

## ON WORD-NUMERALS IN NĀGAVARMA'S CANARESE PROSODY

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### 1. Introduction

In India, three major systems, based on alphabets of *Devanāgarī* script or words of a particular Indian language such as Sanskrit or Prakrit or Canarese, were developed for expressing numbers. The two are the *kaṭapayādi* system<sup>1</sup> and Āryabhaṭa I's alphabetical notation<sup>2</sup> and the other one is word-numerals (*bhūta-saṃkhyā*). These systems excluding Āryabhaṭa I's alphabetical notation have been widespread in India in various disciplines of learning including not only mathematics but also prosody. The purpose of these systems was two-fold. One was to preserve important results.<sup>3</sup> The other was to compose the verses using these systems in accordance with the requirements of their metres.<sup>4</sup>

In the system of word-numerals, numbers were expressed by means of significant words often arranged as in the decimal place-value notation. For example, 4 is represented by *kr̥ta*<sup>5</sup> as it is a special term, meaning cater, employed in India for the dice or the side of a dice with four dots.<sup>6</sup>

The word-numerals are found to have been used in India long before the commencement of the Christian era. The earliest instance of a word being used to denote a whole number is found in the *Śatapatha Brāhmaṇa*. The word used therein is *kr̥ta* denoting 4. The same word for the same purpose was also used in the *Taittirīya Brāhmaṇa*. The word *gāyatrī* (Vedic metre or metre of 24 syllables) denoting 24 is found to have been used in the *Kātyāyana Śrauta Sūtra*.

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<sup>1</sup> Sarma 2012: 37-66.

<sup>2</sup> ĀBha v. 1.2, pp. 3-5.

<sup>3</sup> Jadhav 1998a: 55f.

<sup>4</sup> Datta & Singh 1935: 54; Sarma 2012: 38.

<sup>5</sup> Datta & Singh 1935: 57.

<sup>6</sup> Basham 1954: 207.

The *Lāṭyāyana Śrauta Sūtra* has the word *jagatī* (earth or world or metre of 48 syllables) for 48.<sup>7</sup>

The word-numerals were used in India for expressing both large numbers and small ones. For example, Nemicandra (c. 981), a mathematician of the canonical class of the Jaina school of Indian mathematics,<sup>8</sup> composes, in Prakrit, the compound *vidhu-ṇidhi-ṇaga-nava-ravi-ṇabha-ṇidhi-ṇayaṇa-bala-iddhi-ṇidhi-kharā-hatthī-igitīsasunṇasahiya* (Skt. *vidhu-nidhi-naga-nava-ravi-nabha-nidhi-nayana-balabhadra-ṛddhi-nidhi-khara-hastin- ekatriṃśasūnyasa hitā*, moon-sea-mountain-nine-sun-sky-sea-eye-gentle heroes-spiritual attainment-sea-khara-elephant with thirty one zeroes) to express  $19791209299968 \times 10^{31}$ , a very large number,<sup>9</sup> and *gayana* (Skt. *gagana*, sky) to express 0, a very small number.<sup>10</sup> Both of the numbers are important result; the former is the number of mustards, in a pit of diameter  $10^5$  *yojanas* and depth  $10^3$  *yojanas*, obtained when calculated while the latter is used to form the formula for finding the breadth of the *n*th circular annulus. According to the Digambara Jainas, there are nine *balabhadras* (gentle heroes) of the present *avasarpīṇī* (descending half cycle of the cosmic time). They are Vijaya, Acala, Bhadra, Suprabha, Sudarśana, Nandisena, Nandimitra, Rāma, and Balarāma. Detailed comments on the term *khara* will be offered in chapter 3.

M. Rangacharya gives a list of the word-numerals with their numerical and ordinary significances in English as Appendix I<sup>11</sup> to his edition of the *Gaṇita-sāra-saṅgraha* of Mahāvīrācārya published in 1912. The words usually employed as word-numerals have been compiled from the treatises composed in Sanskrit, without their significances, and listed in *Devanāgarī* script as an Appendix<sup>12</sup> by K. S. Shukla to his edition of the *Vaṭeśvara-Siddhānta* published in 1986. As far as the present author knows, his compilation is the longest one.<sup>13</sup>

Nāgavarma was a noted poet of the Canarese language in the late 10th century.<sup>14</sup> The *Chandōmbudhi* (“Ocean of Prosody”), the *Karṇāṭaka Kādambari*, and the *Kannaḍa Chandassu* (“Canarese Prosody” or “Karnāṭa Prosody”) are his important works. The *Chandombudhi* is

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<sup>7</sup> Datta & Singh 1935: 57f.

<sup>8</sup> Jadhav 2017: 322.

<sup>9</sup> TriLoSā v. 21, pp. 28f.

<sup>10</sup> TriLoSā v. 309, p. 254.

<sup>11</sup> GaSāSa<sub>1</sub>, pp. 287-295.

<sup>12</sup> VaSi, pp. 369-384.

<sup>13</sup> The same compilation has been given in Roman script by K. V. Sarma. See Sarma 2003: 59-69.

