālīnī* in the time of king Kittisīhasūra, who began to reign in Sakkarāj 713, = A.D. 1351–52.

ra(2)-*t̥tha*(2)-*kkha*(2)-*ya*(1), i.e. 1222, and the Jinachakka had reached the year *bhā*(4)-*nu*(0)-*va*(4)-*kkha*(2), i.e. 2404. In Sakkarāj 1222 the given day, the fifth of Phālguna, i.e. Tabaung waxing 5, was 13 February, A.D. 1861.

The Dhammarāja at whose request this work was written was king Mindôn Min, who became king of Burma by dethroning his half-brother Pagan Min early in 1853. He is mentioned here as the founder of Ratana-puṇṇa: this name, which takes in Burmese the form Yadanabon, is the Pāli literary and official appellation of Mandalay, which town Mindôn Min founded in 1859.

When this work was written, the events were culminating which resulted in our permanent acquisition of the Province of British Burma, which was placed under a Chief Commissioner in 1862. And that, no doubt, is why the Sakkarāj year which included the date 13 February, 1861, was called *ratta-kkhaya*, 'loss of territory'. But, why the Buddhist year was called *bhānuvakkha*, meaning apparently 'the chest or the eye of the sun', is not apparent. Nor is it evident why the two years in the other date, of A.D. 1809, were expressed by *gunaggara* and *aḷappāya*.

The following item may be added as a curiosity. Mr. Whish cited a work entitled *Sadratnamālā* as telling us that the proportion of the circumference to a diameter of one *parārdha* (one tenth of a trillion: see p. 119 above) is expressed in this system by—

bhadrāmbudhisiddhajanmagaṇitaśraddhāsmayadbhūpagiḥ.¹

This is tantamount to saying that the value of π is—

$$3.14159265358979324,$$

which is practically correct; the last figure is properly 3, followed by 8, and the decimal runs on to infinity.

¹ Mr. Whish, loc. cit., p. 60, gave *sidha*, *ganita*, *sraddā*, and *gih*. In these details I have had to amend his transliteration.

The expression is a line of a verse in the Śārdūlavikrīḍita metre, the first syllable of which was not given. It comes from a work which is probably of quite late date: and its value of π was taken, no doubt, from the work of some member of the European body of " π -computers", one of whom in the last century carried his value of π to over six hundred places. And it appears to have no connected meaning as a whole. But it is easy to remember, whereas the figures themselves (after the first six) are not so: and it seems an interesting sample of what can be done with this system of notation.

J. F. FLEET.

THE PLANET BRĤASPATI

In the last number of the *Journal* (pp. 514-18) Dr. Fleet has, from the point of view of one interested in the by-ways of astronomy, revived the theory of the connexion of the Vedic BrĤaspati with the planet Jupiter. So much interest attaches to the question of the Vedic knowledge of the planets, and so much weight attaches to any opinion of Dr. Fleet's, that no excuse is needed for an examination of the hypothesis from the standpoint of the general principles affecting the interpretation of Vedic texts.

It should, however, first be noted that there is in favour of the identification of BrĤaspati and Jupiter the high authority of Dr. Thibaut.¹ But Thibaut does not give the reasons for his belief in this view, and it is therefore impossible to estimate precisely what weight should be assigned to his opinion on this point. On the other hand, Mr. Tilak² asserts the identity, but only for the *Taittirīya Brāhmaṇa*, though he finds other mentions of planets in the *R̥gveda* itself. But these other references need not

¹ *Astronomie, Astrologie und Mathematik*, p. 6. Cf. Oldenberg, *Gött. Nach.*, 1909, p. 568.

² *Orion*, p. 161.