माधवीयधातुवृत्तिसैद्धान्तिकानुक्रमणी
Mādhavīyā Dhātuvṛtti Canonical Index

Introduction

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I.   Distinctive feature of the canonical index

The Pāṇinian *Dhātupāṭha* is the list of roots that is an essential constituent of Pāṇini's grammar and that is required by the set of rules in his *Aṣṭādhyāyī* for the derivation of innumerable verbal forms and nominal derivates. As a constituent of the grammar that works in conjunction with the ruleset in the *Aṣṭādhyāyī*, the *Dhātupāṭha* lists roots in forms expected by rules of the grammar. The phonetic shape of roots in this list departs in some respects from the normal prosody of Sanskrit encountered in ordinary usage. In fact, Sanskrit verbal roots are often listed by modern lexicographers, and even by editors of the *Dhātupāṭha* itself, with prosodic modifications customarily found in ordinary Sanskrit usage applied to the roots. Yet as an element in a very specific linguistic system, the root list is the source of roots in initial instruction (*upadeśe*) as opposed to in ordinary usage (*loke*). The present index restores the canonical form of roots expected as original instruction (*upadeśa*) by the rules of Pāṇini's *Aṣṭādhyāyī* and in addition systematically produces from them by the application of regular rules the form of roots normally encountered in modern bilingual lexical sources. The details of the difference between the canonical and normalized forms of roots are discussed in greater detail below in section III.

The question of what form roots should take to best serve as linguistic abstractions in a comprehensive and concise linguistic description of Sanskrit remains an open question in linguistic research.   Indian linguists from Pāṇini and Yāska onwards, and modern linguists using the historical and comparative method, have contributed to this linguistic research. The form roots take in various linguistic systems may differ depending upon the goals and design of the system. Although they leaned heavily on Pāṇini's work, the producers of the major bilingual Sanskrit dictionaries and root lists of the nineteenth and twentieth centuries generally chose to list roots in accordance with the then current knowledge of the history of the Sanskrit language as discovered through the historical and comparative method. The form of roots they abstracted for their linguistic system differs from the form of roots in Pāṇini's linguistic system in a number of respects. The *Pāṇinian Dhātuphāṭha* lists roots as basic elements in a very specific production grammar. The forms such roots take conform to the requirements of rules in the production grammar, namely to rules stated in the *Aṣṭādhyāyī*.

The history of transmission of the *Dhātupāṭha* through oral means, manuscripts, and printed editions has not maintained the root list in a form consistent with the rules of Pāṇini's *Aṣṭādhyāyī*.   The unusual prosody inherent in the canonical form of roots became normalized through the natural adaptation of sequences of sounds to those of ordinary Sanskrit. Knowledgeable transmitters and editors have preserved or restored roots to their canonical forms in varying degrees and consistencies. Roots appear normalized in spite of explicit statements by commentators such as Sāyaṇa in his *Mādhavīya Dhātuvṛtti* regarding the canonical form of roots and in spite of the expert knowledge of Pāṇinian grammar on the part of editors such as Dwarikadas Shastri. The first canonical features to suffer loss in transmission were those most unusual in ordinary Sanskrit as the language adapted. Even ancient grammarians note that nasalized vowel markers in the *Dhātupāṭha* were not recited nasalized but were just conventionally

recognized by Pāṇinian grammarians. In the *Kāśikā* under *A.* 1.3.2 *upadeśe 'j anunāsika it*, the rule stating that nasalized vowels in basic elements in original instruction such as in the *Dhātupāṭha* are markers, Jayāditya writes *pratijñātānunāsikyāḥ pāṇinīyāḥ* (cf. *Vyāḍiparibhāṣā* 121 [Abhyankar 1967: 42]). Cardona (1997: 51) explains, "That is, one accepts that a given vowel was originally nasalized as a marker according to what authoritative teachers have said earlier." Similarly, explicit statements in sūtras and headings in the *Dhātupāṭha* regarding root and marker accents testify that accents were lost in transmission; they were explicitly described because they were not explicitly transmitted. Manuscripts and most editions of the *Dhātupāṭha* do not mark accents. S. M. Katre's 1987 edition is a notable exception. However, even the last does not succeed in restoring roots to their canonical form consistently.

The current index is able to restore roots to their canonical form through the rigorous application of regular rules and the use of digital methods. The effort is motivated by a long term project to produce a computational model of Pāṇini's linguistic system. Restoring the *Dhātupāṭha* to its canonical form is an essential part of that undertaking. By applying regular rules found in Pāṇini's grammar itself to roots in the *Dhātupāṭha* and comparing the output with those found in Shastri's edition, it has been possible to discover and repair inconsistencies that would have eluded even the sharp eye of a conscientious editor.

II.   Sources

The present index derives from Scharf et al's (2009) digital edition of Dwarikadas Shastri's indices to the *Mādhavīyā Dhātuvṛtti.* Both this index and the digital emulation of Shastri's indices also found on the Sanskrit Library site are equipped with links to scanned images of pages of the *Mādhavīyā Dhātuvṛtti.* The indices are based on Shastri's 1983 edition; images are of pages scanned from the 1964 edition. The text, indices, and pagination of the 1983 edition are exactly identical to those of the 1964 edition. The only differences between the 1983 and 1964 editions are that in the 1983 edition the preface and introduction have been re-typeset and continuously paginated, the second part of the fifth appendix has been re-typeset, an additional appendix consisting of an index of particular words *viśiṣṭaśabda-sūcī* has been added (pp. 677-732), and a one-page preface has been added by the publisher. The index of particular words is an alphabetical index of selected derivates that Sāyaṇa mentions in the commentary with approval; it has not been included in the digitization. Despite the fact that the indices and scanned pages derive from different editions, all references remain intact because the substance of the shared five appendices and the pages to which they refer are exactly identical in both editions.

A.   *Bibliography*

Shastri, Dwarikadas, ed. 1964. *The Mādhavīyā Dhātuvṛtti [A treatise on Sanskrit roots based on the Dhātupāṭha of Pāṇini] by Sāyaṇācārya: With a foreword by Raghunath Sharma.* Prachya Bharati Series 1. 1st. ed. Kamachha, Varanasi: Prachya Bharati Prakashan.

स्वामी द्वारिकादासशास्त्री सम्पादकः । १९६४ । श्रीसायणाचार्यविरचिता माधवीया धातुवृत्तिः [पाणिनीयधातुपाठव्याख्यानात्मिका ।] प्राच्यभारतीग्रन्थमालायाः प्रथमं पुष्पम् । वाराणसी--प्राच्यभारतीप्रकाशनम् ।

Shastri, Dwarikadas, ed. 1983. The *Mādhavīyā Dhātuvṛtti* [A treatise on Sanskrit roots based on the *Dhātupāṭha* of Pāṇini] by Sāyaṇācārya. 2nd. ed. Kamachha, Varanasi: Tara Book Agency.

स्वामी द्वारिकादासशास्त्री सम्पादकः । १९८३ । श्रीसायणाचार्यविरचिता माधवीया धातुवृत्तिः [पाणिनीयधातुपाठव्याख्यानात्मिका] . वाराणसी--तारा बुक ऐजेंसी ।

B.   The text and indices

Dwarikadas Shastri's editions include Sāyaṇa's commentary on the *Pāṇinīya Dhātupāṭha* (pp. 1-576), and in addition Sāyaṇa's *Mādhavīyā Nāmadhātuvṛtti* (pp. 577-628). The latter is divided into four sections. The first section, *Kaṇḍvādi*, comments on roots listed in the list beginning with *kaṇḍū* 'itch' (*kaṇḍvādi*), mentioned in *A.* 3.1.27 *kaṇḍvādibhyo yak* (pp. 577-580). The second section, *Sautra-dhātu*s, comments on roots mentioned in sūtras (*sautra-dhātu*) of Pāṇini's *Aṣṭādhyāyī* (pp. 581-583). The third section, *Nāma-pratyaya-dhātu*s, comments on roots formed from lists of nominal stems (*prātipadika*) and words (*pada*). Roots formed from nominals (*nāma-pratyayāḥ dhātavaḥ*) include those formed by sūtras *A.* 3.1.8-20 *supa ātmanaḥ kyac*, etc. (pp. 583-599). Finally, the fourth section, *ṇij-anta-nāma-dhātu*s, comments in particular on roots formed by the addition of the affix *ṇic* to nominal bases mentioned in *A.* 3.1.21 *muṇḍa-miśra-ślakṣṇa-lavaṇa-vrata-vastra-hala-kala-kṛta-tūstebhyo ṇic* and *A.* 3.1.25 *satyāpa-pāśa-rūpa-vīṇā-tūla-śloka-senā-loma-tvaca-varma-varṇa-cūrṇa-curādibhyo ṇic*, as well as on roots formed by the addition of *ṇic* variously to other nominal bases (599-628). Nominal bases are included in the list *curādi* by being referred to implicitly in sūtras read in the *Dhātupāṭha* rather than by being listed explicitly. Dhātusūtra 10.296 *prātipadikād dhātvarthe bahulam iṣṭhavac ca* states that the affix *ṇic* occurs variously (*bahulam*) after a nominal stem (*prātipadikāt*) in the meaning of a root (*dhātv-arthe*) and that subsequent morphophonemic modifications occur as they do before the superlative affix *iṣṭhan*. 10.297 *tat karoti tad ācaṣṭe* provides a couple of the meanings that condition the affix after a nominal stem meaning x: so and so does x, and so and so describes x. For example, the affix *ṇic* occurs after the stem *paṭu* 'smart' to form a verb root meaning to describe as smart. Thus the 3sa pre *paṭayati* occurs alternately with the phrase *paṭum ācaṣṭe* "He describes him as smart." The nominal base *paṭu* is not explicitly read in the list *curādi*; it is included implicitly by the statement of *dhātusūtra*s 10.296-297.