<sup>14</sup> For the date of Nāgavarma see Pollock 2006: 99; cf. Klatt 2016: 541.

the earliest available work on prosody in Kannada. It is addressed to his wife.<sup>15</sup> The *Karnāṭaka Kādambari* is a novel of romance, based on mixed verse and prose called *campū*. It has an originality of its own although it is an adaptation of Bāṇa's Sanskrit *Kādambari*.<sup>16</sup> Nāgavarma was an avowed Jaina.<sup>17</sup> He originally belonged to a migrant Brahmin family which came from the Vengi country (in modern Andhra Pradesh).<sup>18</sup> He was a protégé of Cāvuṇḍarāya, a feudatory of king Rācamalla IV of the western Gaṅga dynasty, who composed the *Triṣaṣṭilakṣaṇa-mahāpurāṇa*, better known as the *Cāvuṇḍarāya-purāṇa*, in 978<sup>19</sup> and erected the superb colossal image of Lord Bāhubali at Śravaṇabelagoḷa. The first consecration ceremony of the image was held on Sunday 13 March of 981.<sup>20</sup> According to Sheldon Pollock, Nāgavarma is the first among as many as five Nāgavarmas who wrote noted classics in the Canarese language over the succeeding few centuries.<sup>21</sup> According to Govinda Pai, our Nāgavarma lived from 950 to 1015.<sup>22</sup>

Reverend Ferdinand Kittel (1832–1903) was a priest and indologist of the Basel Mission in South India. He worked in Mangalore, Madikeri and Dharwad in Karnataka. He edited both the *Chandombudhi* (“Ocean of Prosody”) and the *Kannaḍa Chandassu* (“Canarese Prosody”) in 1875.<sup>23</sup> The present author is fully dependent on Kittel’s edition of Nāgavarma’s Canarese Prosody as he could neither approach the original *Kannaḍa Chandassu* nor is he able to read *Kannada* script. There are found a lot of word-numerals in Nāgavarma’s Canarese Prosody.

This paper aims at highlighting the significances of those word-numerals, comparing them with the ones in Shukla’s compilation, and discussing other related aspects. In this way, it will bring them to the attention of modern scholarship.

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<sup>15</sup> NāCaPro, p. 6; Devarushi 2013: 17f.

<sup>16</sup> Sastri 1958: 384.

<sup>17</sup> NāCaPro, p. xxxviii.

<sup>18</sup> Narasimhachar 1988: 27; Sastri 1958: 384.

<sup>19</sup> Sastri 1958: 384.

<sup>20</sup> Jadhav 2006: 76f.

<sup>21</sup> Pollock 2006: 369.

<sup>22</sup> Bhat 1993: 106.

<sup>23</sup> Nagaraj 2003: 339.

## 2. Word-Numerals from Nāgavarma's Canarese Prosody

The present author finds eighty word-numerals, if each of those that have two significances is counted for once, in Nāgavarma's Canarese Prosody. He sorts them and arranges them in alphabetical order as shown below.

WORD-NUMERALS	DENOTED NUMBER
<i>ambara.</i> <sup>24</sup>	0
<i>adri,</i> <sup>25</sup> <i>bhujaga,</i> <sup>26</sup> <i>garuḍa,</i> <sup>27</sup> <i>khacara,</i> <sup>28</sup> <i>mṛgadhara,</i> <sup>29</sup> <i>pannagarāja,</i> <sup>30</sup> <i>sura,</i> <sup>31</sup> <i>śaśi.</i> <sup>32</sup>	1
<i>kara,</i> <sup>33</sup> <i>pakṣa.</i> <sup>34</sup>	2

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<sup>24</sup> NāCaPro v. 229, p. 64.

<sup>25</sup> NāCaPro v. 283, pp. 88f. & 138.

<sup>26</sup> NāCaPro v. 307, pp. 108 & 145.

<sup>27</sup> NāCaPro v. 295, pp. 94 & 141.

<sup>28</sup> NāCaPro v. 295, pp. 94 & 140.

<sup>29</sup> NāCaPro v. 229, pp. 64 & 146.

<sup>30</sup> NāCaPro v. 295, pp. 94 & 144.

<sup>31</sup> NāCaPro v. 295, pp. 94 & XV & 149.

<sup>32</sup> NāCaPro v. 287, pp. 90 & 148.

<sup>33</sup> NāCaPro v. 298, pp. 96 & 140.

<sup>34</sup> NāCaPro v. 307, p. 108.

<i>dhūmadhvaja,</i> <sup>35</sup> <i>pura,</i> <sup>36</sup> <i>śikhībraja,</i> <sup>37</sup> <i>vahni.</i> <sup>38</sup>	3
<i>ambudhi,</i> <sup>39</sup> <i>ambunidhi,</i> <sup>40</sup> <i>jalanidhi,</i> <sup>41</sup> <i>śaradhi,</i> <sup>42</sup> <i>vārudhi</i> (= <i>vārdhi</i> ), <sup>43</sup> <i>yuga.</i> <sup>44</sup>	4
<i>bāṇa,</i> <sup>45</sup> <i>bhūti,</i> <sup>46</sup> <i>kāmabāṇa,</i> <sup>47</sup> <i>kāmāstra,</i> <sup>48</sup> <i>śara,</i> <sup>49</sup> <i>viṣaya.</i> <sup>50</sup>	5
<i>khara,</i> <sup>51</sup> <i>rasa,</i> <sup>52</sup> <i>ṛtu,</i> <sup>53</sup> <i>ṣaṭka.</i> <sup>54</sup>	6

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<sup>35</sup> NāCaPro p. 143.

<sup>36</sup> NāCaPro v. 285, p. 89; v. 287, p. 90; v. 298, p. 96; v. 307, pp. 108 & XV & 144.

<sup>37</sup> NāCaPro v. 300, pp. 99 & 148.

<sup>38</sup> NāCaPro v. 285, pp. 89 & 147.

<sup>39</sup> NāCaPro v. 164, pp. 47 & 139.

<sup>40</sup> NāCaPro v. 297, pp. 95 & 139.

<sup>41</sup> NāCaPro, p. 142.

<sup>42</sup> NāCaPro v. 319, pp. 117 & 148.

<sup>43</sup> NāCaPro v. 175, p. 50; v. 298, pp. 96 & 147.

<sup>44</sup> NāCaPro v. 128, p. 39; v. 229, pp. 64 & 145.

<sup>45</sup> NāCaPro v. 131, p. 40; v. 164, p. 47; v. 218, p. 61; v. 285, p. 89; v. 287, pp. 90 & 144.

<sup>46</sup> NāCaPro v. 130, p. 40; v. 221, pp. 62 & 145.