Appendices 2-5, pp. 634-675 in Shastri's editions, provide indices to roots discussed in the *Mādhavīyā Dhātuvṛtti* and *Mādhavīyā Nāmadhātuvṛtti*. Appendix 2 (pp. 634-668) is an alphabetical index of roots in the *Dhātupāṭha*. The appendix includes the sense terms provided in the *Dhātupāṭha* (sometimes with ellipsis), the class (*gaṇa*), and the *Dhātupāṭha* sūtra number within the class, and also indicates variant forms of roots reported in the *Mādhavīyā Dhātuvṛtti* by the addition of *pā* (an abbreviation for *pāṭhāntara* 'variant reading') in square brackets to the index entry. Appendix 3 (p. 668) is an index of the *sautradhātu*s in alphabetic order with sense terms and the number of the sūtra in the *sautradhātu* section of the *Mādhavīyā Nāmadhātuvṛtti*. Appendix 4 (p. 669) is

an index of the roots in the gaṇa *kaṇḍvādi* in alphabetic order with an indication of alternate readings (by the addition of *pā* in square brackets) and with reference to the number of the sūtra discussing the root in the *kaṇḍvādi* section of the *Mādhavīyā Nāmadhātuvṛtti*. Finally, appendix 5 lists stems and the stems of words that serve as bases for the root-forming affixes in two parts: part 1 (pp. 670-672) lists stems mentioned in *A.* 3.1.8-20 discussed in section 3 of the *Mādhavīyā Nāmadhātuvṛtti*, and part 2 (pp. 673-675) lists stems that take the affix **ṇic** discussed in section 4 of the *Mādhavīyā Nāmadhātuvṛtti*. Appendix 5 lists stems in order of occurrence (not alphabetic order) with the number of the page on which the root is discussed.

III. The canonical versus normalized form of roots

The present index restores the canonical form of roots and in addition presents the normalized form of the root. The canonical form of the root is the form in which Pāṇini's *Aṣṭādhyāyī* expects to receive the root for the application of its rules. The canonical form is properly given in original instruction (*upadeśa*) in the *Dhātupāṭha* and is opposed to the normalized form of the root as it would appear with a number of replacements and sandhi applied by rules of the grammar. Modern lexical sources such as Monier-Williams' *A Sanskrit-English Dictionary* and grammatical sources such as Whitney's Roots generally cite roots in their normalized form. No edition of the *Dhātupāṭha* has hitherto properly represented roots in their canonical form, nor has any root list or lexicon systematically accounted for the relation between the canonical form of the root and the normalized form.

A. *The canonical form of roots*

1. The inclusion of the *Dhātupāṭha* as an integral appendix to the grammar.

It is known that the *Dhātupāṭha* is an integral element in Pāṇini's grammatical system because Pāṇini explicitly refers to roots in the *Dhātupāṭha* and assigns each the term *dhātu* in *A.* 1.3.1 *bhūvādayo dhātavaḥ*. Roots are subject to affixation by being mentioned in the ablative or genitive in the third adhyāya of the *Aṣṭādhyāyī* where affixes mentioned in the nominative are introduced after them. Roots are mentioned individually, in lists, and by the general designation *dhātu*. Regardless of which method is used to refer to a root, the root must have the phonetic shape expected by the rules in which it is mentioned in order to be subject to the modifications those rules provide. The next paragraphs demonstrate the extent of the reliance of the *Aṣṭādhyāyī* on the *Dhātupāṭha* by detailing some of the general references to roots. While it may be arguable that the ruleset is self-sufficient and does not need an appended root list where the rules themselves mention the specific roots to which they apply, it is blatantly obvious that a supplemental appendix is required where roots are referred to using terms for lists and the generic term *dhātu*. Rules that refer to roots in this more general manner account for essential and ubiquitous speech forms that would be underivable if the reference to specific root forms were not achieved by incorporation of the *Dhātupāṭha* in the system of linguistic description.

Roots are included in Pāṇini's grammatical system by being referred to by the term *dhātu*. The ablative of the term *dhātu* appears in *A.* 3.1.7 *dhātoḥ karmaṇaḥ samānakartṛkād icchāyāṁ vā*, *A.* 3.1.22 *dhātor ekāco halādeḥ kriyāsamabhihāre yaṅ*, and *A.* 3.1.91 *dhātoḥ*. The first two of these rules introduces affixes that form secondary roots from roots. *A.* 3.1.7 introduces the affix *san* after roots to form desiderative roots, and *A.* 3.1.22 introduces the affix *yaṅ* after roots to form intensive roots. The term *dhātoḥ* in *A.* 3.1.22 recurs in sūtras through *A.* 3.1.90. Other secondary root-forming affixes are introduced in the section ending with *A.* 3.1.32 *sanādyantāḥ dhātavaḥ*. Stem-forming affixes called *vikaraṇa* are introduced after roots in *A.* 3.1.33-3.1.90. The third mention of the term *dhātoḥ* is a heading (*adhikāra*) valid until the end of the third adhyāya. Under this heading, about 540 sūtras introduce nearly 180 affixes. Most of the affixes introduced under this heading (about 113) are termed kṛt and form nominal derivates. The *kṛt* affixes include six termed also *kṛtya* that form gerundives. Under the heading *A.* 3.1.91, *A.* 3.3.1 *uṇādayo bahulam* introduces the affixes in the list beginning with *uṇ*, a list taken to refer to affixes introduced in the *Uṇādisūtra*s included as an appendix to the grammar by this reference. The rest of the affixes introduced under the heading *A.* 3.1.91 *dhātoḥ* are verbal affixes. These verbal affixes include the ten *l*-affixes, their eighteen immediate replacements called *tiṅ*, and their twenty-one subsequent replacements.

Roots are included in Pāṇini's system by being included in various lists of roots mentioned in the *Aṣṭādhyāyī*. The most prominent lists are the ten major divisions of the *Dhātupāṭha*, namely, *bhvādi*, *adādi*, etc. Ten rules serve as the general rules that primarily account for the derivation of present stems from these roots. They are listed here in the order of the *Dhātupāṭha* divisions that correspond to the ten classes of presents in modern Sanskrit grammar texts.

Table 1
Major lists referred to for the formation of present stems

1	*A.* 3.1.68	*kartari śap*
2	*A.* 2.4.72	*adiprabhṛtibhyaḥ śapaḥ* (*luk* 58)
3	*A.* 2.4.75	*juhotyādibhyaḥ śluḥ* (*śapaḥ* 72)
4	*A.* 3.1.69	*divādibhyaḥ śyan*
5	*A.* 3.1.73	*svādibhyaḥ śnuḥ*
6	*A.* 3.1.77	*tudādibhyaḥ śaḥ*
7	*A.* 3.1.78	*rudhādibhyaḥ śnam*
8	*A.* 3.1.79	*tanādikṛñbhyaḥ uḥ*
9	*A.* 3.1.81	*kryādibhyaḥ śnā*
10	*A.* 3.1.25	*satyāpa..curādibhyo ṇic*

The last rule, *A.* 3.1.25, provides the root-forming affix **ṇic** after roots listed in the section of the *Dhātupāṭha* beginning with *cur*. The derived root formed by the addition of **ṇic** is itself termed a root (*dhātu*) by *A.* 3.1.32 and is provided with affixes that form not only present tense verbal forms but other derivates besides. *A.* 3.1.68 provides the stem-forming affix **śap** generally after roots under the condition that an agent is to be denoted. This affix remains after class 1 *bhvādi* roots and after the secondary roots ending in **ṇic** formed from class 10 *curādi* roots. The affix **śap** is replaced by two different null affixes after roots of the second class *adādi* and the third class *juhotyādi*. Both null affixes delete

the affix *śap* and nullify any of its effects. *A.* 2.4.72 provides the zero affix *luk* after second class roots. After third class roots, *A.* 2.4.74 provides the zero affix *ślu* that conditions reduplication in addition. In exception to *A.* 3.1.68, the rest of the rules *A.* 3.1.69-81 provide different stem forming affixes, instead of the affix *śap*, after roots of classes 4-9. *A.* 3.1.69 provides the affix *śyan* after roots in the list beginning with *div*, *A.* 3.1.73 provides the affix *śnu* after roots in the list beginning with *su*, *A.* 3.1.77 provides the affix *śa* after roots in the list beginning with *tud*, *A.* 3.1.78 provides the infix *śnam* after the last vowel of roots in the list beginning with *rudh*, *A.* 3.1.79 provides the affix *u* after roots in the list beginning with *tan*, and *A.* 3.1.81 provides the affix *śnā* after roots in the list beginning with *krī*. Ubiquitous Sanskrit present tense verb forms would be underivable if these lists did not succeed in referring to roots listed in the *Dhātupāṭha*.