<sup>47</sup> NāCaPro v. 304, pp. 104 & 140.

<sup>48</sup> NāCaPro v. 161, p. 47; v. 195, pp. 55 & 140.

<sup>49</sup> NāCaPro v. 168, p. 48; v. 221, p. 62; v. 238, pp. 68f. v. 285, pp. 89 & 148.

<sup>50</sup> NāCaPro v. 283, pp. 88f.; v. 311, pp. 112 & 148.

<sup>51</sup> NāCaPro v. 251, p. 74; v. 308, pp. 109 & 140.

<sup>52</sup> NāCaPro v. 136, pp. 41-42; v. 290, p. 91; v. 299, p. 98; v. 300, pp. 99 & 146.

<sup>53</sup> NāCaPro v. 229, p. 64; v. 313, p. 115; v. 335, pp. 124 & 139.

<sup>54</sup> NāCaPro v. 229, p. 64.

*agendra*,<sup>55</sup> *adri*,<sup>56</sup> *dineśahaya*,<sup>57</sup> *giri*,<sup>58</sup> *hayanikara*,<sup>59</sup> *hayatati*,<sup>60</sup>  
*hayavrāta*,<sup>61</sup> *kulagiri*,<sup>62</sup> *muni*,<sup>63</sup> *naga*,<sup>64</sup> *śaila*,<sup>65</sup> *turagavrāta*,<sup>66</sup>  
*yati*.<sup>67</sup>

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*āsāgaja*,<sup>68</sup> *danti*,<sup>69</sup> *digdanti*,<sup>70</sup> *dikkari*,<sup>71</sup> *diś*,<sup>72</sup> *diśā*,<sup>73</sup> *diśāgaja*,<sup>74</sup>

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<sup>55</sup> NāCaPro v. 176, pp. 50 & 138.

<sup>56</sup> NāCaPro v. 218, p. 61; v. 287, pp. 90 & 138.

<sup>57</sup> NāCaPro v. 153, pp. 45 & 142.

<sup>58</sup> NāCaPro v. 126, p. 39; v. 217, p. 61; v. 219, p. 61; v. 222, pp. 62 & 141.

<sup>59</sup> NāCaPro v. 207, pp. 58 & 150.

<sup>60</sup> NāCaPro v. 172, pp. 49 & 150.

<sup>61</sup> NāCaPro v. 212, pp. 59 & 150.

<sup>62</sup> NāCaPro v. 155, pp. 46 & 140.

<sup>63</sup> NāCaPro v. 167, p. 48; v. 227, pp. 64 & 146.

<sup>64</sup> NāCaPro v. 229, pp. 64 & 143.

<sup>65</sup> NāCaPro v. 140, p. 42; v. 154, p. 45; v. 219, pp. 61 & 148.

<sup>66</sup> NāCaPro v. 212, pp. 59 & 142.

<sup>67</sup> NāCaPro v. 189, pp. 54 & 146.

<sup>68</sup> NāCaPro v. 221, pp. 62 & 139.

<sup>69</sup> NāCaPro v. 185, pp. 53 & 142.

<sup>70</sup> NāCaPro v. 151, pp. 45 & 142.

<sup>71</sup> NāCaPro v. 220, pp. 61 & 142.

<sup>72</sup> NāCaPro v. 137, pp. 42 & 143.

<sup>73</sup> NāCaPro v. 149, pp. 44 & 143.

<sup>74</sup> NāCaPro v. 139, p. 42; v. 153, pp. 45 & 143.

<i>diśākari,</i> <sup>75</sup> <i>gaja,</i> <sup>76</sup> <i>gajavraja,</i> <sup>77</sup> <i>gajavrāta,</i> <sup>78</sup> <i>hari,</i> <sup>79</sup> <i>kari,</i> <sup>80</sup> <i>madagaja,</i> <sup>81</sup> <i>nāga,</i> <sup>82</sup> <i>vasu.</i> <sup>83</sup>	8
<i>nidhi,</i> <sup>84</sup> <i>randhra.</i> <sup>85</sup>	9
<i>hara,</i> <sup>86</sup> <i>rudra.</i> <sup>87</sup>	11
<i>arka,</i> <sup>88</sup> <i>bhānu,</i> <sup>89</sup> <i>bhāskara,</i> <sup>90</sup> <i>dinakara,</i> <sup>91</sup> <i>dinanātha,</i> <sup>92</sup> <i>dinapa,</i> <sup>93</sup>	

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<sup>75</sup> NāCaPro v. 198, pp. 56 & 143.

<sup>76</sup> NāCaPro v. 229, p. 64; v. 297, p. 95.

<sup>77</sup> NāCaPro v. 212, pp. 59 & 141.

<sup>78</sup> NāCaPro v. 212, pp. 59 & 141.

<sup>79</sup> NāCaPro v. 224, p. 63; v. 226, pp. 63 & 150.

<sup>80</sup> NāCaPro v. 215, p. 60; v. 222, p. 62; v. 226, p. 63; v. 248, p. 72; v. 251, p. 74; v. 316, p. 116; v. 318, pp. 117 & 140.

<sup>81</sup> NāCaPro, p. 145.

<sup>82</sup> NāCaPro v. 229, pp. 64 & 143.

<sup>83</sup> NāCaPro v. 165, p. 48; v. 189, p. 54; v. 194, p. 55; v. 214, pp. 60 & 147.

<sup>84</sup> NāCaPro v. 166, p. 48; v. 170, pp. 48-49; v. 173, pp. 49-50; v. 196, pp. 55 & 143.

<sup>85</sup> NāCaPro v. 129, p. 40; v. 147, p. 44; v. 208, pp. 58 & 146.

<sup>86</sup> NāCaPro v. 214, p. 60; v. 224, pp. 63 & 150.

<sup>87</sup> NāCaPro v. 203, p. 57; v. 204, pp. 57 & 146.