2.   Markers

Markers are used to allow reference to items so-marked just by reference to the marker in rules that condition various sorts of operations. The system of reference utilizing markers efficiently allows rules to apply to various roots not situated contiguously in the *Dhātupāṭha* without creating an additional list. Reference using markers thereby avoids the prolixity of listing roots in more than one list.

The seven rules immediately following *A.* 1.3.1 that introduces the root list, *A.* 1.3.2-8, designate certain sounds given in original instruction (*upadeśe*) as markers (*it*). The sounds designated as markers in roots include nasalized vowels (*A.* 1.3.2 *upadeśe 'j anunāsika it*), final consonants (*A.* 1.3.3 *hal antyam*), and the initial diphones *ñi*, *ṭu*, and *ḍu* (*A.* 1.3.5 *ādir ñiṭuḍavaḥ*). Markers are excluded from the root itself by being replaced by zero (*lopa*) at the outset (*A.* 1.3.9 *tasya lopaḥ*). Initial root markers include, besides the three diphones *ñi*, *ṭu*, and *ḍu*, the vowels *ī*, *u*, and *o*, the last of which occurs both alone as well as with *ṭu*. Initial markers occur only low-pitched. Final root markers include the vowels *a*, *ā*, *i*, *ī*, *u*, *ū*, *ṛ*, *ḷ*, *e*, and *o*, which may be high-pitched, low-pitched, or circumflexed, and the consonants *k*, *ṅ*, *ñ*, *ṭ*, *ṇ*, *p*, and *ṣ*. The consonant markers *ṅ*, and *ṣ* occur singly as well as following a vowel marker. In addition, the diphone *ir* occurs as a unitary final marker. (The *i* of *ir* does not count as a marker by itself according to the statement *iritāṃ samudāyasyetsañjñā* cited in the *Kāśikā* on *A.* 7.1.58 *idito num dhātoḥ*. [Note: The reference given there, "7.2.4, vt." was not found in the MBh.]) Final vowel markers occur after consonant-final roots; final consonant markers occur after vowel-final roots. Vowels, both those that are markers and those belonging to the root proper, are accented; the accent itself serves the function of a marker.

Numerous rules in the *Aṣṭādhyāyī* refer to roots tagged with phonetic markers by the use of adjectival compounds that explicitly mention just the markers. For example, the terms *ṅit*, *ñit*, *ṣit*, *idit*, *odit*, *anudāttet*, *svaritet*, etc. are bahuvrīhi compounds consisting of the term *it* 'marker', and the markers (shown in bold) *ṅ*, *ñ*, *ṣ*, *i*, *o*, a low-pitched vowel, a circumflexed vowel, etc., respectively. Vowels in technical terms of the grammar are often tagged with *t* to restrict reference to vowels of just the length of vowel mentioned in accordance with *A.* 1.1.70 *taparas tatkālasya*. Such is the case with the term *idit*. Sometimes the *t* is added just to prevent confusion from resulting from the application of vowel sandhi, as in the case of the term *odit*. These bahuvrīhi compounds mean, "those whose marker is x", where x stands for one of the markers. While affixes and even

nominal stems (*prātipadika*s) are affixed with markers, many of these bahuvrīhi compounds refer to roots so marked. The terms *ṅit* and *ñit* in *A.* 1.3.12 and *A.* 1.3.72 respectively refer to roots marked with *ṅ* and roots marked with *ñ* respectively. The former rule provides that verbal terminations termed *ātmanepada* occur after roots marked with *ṅ* and the latter that such terminations occur after roots marked with *ñ* under the additional condition that the result of the action accrue to the agent. (The similar relevance of these rules to roots with accented vowel markers will be discussed shortly.) A search in the *Mādhavīyā Dhātuvṛtti* Canonical Index for all roots marked with *ṅ* displays 55 roots termed *ṅit* and subject to *A.* 1.3.12. [To implement such a search, click on the plus sign to the right of 'Marker' in the search panel at the left of the Index page. Markers are displayed in a vertical list. Click on *ṅ*. A capital 'N' appears in the Marker text box and the Marker check box gets checked. Alternatively, one can simply type 'N' in the text box. Click 'Refresh'.] A similar search for *ñit* roots displays 45 roots subject to *A.* 1.3.72.

Vowel marker accents serve as one of the major organizing features of the *Dhātupāṭha*. Sūtras and headings in the *Dhātupāṭha* explicitly state the range of marker accents, and Sāyaṇa frequently adds remarks reiterating their range and noting specifics about them in his commentary. Marker accents condition the introduction of verbal terminations termed *ātmanepada* or *parasmaipada* just as the markers *ṅ* and *ñ* do. Low-pitched vowel markers condition the introduction of ātmanepada terminations, just as does the final consonant marker *ṅ*, in accordance with *A.* 1.3.12 *anudāttaṅita ātmanepadam*, and circumflexed vowel markers condition the introduction of ātmanepada terminations under the condition that the fruit of the action accrue to the agent, just as does the final consonant marker *ñ*, in accordance with *A.* 1.3.72 *svaritañitaḥ kartrabhiprāye kriyāphale*. In the absence of the semantic condition that the fruit of the action accrue to the agent in roots marked with a circumflexed vowel or final *ñ*, consonant-final roots with high-pitched vowel markers and vowel-final roots with the absence of a final consonant marker constitute the remainder after which parasmaipada terminations are introduced in accordance with *A.* 1.3.78 *śeṣāt kartari parasmaipadam*.

3.   Marker-like root features

Certain features of roots themselves, rather than their markers, serve to condition operations in the grammar just as markers do. These features include root vowel accent and initial retroflex *ṣ* and *ṇ*.

a.   Root vowel accent

Root vowel accents serve as one of the subordinate organizing features of the *Dhātupāṭha*. Root accents are frequently specified in sūtras and headings in the *Dhātupāṭha* along with vowel marker accents, and Sāyaṇa remarks on their range and specifics in the same manner as he remarks on those of the latter. Root vowel accents determine whether certain affixes introduced after roots get an initial augment *i*. A general rule, *A.* 7.2.35 *ārdhadhātukasyeḍ valādeḥ*, provides for the augment in affixes termed *ārdhadhātuka* (by *A.* 3.4.113-117) that begin with a consonant other than *y*. In exception to *A.* 7.2.35, in accordance with *A.* 7.2.10 *ekāca upadeśe 'nudāttāt*, monosyllabic roots with low-pitched root vowels in the *Dhātupāṭha* serve as the condition

for the absence of the initial augment *i* in affixes that follow them. Thus the root *ḍudāñ* is read with a low-pitched (*anudātta*) root vowel. In accordance with *A.* 7.2.10, affixes provided after this root do not get the initial augment *i*. For example the affix *tṛc*, provided in accordance with *A.* 3.1.133, does not, yielding the form *dātā* (m1s of *dātṛ* < *dā* + *tṛ*). Root vowel accents in the *Dhātupāṭha* are indeed hardly different from markers in that they are completely independent of the accent of the root in derived forms. Regardless of how they are accented in the *Dhātupāṭha*, all roots become oxytone (high-pitched on their last vowel) in accordance with *A.* 6.1.162 *dhātoḥ*. [Note: Vowel markers have not yet been nasalized nor have accents and accent markers yet been added to our canonical *Dhātupāṭha* under construction.] Root accents in the *Dhātupāṭha* therefore serve just the specific function specified by *A.* 7.2.10 of indicating whether monosyllabic roots do or do not condition the addition of the initial *i*-augment to affixes provided after those roots.

b. **Initial retroflex *ṣ* and *ṇ***

Initial retroflex consonants are rare in Sanskrit roots. The only Sanskrit roots that appear in usage with an initial retroflex spirant or nasal not made retroflex by prosody are *ṣṭhīv* (2x), *ṣṭhīv* (2x), and *ṣvask*. [Roots that occur in ordinary usage with initial retroflex *ṣ* are locatable in the Canonical Index by entering 'z' in the Normalized Root text box, selecting 'prefix' from the pull-down menu to its right and clicking 'Refresh'. A search on such roots with initial 'R' yields no results. Enter '(z|R)' and selecting 'prefix' also finds just these five roots.] Yet there are 82 other roots taught in the *Dhātupāṭha* (or in the root lists commented upon by Sāyaṇa in his *Nāmadhātuvṛtti*) with initial retroflex *ṣ* (plus 21 variants mentioned in the *Dhātuvṛtti*s), and 35 roots taught with initial retroflex *ṇ* (plus three variants mentioned in the *Dhātuvṛtti*s). [To list retroflex *ṣ*-initial or *ṇ*-initial roots in the Canonical Index, type 'z' or 'R' respectively in the Root text box in the search panel at the left of the Index page, select 'prefix' from the pull down menu to the right of the text box, and click 'Refresh'.] Initial retroflex *ṣ* and *ṇ* in the *Dhātupāṭha* serve to mark roots as subject to retroflection under specific conditions. With the exception of *ṣṭhīv*, *ṣṭhīv*, and *ṣvask*, all roots with initial retroflex *ṣ* and *ṇ* replace the initial retroflex by the corresponding dental in accordance with *A.* 6.1.64 *dhātvādeḥ ṣaḥ saḥ*, and *A.* 6.1.65 *ṇo naḥ*. Retroflexion then occurs to the dental *s* or *n* of a root only if it is a replacement. *A.* 8.3.59 *ādeśapratyayayoḥ* specifies that the retroflex (*mūrdhanyaḥ* 8.3.55) provided after *h*, a semivowel, or a vowel other than one of the *a*-class occurs only in place of an *s* (*saḥ* 8.3.56) that belongs to an affix or is a replacement; an original dental *s* is not subject to replacement. *A.* 8.4.14 *upasargād asamāse 'pi ṇopadeśasya* provides that the dental *n* (*no* 8.4.1) even of an uncompounded root after a preverb that contains *r* or *ṣ* (*raṣābhyām* 8.4.1) is replaced by retroflex *ṇ* (*ṇaḥ* 8.4.1) under the condition that the root contains an *n* that is a replacement of an originally taught retroflex *ṇ*.

The purpose of listing roots with initial retroflex *ṣ* and *ṇ* in the *Dhātupāṭha* is to mark the roots so listed as subject to retroflection in the conditioning environments mentioned in *A.* 8.3.59 and 8.4.14. In answer to the question, "Which roots are listed with retroflex *ṣ* for the purpose of determining the proper distribution of retroflex *ṣ*," (*ṣatvavyavasthārthaṁ ṣādayo dhātavaḥ kecid upadiṣṭāḥ. ke punas te.*) and "Which roots

are listed with retroflex *ṇ* for the purpose of determining the proper distribution of the rule for retroflex *ṇ*," (*ṇatvavidher vyavasthārtham ṇādayo dhātavaḥ kecid upadiṣyante. ke punas te.*) in the *Kāśikā* under *A.* 6.1.64-65, Vāmana answers, "Those that are read in that way" (*ye tathā paṭhyante*). It is therefore clear that the *Dhātupāṭha* forms part of an integral system of grammar with the rules of the *Aṣṭādhyāyī*. The latter depends upon specific indications in the former for the proper application of its rules. Vāmana does go on to describe which roots are listed with retroflex *ṣ* and *ṇ* and which with dental *s* and *n*. There are 105 roots in the *Dhātupāṭha* including the lists commented upon in the *Nāmadhātuvṛtti* (plus 26 variants mentioned in the *Dhātuvṛtti*s) taught with original dental *s* and 18 (plus 1 variant) with original dental *n*. [These can be displayed by typing 's' or 'n' respectively in the Root text box in the search panel at the left of the Index page, selecting 'prefix' from the pull down menu to the right of the text box, and clicking 'Refresh'.]

i. *Commentatorial verification of canonical retroflection*

Sāyaṇa frequently makes comments in the *Mādhavīya Dhātuvṛtti* that explicitly affirm that roots are to be listed with initial retroflex *ṣ* or *ṇ*. For example, under 1.108 *ṣṭuc*, 1.121 *ṣasj*, 1.639 *ṣṭyai*, and 8.2 *ṣaṇ*, he cites *A.* 6.1.64 *dhātvādeḥ ṣaḥ saḥ* exactly. Under 1.521, he writes regarding the root *ṣṭag* marked with *e*, "In a certain lexical source dental-initial *sthage* is read too. That is inconsistent with the rule regarding initial instruction with *ṣ*." (*kvacit kośe sthage iti dantyādir api paṭhyate. tat ṣopadeśalakṣaṇaviruddham.*) Under 1.210 *ṣaṭ*, 1.278 *ṣap*, and 1.137 *ṣarj*, he cites a restrictive rule, *A.* 8.3.61 *stautiṇyor eva ṣaṇyabhyāsāt*, that limits retroflection in the reduplicate syllable of desideratives to the root *ṣṭu* and causative roots in order to verify the absence of retroflection by *A.* 8.3.59 in *sisaṭiṣati, sisapiṣati, sisarjiṣati* (all 3sa pre des) (*stautiṇyor eva iti aṣatvam* under 1.210 and 1.278, *stautiṇyor eva iti niyamān na ṣatvam* under 1.137). Citing the restrictive rule affirms that *A.* 8.3.59 does regularly apply to other forms of the root and thereby implies that the root is subject to replacement of initial *ṣ* with *s* by *A.* 6.1.64 and hence is read in the *Dhātupāṭha* with initial *ṣ*. Similarly, under 1.583 *ṣad*, he cites *A.* 8.3.63 *prāk sitād aḍvyavāye 'pi* to account for the retroflection of the *s* in *nyaṣīdat* (3sa ipf) (*nyaṣīdat--prāk sitād aḍvyavāye 'pi iti ṣatvam*). He then cites *A.* 8.3.64 *sthādiṣv abhyāsena cābhyāsasya* to account for both instances of retroflex *ṣ* in *nyaṣīṣadat* (3sa aor caus). He offers the alternative explanation that retroflection of the first sibilant is due to *A.* 8.3.66 *sadir aprateḥ* in conjunction with *A.* 8.3.63 and of the second to *A.* 8.3.57 *iṇkoḥ*. (*nyaṣīṣadat ity atra sthādiṣv abhyāsena ca ity ubhayatra ṣatvam. yad vā--abhyāsasya sadir aprateḥ prāk sitād aḍvyavāye 'pi iti ṣatvam. uttarasya tu iṇkoḥ iti.*). The citations affirm that the root is read with initial retroflex because, in accordance with *A.* 8.3.59 *ādeśapratyayayoḥ*, *A.* 8.3.63-64 and 8.3.66 apply to root-initial *s* that is a replacement. Often his comments regarding variant readings confirm that the root is read with initial *ṣ*. For example, under 10.21 *ṣanb*, he confirms that the root is read with initial *ṣ* by mentioning that some read the root with initial dental and a long vowel as *sāmb* (*sāmba iti kecid dantyādiṁ dīrghavantaṁ ca paṭhanti*). Both Sāyaṇa, under 1.365 and 4.4, and Vāmana, in the *Kāśikā* under *A.* 6.1.64, cite a passage from Patañjali's *Mahābhāṣya* 3.42 that negates the replacement of initial retroflex *ṣ* in the roots *ṣṭhiv, ṣvask*, and in denominative roots (*subdhātuṣṭhivuṣvaskatīnāṁ satvapratiṣedhaḥ*; the *Kāśikā* adds *vaktavyaḥ*).

Sāyaṇa explicitly affirms that roots are to be listed with initial retroflex *ṇ* in a number of comments just as he does that roots are to be listed with initial retroflex *ṣ*. For example, he states that the root 1.207 *ṇaṭ* is taught with initial *ṇ* (*ayaṃ ṇopadeśaḥ*), and, where the root is repeated with dental *n* as 1.515 *naṭ* in the list *ghaṭādi* for the purpose of referring to that root, he reiterates that it is taught with initial retroflex *ṇ* (*ayaṃ ṇopadeśa iti prāg uktam*), even though it appears in the *ghaṭādi* list with initial dental. Under 1.46 *ṇad*, Sāyaṇa explicitly mentions *A.* 6.1.65, the rule that replaces the initial retroflex *ṇ* with a dental *n* (*ṇo naḥ . dhātvāder iti śeṣaḥ*). Commenting on this root and several others, Sāyaṇa refers to rules that provide for the retroflection of an *n* that is a replacement of root-initial retroflex *ṇ* by *A.* 6.1.65. These rules include *A.* 8.4.14 *upasargād asamāse 'pi ṇopadeśasya* which provides that the *n* of a root that has a retroflex *ṇ* in initial instruction is replaced by retroflex *ṇ*, even when the condition for retroflection occurs in a preceding preverb, regardless of whether it is compounded or not. Initial *n* is replaced by retroflex *ṇ* in verbs preceded by the preverb *pra*, which contains an *r* which conditions retroflection. Sāyaṇa refers to *A.* 8.4.14 to justify retroflection in several such instances:

- *praṇadati*, 3sa pre of 1.46 *ṇad* (*upasargād asamāse 'pi ṇopadeśasya iti upasargasthān nimittāt paratvena nakārasya ṇatvam*);
- *praṇakhati* and *praṇankhati*, 3sa pre of 1.91 *ṇakh* marked with *a* and *ṇakh* marked with *i* (*mūrdhanyāder upadeśa upasargāt iti ṇatvena praṇakhati ityādy api yathā syād iti*);
- *praṇahyate*, 3sm pre of 4.60 *ṇah* (*praṇahyate--upasargāt ityādinā ṇatvam*);
- *praṇedati*, 3sa pre of 1.602 *ṇid* and *ṇed* (*praṇedati--upasargāt iti ṇatvam*);
- *praṇauti*, 3sa pre of 2.30 *ṇu* (*praṇauti--upasargād asamāse 'pi iti ṇatvam*);
- *praṇudate*, 3sm pre, and *praṇudati*, 3sa pre of 6.2 *ṇud* (*upasargād asamāse 'pi iti ṇatvam*);
- *praṇilati*, 3sa pre of 6.67 *ṇil* (*praṇilati--upasargād asamāse 'pi iti ṇatvam*);
- *praṇenekti*, 3sa pre of 3.19 *ṇij* (*praṇenekti--upasargād asamāse 'pi*);
- *praṇikṣati*, 3sa pre of 1.429 *ṇikṣ* (*praṇikṣati ityādau upasargāt iti ṇatvaṃ bhavati*); and
- *praṇindati*, 3sa pre of 1.56 *ṇid* marked with *i* (*praṇindati--upasargād asamāse 'pi iti ṇatvam*).