<sup>88</sup> NāCaPro v. 326 p. 120; v. 329, pp. 121 & 139.

<sup>89</sup> NāCaPro v. 327, pp. 121 & 145.

<sup>90</sup> NāCaPro v. 184, pp. 52f. & 145.

<sup>91</sup> NāCaPro v. 223, pp. 62 & 142.

<sup>92</sup> NāCaPro v. 205, p. 57; v. 216, pp. 60 & 142.

<sup>93</sup> NāCaPro v. 248, pp. 72 & 142.

<i>dineśa</i> , <sup>94</sup> <i>divasādhīpa</i> , <sup>95</sup> <i>divasakara</i> , <sup>96</sup> <i>mārtaṇḍa</i> , <sup>97</sup> <i>padminīmitra</i> , <sup>98</sup> <i>ravi</i> , <sup>99</sup> <i>vidyādhara</i> . <sup>100</sup>	12
<i>manu</i> . <sup>101</sup>	14
<i>pakṣa</i> . <sup>102</sup>	15
<i>dharaṇīśvara</i> , <sup>103</sup> <i>mahīśvara</i> , <sup>104</sup> <i>rāja</i> . <sup>105</sup>	16
<i>rāvaṇakara</i> . <sup>106</sup>	20

### 3. Discussion

Before stressing the significances of the above word-numerals the present author would like to inform the reader that the angular bracket, wherever it is used, contains paraphrase supplied by him to achieve comprehensiveness together with clarity.

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<sup>94</sup> NāCaPro v. 200, pp. 56 & 142.

<sup>95</sup> NāCaPro v. 148, pp. 44 & 143.

<sup>96</sup> NāCaPro v. 186, pp. 53 & 142.

<sup>97</sup> NāCaPro v. 199, pp. 56 & 146.

<sup>98</sup> NāCaPro v. 213, pp. 59 & 144.

<sup>99</sup> NāCaPro v. 209, p. 58; v.295, p. 94; v. 316, pp. 116 & 146.

<sup>100</sup> NāCaPro v. 295, pp. 94 & 147.

<sup>101</sup> NāCaPro v. 316, p. 116; v. 318, p. 117; v. 321, p. 118; v. 330, pp. 122 & 145.

<sup>102</sup> NāCaPro v. 210, p. 59; v. 211, pp. 59 & 144.

<sup>103</sup> NāCaPro v. 297, pp. 95 & 143.

<sup>104</sup> NāCaPro v. 198, pp. 56 & 146.

<sup>105</sup> NāCaPro v. 248, p. 72; v. 316, pp. 116 & 146.

<sup>106</sup> NāCaPro v. 248, pp. 72 & 146.

2.1 Since sky is empty, *ambara* (sky) represents 0.

2.2 *Adri* represents 1 when it appears in the sense of *Meru* where *Meru* is a particular mountain in ancient Indian Jaina cosmography. It is situated in the middle of the *Jambūdvīpa* ('Rose-apple or Plum-Tree Island').<sup>107</sup> There are the two major epics of ancient India; one is the *Rāmāyaṇa* and the other is the *Mahābhārata*. *Garuḍa* is a mythical bird. According to the epic *Rāmāyaṇa*, Kaśyapa, son of Marīci and grandson of Brahmā, had eight wives. One of them was Tāmrā. Five daughters were born to her. One of them was Śukī. Nalā was born from her and from Nalā was born Vinatā. *Garuḍa* was one of the two sons of Vinatā.<sup>108</sup> This way, *garuḍa* is only one of a kind. Hence, *garuḍa* indicates 1. *Khaga* is the synonym of *khacara*.<sup>109</sup> According to *Paurāṇik* thought, *khaga* is either a serpent born in the *Kaśyapa* family or a synonym of Lord Śiva.<sup>110</sup> Since each of them is one in number, *khacara* denotes 1. Vāsuki was one of the famous serpents. He was anointed by the serpents as their king.<sup>111</sup> *Pannagarāja* means to be the king (*rāja*) of serpents (*pannaga*).<sup>112</sup> In this way, Vāsuki is *pannagarāja*. Since Vāsuki is the name of a particular serpent, each of *pannagarāja* and its synonym *bhujaga*<sup>113</sup> denotes 1. Since god is always only one in true sense, *sura* (god)<sup>114</sup> represents 1. Moon represents 1 as there is only one moon.<sup>115</sup> This is why *śaśi* (moon) indicates 1.

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<sup>107</sup> Jaini 1917: 67.

<sup>108</sup> Mani 1975: 281.

<sup>109</sup> Cappeller 1891: 143.

<sup>110</sup> Mani 1975: 408.

<sup>111</sup> Mani 1975: 838.

<sup>112</sup> Cappeller 1891: 296 & 446.

<sup>113</sup> Cappeller 1891: 380.

<sup>114</sup> Cappeller 1891: 626.

<sup>115</sup> The Jainas had a peculiar conception of two suns, two moons, and two sets of 27 *nakṣatras* (asterisms). This conception was a consequence of the Jaina cosmography according to which the earth is regarded as a series of an innumerable number of concentric circular annuli which are alternatively islands and oceans. See Bose, Sen, & Subbarayappa 1989: 80. Following this conception, moon should have denoted 2 instead of 1. However, Nemicandra (c. 981), Nāgavarma's contemporary mathematician of the canonical class of the Jaina school of Indian mathematics, used the term *vidhu* (moon) to represent 1. See TriLoSā v. 21, pp. 28f. After Nāgavarma, Rājāditya, a mathematician of the exclusive class of the Jaina school of Indian mathematics, of the twelfth century used each of the terms *caṇdra* (Skt. *candra*, moon), *himakara* (moon), *himāṃśu* (moon), *iṇḍu* (Skt. *indu*, moon), *sasi* (Skt. *śaśin*, moon), *sitakara* (Skt. *śitakara*, moon), *soma* (moon), etc., to denote 1. See Jadhav 2018: 55 and 57. The general conception of one moon seems to have been followed by the Jainas while using or employing world-numerals. See Schubring 1935/2000 § 128 on this matter.