These references provide explicit confirmation that the canonical form of the root in the *Dhātupāṭha* appears with initial retroflex in conformity with the expectations of the *Aṣṭādhyāyī*.

4. Impossible phonetics

The canonical form of the root often incorporates phonetics that are impossible or unusual in ordinary Sanskrit.

a. Dental stops following initial retroflex *s*

The preceding section just discussed that Pāṇini expects that roots subject to retroflection be listed in the *Dhātupāṭha* with an initial retroflex *ṇ* or *ṣ* (e.g. *ṇam*, *ṣic*), which is exceedingly unusual in ordinary Sanskrit, as opposed to with a dental (*nam*, *sic*). In addition, in eighteen roots that begin with a sibilant-initial consonant cluster subject to retroflection, he requires that the root, though listed with initial retroflex *ṣ*, contain a subsequent dental stop. Hence the roots are required to be listed *ṣṭak*, *ṣṭag*, ..., *ṣṭhā*, with

retroflex *ṣ* followed by dental *t* or *th* as opposed to normalized with dentals (*stak*, *stag*, ...,
sthā) or semi-normalized with retroflex clusters (*ṣṭak*, *ṣṭag*, ..., *ṣṭhā*). [These 18 roots are
locatable in the Canonical Index by simultaneously entering the regular expression
"s[tT]" in the Normalized root text box, "z[tT]" in the Root text box, selecting 'prefix' in
the pull-down menu to the right of each text box, and clicking 'Refresh'.] A dental stop
following a retroflex sibilant is impossible in ordinary Sanskrit and disallowed by
Pāṇinian rules: In accordance with *A*. 8.4.41 *ṣṭunā ṣṭuḥ*, such a dental is replaced by its
corresponding retroflex stop.   The reason that Pāṇini requires the dental stop after
retroflex *ṣ* in these roots is that he has no other mechanism to allow the dental to appear.
Only the initial retroflex *ṣ* is restored to a dental by *A*. 6.1.64; a subsequent retroflex stop
would not be restored to a dental. If the stop were retroflex rather than dental, retroflexes
would erroneously appear in forms where the usual conditions for retroflection were
absent.   *A*. 8.4.41 *ṣṭunā ṣṭuḥ* would apply to the preceding dental *s* because of the
presence of the subsequent retroflex stop. Moreover, even the isolated stop would appear
retroflex in reduplicated forms.   In accordance with *A*. 7.4.61 *śarpūrvāḥ khayaḥ*, the
subsequent unvoiced stop remains rather than the initial spirant in roots beginning with
clusters of spirant plus unvoiced stop.   If the stop were retroflex, reduplicated forms
would begin with a retroflex (e.g. **ṭaṣṭhau* instead of *tasthau*).   To avoid these
undesirable eventualities, Pāṇini requires that the *Dhātupāṭha* list these roots with the
impossible phonetic sequence of a dental stop following an initial retroflex sibilant.

   Although his comments on roots with initial retroflex *ṣ* followed by an unvoiced stop
never explicitly affirm that they are to be read with dental *t* or *th* rather than retroflex *ṭ* or
ṭh, his comment on 1.365 *ṣṭhiv* is probative. He cites Vāmana's statement in the *Kāśikā*
under *A*. 6.1.64 that, in exception to *A*. 6.1.64, the initial retroflex *ṣ* in this root is not
subject to replacement by a dental and that the second sound is either dental *th* or
retroflex *ṭh*. He closes by stating that both are standard because the teacher has explained
it to students both ways.   (*subdhātuṣṭhivuṣvaṣkaṭīnāṁ pratiṣedhaḥ iti pretiṣedhaḥ
satvasya.   asya dvitīyas thakāras ṭhakāro veti vṛttiḥ.   ācāryeṇa śiṣyebhya ubhayathā
pratipādanāt ubhayam api pramāṇam iti vyākhyātāraḥ.*) He goes on to cite perfect forms
tiṣṭheva (3sa prf) and *tiṣṭhivatuḥ* (3da prf) with initial dentals. Vāmana makes the point
clear in the *Kāśikā* passage cited. He states, "It is wished that the second sound of this
root *ṣṭhivu* is the sound *th* and the sound *ṭh*. In that way the form of the reduplicate
syllable is two-fold: *teṣṭhīvyate/ṭeṣṭhīvyate*." (*ṣṭhivu ity asya dvitīyas thakāras ṭhakāraś
ceṣyate.   tena teṣṭhīvyate/ṭeṣṭhīvyate iti cābhyāsarūpaṁ dvidhā bhavati.*) He cites the 3sm
pre int form of the root once with initial dental and once with initial retroflex. Vāmana's
explicit statement that the root is read both ways, with dental and retroflex, in order to
account for the occurrence of reduplicated verb forms with both dental and retroflex stops
initial in the reduplicate syllable makes it clear that Pāṇini's grammar requires the root to
be read both ways in the *Dhātupāṭha*. Sāyaṇa's citation of the passage in his commentary
on the *Dhātupāṭha* explicitly affirms that the maintainers of the text of the *Dhātupāṭha*
indeed read the text in accordance with that understanding. The principle articulated with
regard to this root, namely that the stop subsequent to the initial retroflex *ṣ* must be read
as a dental rather than a retroflex to account for the appearance of the dental initial in the
reduplicate syllable of reduplicated verb forms, is applicable to the other eighteen roots
that have an unvoiced stop following an initial retroflex *ṣ*: those stops are to be read as
dentals in the *Dhātupāṭha*.

b.   Dental *n*

For reasons similar to those that require dental stops to follow retroflex sibilants initial in roots beginning with consonant clusters, Pāṇini requires that the canonical form of spirant-final and stop-final roots with penultimate nasal have dental *n*. Canonical dental *n* contrasts with an anusvāra before a spirant, or with a nasal homorganic with a following stop, in the normalized form of the root. For example, canonical *ans* and *anc* contrast with normalized *aṁs* and *añc*. There are 67 roots where the canonical dental nasal contrasts with a nasal homorganic with a following non-dental stop [locatable in the Index by entering "[NYRm][kKgGNcCjJYwWqQRpPbBm]" in the Normalized root text box, "n[kKgGNcCjJYwWqQRpPbBm]" in the Root text box, selecting 'any' from the pull down menus to the right of each text box, and clicking 'Refresh'] and 12 where the canonical dental nasal contrasts with normalized anusvāra followed by a spirant [locatable in the Index by entering "M[Szsh]" in the Normalized root text box, "n[Szsh]" in the Root text box, selecting 'any' from the pull down menus to the right of each text box, and clicking 'Refresh']. In accordance with *A.* 8.3.24 *naś cāpadāntasya jhali* the dental *n* is replaced by an *anusvāra* in all 79 such roots. In addition, in the first 67, *anusvāra* is subsequently replaced by the nasal homorganic with the following stop in accordance with *A.* 8.4.58 *anusvārasya yayi parasavarṇaḥ*.

If the *Dhātupāṭha* listed roots with the homorganic nasal rather than dental *n*, however, problems would arise. In the 29 palatal-final roots with a penultimate nasal, there would be no mechanism to produce a velar nasal when the final palatal was replaced by a velar. For example, the 3sa pre of the root *añj* is *anakti*. The final *j* is replaced by a velar *g* in accordance with *A.* 8.2.30 *coḥ kuḥ* and by an unvoiced *k* in accordance with *A.* 8.4.55 *khari ca*. *A.* 8.3.24 applies to a dental *n*, but there is no mechanism that transforms a palatal nasal *ñ* to a velar.

The motivation for simplifying the rules of nasal transformation and utilizing the dental nasal in roots as a quasi marker of homorganic nasalization is economy. The pipeline for transforming the dental nasal to *anusvāra* and homorganic stop (by *A.* 8.3.24 and 8.4.58) applies not just to roots listed with nasals preceding stops and spirants, but also to roots and nominal derivates in which a nasal is inserted. The nasal augment *num* is inserted after the vowel of a root marked with *i* in accordance with *A.* 7.1.58 *idito num dhātoḥ*. For example, the 3sm pre of the root 1.70 *śak*, provided with the final marker *i*, is *śaṅkate*, and the 3sa pre of the root 10.2 *cit*, provided with the final marker *i*, is *cintayati*. Sāyaṇa explicitly states in his commentary on the latter root that the augment *num* occurs because the root is marked with *i* (*idittvān num*). While no alteration of the inserted nasal is required in the latter, the former root requires transformation to a velar nasal through the pipeline of *A.* 8.3.24 and 8.4.58. There are 308 roots marked with *i*. Thirty-seven of them have a spirant following their root vowel and require transformation of the *n*-augment to anusvāra. 209 of them have a non-dental stop following their root vowel and require further transformation of the *n*-augment to a nasal homorganic with the following stop.

Moreover, *A.* 7.1.59 *śe mucādīnām* provides that the augment *num* be added to roots in the list beginning with *muc* when the stem-forming affix *śa* follows. The stem-forming affix *śa* is added to roots in the list beginning with *tud*, that is, class 6 roots, in accordance with *A.* 3.1.77 *tudādibhyaḥ śaḥ*. For example, the 3sa pre of the root *muc* is

muñcati and of *piś piṁśati*. There are eight roots listed in *Dhātupāṭha* sūtras 6.138-148; nine including *piś dīpanāyām* mentioned in Sāyaṇa's commentary on 6.149. [To locate them, first enter the root *muc* in the Root text box and click 'Refresh'. The class 6 root muc is 6.138. Then enter '6' in the text box under 'Class' in the search panel at the left of the Canonical Index, select 'Sutra' from the sort pull-down menu, click 'Refresh', and scroll down to sūtra numbers 138-149.] A few other rules provide for addition of the augment *num* to roots and transformation of the dental nasal (*A.* 7.1.60-69).

A. 7.1.70 *ugidacāṁ sarvanāmasthāne 'dhātoḥ* provides for the addition of the augment *num* to stems ending in an affix marked with *u*, *ṛ*, or *ḷ* that are not roots, as well as to stems ending in the root *ac*, under the condition that they are followed by a nominal termination termed *sarvanāmasthāna* by *A.* 1.1.42-43. Relevant derivates of the root *anc* include, for example, *prāṅ* (m1s of *prāñc < pra-añc*), and relevant derivates formed with affixes marked with *u*, *ṛ*, or *ḷ* include those formed with the affix *īyas**un*** such as *śreyāṁsi* (n1/v/2p *śreyas*). These nominal derivates also require transformation of the dental nasal of the augment ***num***. Pāṇini achieves economy of statement by inserting just the dental nasal as an augment to roots and stems, requiring that post-vowel root nasals followed by stops and spirants be dental, and funneling all nasal transformation through just two simple rules *A.* 8.3.24 and 8.4.58.

Another motivation for listing roots that have a penultimate nasal with dental *n*, rather than with anusvāra or the nasal homorganic with the following stop, is to simplify rules regarding the deletion of the penultimate nasal. *A.* 6.4.23 *śnān nalopaḥ* provides for the deletion of *n* following the class 7 stem-forming affix ***ś**nam*. The affix *na* marked with *ś*, due to which it is termed *sārvadhātuka* by *A.* 3.4.113, and *m*, due to which it is inserted after the vowel of the root by *A.* 1.1.47, is provided for roots in the list beginning with *rudh* by *A.* 3.1.78 *rudhādibhyaḥ śnam*. For example, *bhanakti* (3sa pre), *bhaṅktaḥ* (3sd pre), ..., *bhañjvaḥ* (1da pre), *bhañjmaḥ* (1pa pre) derive from root 7.21 *bhanj*. Steps that insert the infix and delete the nasal are as follows: *bhanj* + *ti* > (3.1.78) *bha-na-nj* + *ti* > (6.4.23) *bha-na-j* + *ti*. Velarization and loss of voicing of the final *j* in the first (3sa pre) occur as follows: (8.2.30) *bha-na-g* + *ti* > (8.4.53) *bha-na-k* + *ti*.

The next rule, *A.* 6.4.24 *aniditāṁ hala upadhāyāḥ kṅiti*, provides that penultimate dental *n* in consonant final roots not marked with *i* followed by an affix marked with *k* or *ṅ* be replaced by zero (*lopa*). For example, the past passive participle of the root 1.488 *srans* marked with *u* is *srasta* derived from *srans**u*** + ***k**ta* > (1.3.9) *srans* + *ta* > (6.4.24) *sras* + *ta*. The past passive participle affix *ta* is marked with *k* conditioning the application of *A.* 6.4.24. Similarly derived is *asrasat* (3sa aor) with the stem-forming affix *a* marked with *ṅ*: *srans**u*** + *a**ṅ*** + *ti**p*** > (1.3.9) *srans* + *a* + *ti* > (3.4.100) *srans* + *a* + *t* > (6.4.24) *sras* + *a* + *t* > (6.4.71) *asras* + *a* + *t*. The term *nalopa* in *A.* 6.4.23 recurs in *A.* 6.4.24 and in rules up to *A.* 6.4.33. *A.* 6.4.24-29 provide for the deletion of dental *n* in roots. *A.* 6.4.30 *nāñceḥ pūjāyām* negates the deletion of dental *n* in the root 1.118 *anc* in the meaning honor, *A.* 6.4.32 optionally negates the deletion of dental *n* in 4.91 *naś* and roots ending in *j*, and *A.* 6.4.33 provides such deletion optionally for 7.21 *bhanj* before the 3sp aor affix ***c**i**ṇ***, which is not marked with *k* or *ṅ*. Now the past passive participle of 1.595 *anc*, which is marked with *u*, is *akta*, for example in *udakta* 'drawn' in the phrase *udaktam udakaṁ kūpāt* "The water has been drawn from the well." The penultimate *n* of the root is deleted before the *k*-marked affix *ta* in accordance with *A.* 6.4.24 because *anc*

is not marked with *i*. On the other hand, in the sense of honor the past passive participle of *anc* is *añcita*, for example in *añcitam eva śiro vahati* "He bears his head erect." In accordance with *A*. 6.4.30, the penultimate *n* is not deleted. The absolutive of 7.27 *anj* may take one of three forms: *añjitvā*, *aṅktvā*, or *aktvā*. Where there is no *i*-augment in the latter two forms, the root is subject to deletion of its penultimate *n* optionally in accordance with *A*. 6.4.32 because the root ends in *j* and the affix is marked with *k*. If spirant final roots such as *srans* were listed with anusvāra rather than dental *n*, and roots ending in non-dental stops such as *anc* and *anj* were listed with a homorganic penultimate nasal rather than dental *n*, there would be no mechanism to delete the nasal by rules *A*. 6.4.24-29, and it would be vacuous to negate the deletion of the dental *n* in *anc* in the meaning of honor by *A*. 6.4.30, to negate such deletion optionally by *A*. 6.4.32, and to provide it optionally by *A*. 6.4.33.

i.   *Commentatorial verification of penultimate dental* n

Sāyaṇa explicitly affirms that roots are to be listed with penultimate dental *n* in a number of comments. He states outright that roots with penultimate nasal have a dental as their penultimate sound in his comments on several roots, even when the text shows the roots with homorganic nasal. For example, under 1.116 *kuñca kruñca kauṭilyālpībhāvayoḥ* where the roots *kunc* and *krunc* are read with palatal *ñ* rather than dental *n*, he writes, "These two are dental-penultimate." (*dantyopadhāv imau.*)

Sāyaṇa explicitly refers to *A*. 6.4.23 in commenting on class 7 roots with penultimate nasal. For example, under 7.21 he justifies the deletion of the penultimate nasal of the root *bhanj* in *bhanakti* (3sa pre), *bhaṅktaḥ* (3sd pre), etc. by writing, "The *n* of the root is replaced by zero by *A*. 6.4.23 *śnān nalopaḥ*." (*śnān nalopaḥ iti prakṛtinakārasya lopaḥ.*) He explicitly refers to *A*. 6.4.24 numerous times under 1.116, 1.281, 5.24, and 4.61. For example, under 1.116 regarding the derivation of the past passive and past active participles *kucita* and *kucitavat* from the root *kunc*, he writes, "Deletion of the *n* occurs by *A*. 6.4.24 *aniditām*." (*kucitaḥ kucitavān--aniditām iti nalopaḥ.*) Again under 1.281 *supa tumpa ... hiṃsārthāḥ*, where the root *tunp* is read with *m* homorganic with the following *p* rather than with dental *n*, he writes regarding the derivation of the optative of wish *tupyāt* (3sa aop), "Deletion of the nasal occurs by *A*. 6.4.24 *aniditām* because the affix is marked with *k* by *A*. 3.4.104 *kid āśiṣi*." (*kid āśiṣi iti kittvāt aniditām iti nalopaḥ.*) Again he explicitly mentions the rule in his justification of the deletion of penultimate *n* of root 5.24 *danbh* in the class 5 present *dabhnoti* (3sa pre), "Deletion of *n* occurs by *A*. 6.4.24 *aniditām*." (*dabhnoti--aniditām iti nalopaḥ.*)

Sāyaṇa explicitly mentions other rules in this sequence that delete penultimate dental *n* as well. *A*. 6.4.25-26 apply only to a dental *n* since the term *nalopaḥ* recurs in these rules from *A*. 6.4.23. Although 1.706 *sañja saṅge*, 1.695 *ṣvañja pariṣvaṅge*, and 1.721 *rañja rāge* list the roots *ṣanj*, *ṣvanj*, and *ranj* with penultimate palatal *ñ* homorganic with the final *j* of the roots instead of with penultimate dental *n*, Sāyaṇa writes regarding the class 1 present *sajati* (3sa pre), "Deletion of the nasal occurs before *śap* by *A*. 6.4.25 *daṃśasañjasvañjām*" (*sajati--śapi daṃśasañjasvañjām ity anunāsikalopaḥ*), and regarding the class 1 present *svajate* (3sm pre), "Deletion of the nasal occurs by *A*. 6.4.25 *daṃśasañjasvañjāṃ śapi*" (*svajate--daṃśasañjasvañjāṃ śapi ity anunāsikalopaḥ*).