The present author could not identify as to why *mṛgadhara* represents 1. However, *mṛgadhara* seems to him to mean to be moon. None of *adri*, *khacara*, *garuḍa*, *pannagarāja*, *bhujaga*, *mṛgadhara*, and *sura* is found in Shukla's compilation.<sup>116</sup>

2.3 Words that occur always in pairs represent 2. So, both *kara* (<two> hand<s>) and *pakṣa* (<two> fortnight<s>) denote 2. Each of them is found in the *Vyavahāra-gaṇita* ('Mathematics of Transaction' or 'Determinations Regarding Mathematics'), the first available mathematical text in Kannada, composed by Rājāditya (12<sup>th</sup> century).<sup>117</sup>

2.4 In Vedic thoughts, *agni* (fire) is considered to be the mouth of the gods and the goddesses. Fire on land, lightning in the atmosphere, and the sun in the sky are its manifestations at three levels.<sup>118</sup> As per the thoughts on sacrificial fire, *gārhapatya*, *āhavanīya*, and *dakṣiṇa* are three sacrificial fires (*agnis*).<sup>119</sup> Since *dhūmadhvaja* (smoke-flag), *śikhibraja*, and *vahni* (fire) are synonyms of *agni*,<sup>120</sup> each of them, for one of the two reasons, represents 3. If *śikhibraja* appears in the sense of sun, it denotes 1.<sup>121</sup> According to *Paurāṇika* thoughts, Tārākṣa, Kamalākṣa, and Vidyunmālī were three demon brothers. Since *tripura* (three cities) or simply *pura* (city) designates the three moving cities made of gold, silver, and iron, built by them, and destroyed by Lord Śiva when the three brothers became a threat to the gods,<sup>122</sup> *pura* denotes 3.

Among these four word-numerals *dhūmadhvaja* and *śikhibraja* are not found in Shukla's compilation.<sup>123</sup>

2.5 In the *Ṛgveda* are mentioned the four oceans (*samudra*). Those four seas are the *Arvāvat* sea, the *Parāvāt* sea, the *Sarasvat* sea, and the *Śaryaṇāvāt* sea.<sup>124</sup> This is why *ambudhi*, (<four>

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<sup>116</sup> VaSi, p. 369.

<sup>117</sup> Jadhav 2018: 55.

<sup>118</sup> Lochtefeld 2002: 14f.

<sup>119</sup> GaSāSa<sub>1</sub>, p. 287.

<sup>120</sup> NāCaPro, p. 143. The exact meaning of *śikhibraja* could not be learnt by the present author.

<sup>121</sup> NāCaPro, p. 99; Apte 1893: 149.

<sup>122</sup> Harshananda 2008 III: 394.

<sup>123</sup> VaSi, p. 369.

<sup>124</sup> Bhargava 1964: 1-23.

sea<s>) shows 4. *Vārudhi* or *vārdhi* must be *vāridhi* (sea).<sup>125</sup> Since *ambunidhi* (receptacle for water), *jalanidhi* (receptacle for water), and *vārudhi* or *vārdhi* are the synonyms of *ambudhi*,<sup>126</sup> each of them represents 4. Since *śaradhi* (receptacle for arrows) is also used to designate a type of ocean,<sup>127</sup> it denotes 4. The *Purāṇas* often refer to four *yugas* (epochs) which come and go in a cyclic order. They are *Kṛta*, *Tretā*, *Dvāpara*, and *Kali*. They differ from one another in their characteristic features. This is why *yuga* (<four> epoch<s>) represents 4.

Among these word-numerals *śaradhi* is not found in Shukla's compilation<sup>128</sup> but occurs in the *Vyavahāra-gaṇita* of Rājāditya (12<sup>th</sup> century).<sup>129</sup>

2.6 Kāma is a young handsome god. He is also called Kāmadeva (god of sexual desire or love), Madana, or Manmatha. The tips of his five arrows are fragrant flowers. *Aravinda* (day-lotus), *Aśoka* (<the flower of> Aśoka tree), *Cūta* (<the flower of> Mango tree), *Navamālikā* (jasmine), *Nīlotpala* (blue lotus) are those five flowers.<sup>130</sup> For this reason each of *bāṇa* (<the five> arrow<s> <of Kāma>), its synonym *śara* (arrow), and its associated terms *kāmabāṇa* (the arrow of Kāma) and *kāmāstra* (the weapon of Kāma) denotes 5. *Tejas* (fire), *vāyu* (air), *pṛthvī* (earth), *ākāśa* (space/ether), and *ap* (water) are the five elements (*pañcabhūta*). The whole visible world is composed of one or more of these five elements.<sup>131</sup> This is why *bhūta* (<the five> element<s>) corresponds to 5. The chief instruments, with which a human being is equipped for acquiring knowledge from the external world and react to it, are the five *indriyas* (sense-organs). Those five *indriyas* are *ghrāṇa* (olfactory system), *tvag* (somatosensory system), *rasanā* (gustatory perception system), *cakṣu* (ocular system), and *śrotra* (auditory system).<sup>132</sup> Since the pleasure

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<sup>125</sup> Cappeller 1891: 486; Apte 1893: 381.

<sup>126</sup> Apte 1893: 291.

<sup>127</sup> Cappeller 1891: 539.

<sup>128</sup> VaSi, pp. 369-370.

<sup>129</sup> Jadhav 2018: 55.

<sup>130</sup> Mani 1975: 378f.; Apte 1893: 224 & 248; Cappeller 1891: 40 & 174.

<sup>131</sup> Cappeller 1891: 382; Mani 1975: 547.

<sup>132</sup> Harshananda 2008 II:68f.

acquired through these five sense-organs is *viṣaya*<sup>133</sup>, the *viṣaya* denotes 5. Those five pleasures are *gandha* (smell), *sparsā* (touch), *rasa* (taste), *rūpa* (form), and *śabda* (sound).<sup>134</sup>

Among these six word-numerals *kāmabāṇa* and *kāmāstra* are not found in Shukla's compilation.<sup>135</sup>

2.7 *Āyurveda* recognizes six tastes, namely, *madhur* (sweet), *amla* (sour), *lavaṇa* (salty), *kaṭu* (bitter), *tikta* (pungent), and *kasāya* (astringent). They are called either *ṣaḍrasa* (<six> taste<s>) or simply *rasa*. This is why *rasa* represents 6. Unlike many other countries, the Indian subcontinent has six seasons. They are *vasanta* (spring), *griṣma* (summer), *varṣā* (rainy/monsoon), *śarad* (autumn), *hemanta* (fall winter), and *śiśira* (winter). This is why *ṛtu* (<six> season<s>) denotes 6. There is no need to explain why *ṣaṭka* (consisting of six)<sup>136</sup> represents 6 as its meaning itself is sufficient.

Catherine Morice-Singh gives an indication on how the uncertain and seemingly lost link between *khara* (hard, harsh, rough, etc.) and the number 6 can be recovered.<sup>137</sup> She had noticed that in the notes attached to one manuscript of the *Gaṇita-sāra-saṅgraha* found by Hiralal Jain in Karanja, District Akola, Maharashtra short comments about the meaning of *khara* in a *bhūta-saṃkhyā* (word-numeral) context appear in the beginning of chapter two. These notes can also be read in the Annexe 5 of L. C. Jain's translation of the *Gaṇita-sāra-saṅgraha* into Hindi. There, *khara* is first linked to *jīva* (*khara iti ṣaḍjīva*). Then, a link between *puruṣa* and *jīva* (*puruṣa – jīvoityarthah*) and finally a saying, are given: “*satya-saṃdhaḥkharojñeyahkharo 'pi puruṣomataḥ*”.<sup>138</sup> The general meaning would be that man is one among the numerous categories of beings (*jīva*) which may, according to Jain ontology, be grouped into six main ones, five *sthāvaras* (immobile beings) and one *trasa* (mobile being). But man is the only one who has the capacity to be firm enough and true to his engagements if he decides to know that it is his own firmness and efforts which could lead him to gain ultimate liberation. This is why *khara* represent 6. At two places, Kittel writes that *khara = kara*.<sup>139</sup> In

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<sup>133</sup> Cappeller 1891: 511.

<sup>134</sup> GaSāSa<sub>1</sub>, p. 293.

<sup>135</sup> VaSi, p. 370.

<sup>136</sup> Cappeller 1891: 565.

<sup>137</sup> Morice-Singh 2016: 42.

<sup>138</sup> Morice-Singh 2015: 71; GaSāSa<sub>2</sub>, p. 62.

<sup>139</sup> NāCaPro, pp. 109 & 140.

the notes attached to Karanja edition of the *Gaṇita-sāra-saṅgraha* are found no links between *khara* and *kara*.

Among these four word-numerals *ṣaṭka* is not found in Shukla's compilation.<sup>140</sup>

2.8 According to *Paurāṇika* thoughts, there are seven mountains in the region of *Bharatavarṣa*. They are Mahendra, Śukti, Malaya, Ṛakṣaka, Pāriyātra, Sahya, and Vindhya.<sup>141</sup> This is why *adri* (<seven> mountain<s>) represents 7. Since *giri*, *naga*, and *śaila*, are the synonyms of *adri*<sup>142</sup> and its associated terms are *agendra* (king of mountains) and *kulagiri* (family of mountains), each of them shows 7. Since seven rays of the sun are its seven bright horses,<sup>143</sup> *dineśahaya* (sun's <seven> horse<s>) denotes 7. The present author could not identify the complete meaning of each of *hayanikara*, *hayatati*, *hayavrāta*, and *turagavrāta* but is sure that each of them represents 7 as each of them contains the term *haya* (horse) or *turaga* (horse). *Aṅgirasarṣis* have been said to be seven in number. By way of the *Paurāṇika* tradition they have reached us as *saptarṣi* (seven sages <or seven stars of the Great Bear>).<sup>144</sup> Since *muni* (ascetics) and *yati* (ascetics) are the synonyms of *ṛṣi*, each of them is a sign of 7.

Among these thirteen word-numerals *agendra*, *dineśahaya*, *hayanikara*, *hayatati*, *hayavrāta*, *kulagiri*, and *turagavrāta* are not found in Shukla's compilation.<sup>145</sup>

2.9 According to the *Paurāṇika* thoughts, eight elephants hold the earth in eight directions. Those eight elephants are Airāvata in *pūrva* (east), Puṇḍarīka in *āgneya* (south-east), Vāmana in *dakṣiṇa* (south), Kumuda in *nairṛta* (south-west), Añjana in *paścima* (west), Puṣpadanta in *vāyavya* (north-west), Sārvabhauma in *uttara* (north), and Supratīka in *īśāna* (north-east).<sup>146</sup> This is why each of *danti* (elephant<s> <in eight directions>), its synonyms *gaja* (elephant), *kari* (*karī* or *karin*, <wild> elephant), and, *nāga* (male elephant)<sup>147</sup>, and its associated terms *digdanti* (<eight> direction<s> of elephant<s>), *dikkari* (<eight> direction<s> of elephant<s>), *diś* (<eight>

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<sup>140</sup> VaSi, p. 370.

<sup>141</sup> SiŚi, *Golādhyāya*, *Bhuvanakośa*, v. 42, p. 351.

<sup>142</sup> Apte 1893: 275.

<sup>143</sup> Jadhav 1998b: 3.