Regarding the class 1 present *rajati* (3sa pre), he writes, "Deletion of the nasal occurs before *śap* by A. 6.4.26 *rañjeś ca*" (*rajati--rañjeś ca iti śapy anunāsikalopaḥ*).

Sāyaṇa often more briefly refers rules that delete the penultimate dental *n* just by mentioning *n*-deletion (*nalopa*) or nasal-deletion (*anunāsikalopa*) as in 1.121, 1.119, 6.27, 1.117, 10.147, 1.286, or even more vaguely by referring to the deletion of the penultimate sound (*upadhālopaḥ*) as in 1.706. For example, even though the root *glunc* is read in 1.121 *gluñcu ṣasja gatau* with palatal *ñ* homorganic with the following *c* instead of penultimate dental *n*, Sāyaṇa writes that the optional *a*-aorist *aglucat* (3sa aor) is formed by the addition to the root of the affix *luṅ*, the optional addition of the stem-forming affix replacement *aṅ* by A. 3.1.58 *jṛstambhu...*, and deletion of *n*. (*luṅi jṛstambhu ityādinā vāṅi nalope--aglucat/agluñcīt.*) Similarly, even though root *vanc* is read in 1.119 *vañcu cañcu ... gatyarthāḥ* with palatal *ñ*, he writes that *vacyāt* (3sa aop) is formed by deletion of the nasal because the augment *yāsuṭ* added to the optative of wish is marked with *k* (*āśīrliṅi yāsuṭaḥ kitvād anunāsikalope vacyāt*). In the *Kāśikā* under A. 3.4.104 *kid āśiṣi*, Vāmana explains that the marker *k* is associated with the affix rather than the augment. While the reference in Sāyaṇa's passage is to deletion of a nasal (*anunāsika*), the applicable rule A. 6.4.24 applies to dental *n* before an affix marked with *k* or *ṅ*. Regarding another optative of wish, *tṛphyāt* (3sa aor) derived from *tṛnph*, he writes under 6.27 that there is deletion of *n* because the augment *yāsuṭ* is marked with *k*. (*āśiṣi tṛphyāt--yāsuṭaḥ kittvān nasya lopaḥ.*) Under 1.706 *ṣañja saṅge* where the root *sanj* is listed with palatal *ñ* homorganic with the final *j* of the root, Sāyaṇa justifies the deletion of the penultimate *n* of the root in the optative of wish *sajyāt* (3sa pre) by referring just to penultimate-deletion (*āśiṣi kitvād upadhālope--sajyāt*).

Sāyaṇa explicitly refers to A. 6.4.30-32 negating the deletion of *n* in his comments on a number of roots. Under 1.118 *anc*, he justifies the absence of deletion of the penultimate *n* in *anc* in the meaning 'honor' by citing A. 6.4.30 outright. He writes, "'The teacher is honored (*añcyate*)', 'one should honor (*añcyāt*)', etc. occur because of the negation of the deletion of *n* in the sense of honor by A. 6.4.30 *nāñceḥ pūjāyām*." (*pūjāyāṁ tu 'nāñceḥ pūjāyām' iti nalopaniṣedhād 'añcyate guruḥ' 'añcyāt' ityādi bhavati.*) He mentions the absence of deletion of *n* under 1.595. Although Sāyaṇa reads 1.595 *ancu gatau yācane ca*, he reports the divergent opinion of Kṣīrasvāmin who reads two roots *ancu* and *anci* in the meaning *gati*. He reads *anc* marked with *i* in the latter in order to justify the past passive participle with penultimate *n* in the meaning 'gone'. Sāyaṇa writes, "The reason for reading *anci* is the marker *i*; he explains the absence of deletion of the penultimate *n* in *añcita*." (*tatra idittvaprayojanam . añcita ityādau nalopābhāvam āha.*) Sāyaṇa explicitly refers to A. 6.4.32 in his comment on 7.27. He writes, "Under the option that there is no *i*-augment, there is deletion of the nasal under one option by A. 6.4.32 *jāntanaśāṁ vibhāṣā*." (*anitpakṣe jāntanaśāṁ vibhāṣā iti pakṣe 'nunāsikalopaḥ.*)

A. 6.1.2 *ajāder dvitīyasya* is a heading stating that the second syllable of vowel-initial roots is reduplicated. A. 6.1.3 *na ndrāḥ saṁyogādayaḥ* negates the reduplication of conjunct-initial *n*, *d*, and *r* included in such a syllable. These headings are valid in subsequent rules including A. 6.1.9 *sanyaṅoḥ* which provides reduplication before the desiderative and intensive affixes *san* and *yaṅ*. A. 6.1.9 accounts for reduplication in *ṛmpiphiṣati* (3sa pre des) derived from the base root 6.30 *ṛnph* by introducing elements as

follows: *ṛmpha* + *iṭ* (7.2.35) + *san* (3.1.7) + *śap* (3.1.68) + *tip* (3.4.78), and deleting markers by *A.* 1.3.9. After arriving at the stage *ṛmphisati*, reduplication occurs by *A.* 6.1.9 producing *ṛmphiphisati*. The *n* is not reduplicated in accordance with *A.* 6.1.3. Subsequently, the *n* is replaced by anusvāra and, after retroflection of the *s*, the anusvāra is replaced by the nasal homorganic with the following stop: (8.3.24) *ṛṁphiphisati* > (8.3.59) *ṛṁphiphiṣati* > (8.4.54) *ṛṁpiphiṣati* > (8.4.58) *ṛmpiphiṣati*. If the root were read in the *Dhātupāṭha* with penultimate *m* rather than *n*, the negation regarding reduplication of *n* stated in *A.* 6.1.3 would not apply. The *m* would be reduplicated in accordance with *A.* 6.1.2 resulting in the erroneous form **ṛmpimiṣati*. In order for the reduplication of roots with penultimate nasal to work properly, the *Aṣṭādhyāyī* requires that such roots be read in the *Dhātupāṭha* with dental *n* rather than with anusvāra or a nasal homorganic with a following non-dental stop. Sāyaṇa explicitly refers to the negation regarding reduplication of penultimate *n* stated in *A.* 6.1.3. He states regarding the derivation of *ṛmpiphiṣati*, for example, that there is reduplication of the root devoid of the *n* because the anusvāra and the homorganic nasal that replace the *n* have not arisen. (*ṛmpiphiṣati--ity atrāpy anusvāraparasavarṇayor asiddhatvān nakāravarjitasya dvirvacanam.*)

c. Penultimate dental sibilant *s*

Pāṇini requires that the canonical form of two roots have penultimate dental sibilant *s*, even when *s* rarely appears in usage, and that the canonical form of four others have penultimate *s*, even when it never appears in usage. Dental *s* is required in 6.14 *vrasc* and *sasc*, as opposed to a palatal spirant actually read in the normalized forms *vraśc* and *saśc*. (The latter root is a variant which Sāyaṇa mentions some (*ke cit*) read in 1.121.) Although unusual, there are speech forms in which the penultimate dental *s* of a root does appear in usage. The term *yūpa-vraská* occurs in *Ṛgveda* 1.162.6a. Monier-Williams translates it 'cutting the sacrificial post'. Sāyaṇa in his comment on 6.14 *ovraścū chedane* derives the gerundive *vraskyaḥ* 'to be cut' as well as the action noun *vraskaḥ* from the root *vrasc* by the addition of the affixes **ṇyat** and **ghañ** respectively. The *kṛtya* (*A.* 3.1.95) affix **ṇyat** is provided after consonant final roots, as well as after roots ending in *ṛ*, in accordance with *A.* 3.1.124 *ṛhalor ṇyat*. The affix **ghañ** occurs generally after a root when the action denoted by the root or a participant in the action other than an agent is to be denoted in accordance with rules *A.* 3.3.18 *bhāve* and *A.* 3.3.19 *akartari ca kārake sañjñāyām*. Although not found, presumably a gerundive **saskya* and action noun **saska*, similar to *vraskya* and *vraska* derived from the root *vrasc*, could be derived from the root *sasc*.

While the penultimate *s* is found in the derivates of two roots, yet Pāṇini requires that the canonical form of four other roots have penultimate dental sibilant *s*, even when no *s* appears in usage. All four of these roots end in *j*. For example, *s* is required in *lasj*, as opposed to a palatal stop in the normalized form *lajj*. [To locate all six roots with penultimate *s*, enter "s." in the Root text box and "[^s]." in the Normalized root text box in the Canonical Index search panel.] The sequences of dental *s* followed by a palatal stop, and of a sibilant followed by a voiced stop, are impossible in Sanskrit prosody. In these roots, the dental *s* is replaced by a palatal before the following palatal stop in accordance with *A.* 8.4.40 *stoḥ ścunā ścuḥ*, and the spirant is replaced by its corresponding voiced unaspirated stop in accordance with *A.* 8.4.53 *jhalāṁ jaś jhaśi*.