<sup>144</sup> Jadhav 1998b: 3.

<sup>145</sup> VaSi, p. 370.

<sup>146</sup> AKo v. 1.3.3, p. 25.

<sup>147</sup> Cappeller 1891: 265.

direction<s> <of elephants>), *diśā* (<eight> direction<s> <of elephants>), *diśāgaja* (<eight> direction<s> of elephant<s>), *diśākari* (<eight> direction<s> of elephant<s>), *gajavraja* (dust-particle<s> <flying from the toenails> of an elephant), and *madagaja* (elephant's rut) denotes 8. The present author could not identify the complete meaning of each of *āsāgaja*, and *gajavrāta* but is sure that each of them represents 8 as each of them contains the term *gaja* (elephant). He could not identify why *hari* represents 8. Vasu was Dakṣa's daughter. Dharmadeva was her husband. *Aṣṭavasus* (eight *vasus*) were born to them. They were *gaṇadevatās* (troops of deities who appear in classes). According to the *Bhāgavata Purāṇa*, they are Droṇa, Prāṇa, Dhruva, Arka, Agni, Doṣa, Vasu, and Vibhāvasu. They are, in the *Harivaṃśa Purāṇa*, Akha, Dhara, Dhruva, Soma, Anila, Anala, Pratyūṣa, and Prabhāsa. According to the *Mahābhārata*, they are Dhara, Dhruva, Soma, Ahar, Anila, Anala, Pratyūṣa, and Prabhāsa. According to certain *purāṇas*, they are the sons of Kaśyapa. In the *Viṣṇu Purāṇa*, they are Āpa, Dhruva, Soma, Dharmā, Anila, Anala, Pratyūṣa, and Prabhāsa. This variation in their names only suggests that some of them have two or more names.<sup>148</sup> This is why *vasu* (<eight> *vasu*<s>) shows 8.

Among these sixteen word-numerals, *āsāgaja*, *digdanti*, *dikkari*, *diśā*, *diśāgaja*, *diśākari*, *gajavraja*, *gajavrāta*, *hari*, and *nāga* are not found in Shukla's compilation<sup>149</sup> but *digdanti* of them occurs in the *Vyavahāra-gaṇita* of Rājāditya (12<sup>th</sup> century).<sup>150</sup>

2.10 According to the *Paurāṇika* thoughts, *mahāpadma*, *padma*, *śaṅkha*, *makara*, *kacchapa*, *mukunda*, *kunda*, *nīla*, and *kharva* are *navanidhi* (nine treasures) and they belong to Kubera, the god of wealth.<sup>151</sup> This is why *nidhi* (<*nava*>*nidhi*) represents 9. A human being is said to have nine exit points called *navadvāra* (nine gates) or *navarandhra* (nine outlets) through one of which the soul finally leaves the body. They are two eyes, two nostrils, two ears, one mouth, the anus, and the genitals.<sup>152</sup> This is why *randhra* becomes a sign of 9.

2.11 When Sanandana, Sanaka, Sanātana, and Sanatkumāra created by Lord Brahmā showed no interest at all in the creation of the world, Brahmā became angry to such an extent that he prepared to destroy all the three parts of the world. At that time, the whole world was illuminated by the radiance that emanated from the fire of his fury. Then from his shining

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<sup>148</sup> Mani 1975: 65f.

<sup>149</sup> VaSi, p. 370.

<sup>150</sup> Jadhav 2018: 56.

<sup>151</sup> Mani 1975: 544; GaSāSa<sub>1</sub>, p. 291; also see DraSaṃ, p. x.

<sup>152</sup> BhaGī v. 5.13, pp. 255f.

eyebrows, which were curved with fury, a figure of unbearable radiance like the mid-day sun came out. That figure was Rudra. Half of the fierce body of Rudra was a woman and the other half was a man. As soon as Brahmā said ‘divide’, Rudra split himself into the figure of a man and the figure of a woman. He again divided the body of the man into eleven figures. These eleven figures are the eleven Rudras. Similarly, from the female half eleven Rudrāṅīs came into being. They became the wives of the eleven Rudras.<sup>153</sup> This is why *rudra* represents 11. The names of the eleven Rudras are given differently in the different *Purāṇas*. According to some *Purāṇas*, the eleven Rudras are Aja, Ekapāda or Ekapāt, Ahirbudhnya, Tvaṣṭā, Rudra, Śambhu, Tryambaka, Aparājita, Īśāna, Tribhuvana, and Hara.<sup>154</sup> Since Hara is one of the eleven Rudras, *hara* denotes 11.

2.12 Aditi was the wife of Kaśyapa. The Sun was born to her. Several sons were born to her. They are known by the names Ādityas, Vasus and so on. Of these Ādityas (the sons of Aditi) are twelve in number. There is a difference of opinion as to who these twelve Ādityas are. According to the *Agni Purāṇa*, they are Varuṇa, Sūrya (the Sun), Sahasrāṁśu, Dhātā, Tapana, Savitā, Gabhstī, Ravi, Parjanya, Tvaṣṭā, Mitra, and Viṣṇu. In the *Ādi Parva* of the *Mahābhārata* it is stated that Dhātā, Aryamā, Mitra, Śukra, Varuṇa, Aṁśa, Bhaga, Vivasvān, Pūṣā, Savitā, Tvaṣṭā, and Viṣṇu are the twelve Ādityas. These names are very often used as synonyms of the Sun.<sup>155</sup> This is why *arka* (sun) denotes 12. *Bhānu*, *bhāskara*, *mārtaṇḍa*, and *ravi* are the synonyms of *arka*.<sup>156</sup> Each of them represents 12. *Dinakara* (one who makes day), *dinanātha* (lord of day), *dinapa* (*dina*←*adhi*→*pa*, lord of day), *dineśa* (lord of day), *divasādhipa* (*divasa*←*adhipa*, lord of day), *divasakara* (one who makes day), and *padminīmitra* (lotus-friend) are semantically associated to *arka*. Each of them corresponds to 12. Vidyādhara, Apsarases (celestial maids), Yakṣas, Gandharvas, Kinnaras and so on are the groups of demi-gods. All these groups live in the sky. Of these, Vidyādhara wear garlands.<sup>157</sup> The Vidyādhara (keepers of knowledge) seem to be a group of twelve demi-gods. This may be the reason for the fact that *vidyādhara* represents 12. *Divasādhipa*, *divasakara*, and *vidyādhara*, are not found among the thirteen word-numerals in Shukla’s compilation.<sup>158</sup>

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<sup>153</sup> Mani 1975: 654.

<sup>154</sup> Mani 1975: 654.

<sup>155</sup> Mani 1975: 770.

<sup>156</sup> Cappeller 1891: 13 & 225; Apte 1893: 420.

<sup>157</sup> Mani 1975: 850.

<sup>158</sup> VaSi, p. 371.

2.13 The universe (*prapañca*) is perishable. At one time, it takes its origin. At another time, it perishes. Brahmā, the creator of the universe, undergoes birth and death. The period between his birth and his death is known as *mahākalpa*. His one day is called *kalpakāla* or simply *kalpa*. In the *Purānas* one *kalpa* is divided into fourteen parts. The ruler of each of these parts is Manu. This way, there are fourteen Manus. The life-span of each Manu is called a Manvantaram.<sup>159</sup> This is why *manu* designates 14.

2.14 Fifteen days make one *pakṣa* (fortnight).<sup>160</sup> This is why it refers to 15.

2.15 The present author could not identify as to why each of *dharaṇīśvara*, *mahīśvara*, and *rāja* represents 16. None of these three word-numerals is found in Shukla's compilation.<sup>161</sup>

2.16 According the Rāmāyaṇa, *Rāvaṇa* was the demon king of Laṅkā. The present author could not identify for certain as to why *rāvaṇakara* indicates 20. *Rāvaṇa* had ten heads. Keeping this in view, *rāvaṇakara* seems to mean to be twenty, ten multiplied by two, hands (*kara*). It is not found in Shukla's compilation.<sup>162</sup>

2.17 We have observed above that Nāgavarma allows *adri* to denote both 1 and 7, *kara* to represent both 1 and 6, and *pakṣa* to signify both 2 and 15. He accommodated both meanings for each of them. In this way, he represented what were prevalent. But for a reader it is difficult, but not impossible on the basis of context, to choose the corresponding significance.

2.18 Nāgavarma not only expresses the number 67,108,864 by using *yuga* (4), *ṛtu* (6), *gaja* (8), *nāga* (8), *ambara* (0), *mṛgadhara* (1), *naga* (7), *ṣaṭka* (6),<sup>163</sup> but also shows the number 16 as the sum of *pura* (3), *bāṇa* (5), *vahni* (3), *śara* (5).<sup>164</sup>

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<sup>159</sup> Mani 1975: 482.

<sup>160</sup> Cappeller 1891: 288.

<sup>161</sup> VaSi, p. 371.

<sup>162</sup> VaSi, p. 371.

<sup>163</sup> NāCaPro, p. 64.

<sup>164</sup> NāCaPro, p. 89.

2.19 The period between the ninth century and 1250 is the classical age of Kannada literature. Kannada appears to have been in common use for literary purpose during this period. Kannada of this period has been preserved in several works written by Jaina scholars.<sup>165</sup> Nāgavarma, who is said to have lived from 950 to 1015, became popular during this period. During this period Kannada has borrowed many words from Sanskrit either in their true form or in the form in which Sanskrit terms changed to suit the tongue of the Kannada people.<sup>166</sup> This is why almost all the word-numerals referred to by Nāgavarma are in Sanskrit.

#### 4. Concluding Remarks

Every word-numeral referred to by Nāgavarma is the bearer of concepts rooted in the Jaina cosmography or one of the two epics or the genealogy of gods, demi-gods, and troops of gods who appear in classes or the parts of human body or time-measures or sacrificial fires or the seas in Vedic India or the epoch or the weapon of the god of sexual desire or the constituents of the visible universe or *Āyurveda* or the Indian seasons or the groups of numbers or the *Paurāṇika* geography of mountains or the rays of the sun in terms of horses or the stars in the sky or the cosmography, using elephants or treasures or the creation of man and woman in the world.

Almost all the word-numerals referred to by Nāgavarma are in Sanskrit. Those word-numerals are the products of interlinking mathematics, particularly numbers, with other disciplines of learning.

Some of the very typical Jaina terminology except for *adri*, in the sense of *Meru*, and *khara* is totally missing from the word-numerals Nāgavarma employed, although he was of Jaina faith. For example, *rūpa* (1), *naya* (2), *ratna* (3), *gati* (4), *kaṣāya* (4), *vrata* (5), *jīva* (6), *dravya* (6), *leśyā* (6), *tattva* (7), *karman* (8), and *padārtha* (9) are not employed as word-numerals as they are employed in the *Gaṇita-sāra-saṅgraha* by Mahāvīra (c. 850), who was also of Jaina faith.<sup>167</sup> The plausible reason in this regard may be that he had written the *Kannaḍa Chandassu* (“Canarese Prosody”) before he became Jaina by faith. After all, he was an avowed Jaina. The other may be a reason that he freely employed the word-numerals irrespective of faith.

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<sup>165</sup>Kittel 1894: iii-iv; Mugali 2006: 179.

<sup>166</sup>Kittel 1894: xiv.

<sup>167</sup>Morice-Singh 2015: 64-73.

## ACKNOWLEDGEMENTS

The present author is grateful to the editor of this journal for suggestions and comments. He would also like to place on record his thanks to the referee of this paper for offering suggestions and comments, especially a detailed comment on the term *khara*.

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