The un-prosodic presence of the dental *s* in roots where it rarely or never appears in derivates calls for an explanation. The selection of the canonical form of basic elements in generative grammar is governed by considerations besides the occurrence, or frequency of occurrence, of certain sounds in usage. Economy of rules is a factor that overrides the frequency of phonetic sequences in usage. A generative linguistic system is designed to account for all usage, common as well as rare, in an efficient manner. Rules and basic elements are selected in accordance with that purpose. The design of the system often requires positing basic elements that do not occur in usage for the purpose of achieving simplicity and efficiency through abstraction. Thus Pāṇini posits certain phonetic units in his root list for the same reason that he posits abstract phonetic symbols such as *l* and *jh* in verbal terminations. These phonetic units allow greater simplicity in the statement of rules. Abstract phonetic elements function much like markers in conditioning the operation of certain rules. Phonetic elements in roots are deliberately selected with a view to feeding certain rules formulated for general purposes.

While it is true that the overwhelming majority of verbal forms and nominal derivates of the roots with penultimate dental *s* do not have such a sound, the grammar already requires general rules that delete or transform such an *s* to the sounds that do occur. Positing roots with penultimate *s* feeds these rules and produces the required forms at no additional cost to the efficiency of the linguistic system. Conversely, positing basic elements with the phonetic sequences found in the most common forms would require the formulation of additional special rules to account for the less common forms. The few derivates *vraskya*, *vraska*, etc. from *c*-final roots with penultimate *s* have just been mentioned. Although no derivates from *j*-final roots with penultimate *s* preserve *s*, several derivates of such roots contain the closest unaspirated voiced stop in Sanskrit, namely *d*, produced at the same place of articulation. Monier-Williams lists *puru-madga* m. 'Name of a man' in the *Ārṣeyabrāhmaṇa*, *madgu* m. 'a diver bird', etc., plus a few derivates of the latter. Sāyaṇa derives *madgyaḥ*, *madgaḥ*, and *madguḥ* from the root 6.123 *masj* and derives *bhradgyaḥ* from the root 6.4 *bhrasj*. The same rule that accounts for the replacement of the final *c* in 6.14 *vrasc* by *k* in *vraskya* and *vraska*, also accounts for the replacement of the final *j* of *masj* and *bhrasj* by *g*. This rule, *A.* 7.3.52 *cajoḥ ku ghiṇṇyatoḥ*, is a general rule by which the final palatal of a stem followed by the gerundive-forming affix **ṇyat** or an affix marked with *gh* is replaced by its corresponding velar. Derivates accounted for by the rule include common words such as *pākya* 'having to be cooked' and *pāka* 'cooking' from the root *pac* 'cook', *vākya* 'statement' from the root *vac* 'speak', and *tyāga* 'abandonment' from the root *tyaj* 'abandon'. While the *s* of *c*-final roots remains before their unvoiced velar replacement in *vraskya*, etc., *s* is replaced by *d* in *j*-final roots by the general rule of voicing assimilation *A.* 8.4.53 *jhalāṁ jaś jhaśi* by which a non-nasal stop or spirant followed by a voiced stop is replaced by its corresponding voiced unaspirated stop. *A.* 8.4.53 accounts for the ubiquitous deaspiration found for example in the agent noun *lab-dhṛ*, infinitive *lab-dhum*, and gerundive *lab-dhavya* from the root *labh*. Although the penultimate *s* of *j*-final roots does not appear in derivates with penultimate *d* instead, positing an original *s* rather than original *d* in them entails no additional cost because *s* is transformed to *d* without the statement of any additional rules.

Positing an original sibilant *s* instead of the stop *d* in *j*-final roots, and indeed positing original dental *s* instead of palatal *ś* or *j* in all six of the roots with penultimate *s*, not only

entails no additional cost in producing *d*, *ś*, or *j* where needed, it also accounts for the deletion of the sound where needed without cost. Conversely, positing original *d*, or *ś* or *j*, would require additional statement because there is currently no mechanism in the grammar for turning a stop into a sibilant or of turning a palatal into a dental. *A*. 8.2.29 *skoḥ saṁyogādyor ante ca* provides that *s* or *k* initial in a conjunct followed by a stop or spirant, or word-final, is replaced by zero (*lopa*). Thus a general phonetic operation is allowed to apply to delete the *s* in the roots *lasj* and *masj* to obtain the past passive participles *lagna* (*lasj* + *ta* > (8.2.29) *laj* + *ta* > (8.2.30) *lag* + *ta* > (8.2.45) *lag* + *na*), and *magna* (*masj* + *ta* > (8.2.29) *maj* + *ta* > (8.2.30) *mag* + *ta* > (8.2.45) *mag* + *na*), respectively. Otherwise, if the roots were listed with prosodically normal double *j* (*lajj*, *majj*), an explicit marker or listing would be required to specify where the initial *j* in the conjunct was to be deleted. Granted that there is usually a clear phonetic criterion that distinguishes the case: where double *j* is desired it is always followed by a vowel, for example in *rajju*, *lajjā* and 381 others listed in MW as well as in inflected forms of these roots, e.g *majjati*, (3sa pre), etc., and *lajjate* (3sm pre), etc. However, the blemish would remain that a double stop would be allowed to remain before the *n* to produce incorrect participle forms *laggna and *maggna instead of the correct *lagna* and *magna*. The same rule *A*. 8.2.29 that accounts for the absence of the conjunct-initial *g* in these past participles deletes the *s* in *vrasc* in the past participle *vṛkṇa* (*vrasc* + *ta* > (6.1.16) *vṛasc* + *ta* > (6.1.108) *vṛsc* + *ta* > (8.2.29) *vṛc* + *ta* > (8.2.30) *vṛk* + *ta* > (8.2.45) *vṛk* + *na* > (8.4.2) *vṛk* + *ṇa*). Reading the roots in the *Dhātupāṭha* with dental *s* serves to economize rule statement: *A*. 8.2.29 needs to mention just dental *s* rather than various sibilants (*ś*) and stops (*d*, *j*).

i. *Commentatorial verification of penultimate dental sibilant s*

Sāyaṇa explicitly refers to the *s* of the five roots listed with penultimate *s* in the *Dhātupāṭha* in his derivation of various forms. He mentions the deletion of *s* by *A*. 8.2.29, its replacement by a palatal in accordance with *A*. 8.4.40, the subsequent replacement of the palatal spirant by *j* in accordance with *A*. 8.4.53, the direct replacement of *s* by *d* in accordance with *A*. 8.4.53, and the lack of deletion of *s* in forms where the penultimate *s* remains. He explicitly mentions the deletion of *s* by *A*. 8.2.29 in his derivation of several forms. He cites the sūtra in full in his derivation of the perfect *mamaṅktha* (2sa prf) from the root 6.123 *masj* (*skoḥ saṁyogādyoḥ iti salopaḥ*). He cites the incipit of *A*. 8.2.29 stating that there is deletion of the sound *s* in his derivation of the agent noun *bharṣṭā* (m1s) (*skoḥ iti sakārasya lopaḥ*) and future *bhrakṣyate* (3sm/p fut) (*skoḥ iti salopaḥ*) from the root 6.4 *bhrasj*. He similarly mentions deletion and cites the incipit in his derivation of the present *lajjate* (3sm pre) and past passive and active participles *lagnaḥ* and *lagnavān* from 6.12 *lasj* (*'skoḥ' iti salopaḥ*), and in his derivation of the perfect *vavraṣṭha* (2sa prf) (*skoḥ iti salope...*), past passive and active participles *vṛkṇaḥ* and *vṛkṇavān* (*'skoḥ' iti salopaḥ*), and the noun *vṛkṣaḥ* 'tree' (*skoḥ iti salopaś ca*) from 6.14 *vrasc*. He more briefly mentions *s*-deletion (*salopa*) in deriving the optative of wish *bharkṣīṣṭa*/*bhrakṣīṣṭa* (3sm aop) and the noun *bhṛguḥ* (m1s) from 6.4 *bhrasj*, in deriving the past passive and past active participles *magnaḥ* and *magnavān* from 6.123 *masj*, and in deriving the future *vrakṣyati* (3sa fut) and *s*-aorist *avrākṣīt* (3sa aor) from 6.14 *vrasc*.

Sāyaṇa explicitly mentions the replacement of *s* by a palatal in accordance with *A.* 8.4.40, and the subsequent replacement of the palatal spirant by *j* in accordance with *A.* 8.4.53 in his derivation of the verb forms *sajjati* (3sa pre) from 1.121 *ṣasj* and *bhṛjjati* (3sa pre), etc. from 6.4 *bhrasj*. Deriving *sajjati*, he writes, "The second *s* is replaced by its corresponding palatal *ś* by *A.* 8.4.40, and then that is replaced by its corresponding voiced unaspirated stop *j* in accordance with *A.* 8.4.53." (*sajjati--... dvitiyasya sakārasya ścutvena* [*jaśtvena* sic!] *śakāre tasya 'jhalāṁ jaś jhasi' iti jaśtvena jakāraḥ.*)

In the latter of two proposed sequences of derivation of *bhṛjjati* he writes, "The form is derived when the *s* itself, because its replacement by a voiced unaspirated stop is uneffected, is replaced by its corresponding palatal *ś* by *A.* 8.4.40, and then that is replaced by its corresponding voiced unaspirated stop *j* by *A.* 8.4.53." (*jaśtvasyāsiddhatvāt sakārasyaiva ścutve śakāras tasya jhalāṁ jaś jhaśi iti jaśtvena jakāre 'pi rūpaṁ setsyati.*) In the alternative derivation of this form, Sāyaṇa describes the replacement of the *s* by its corresponding voiced aspirated stop *d* first by *A.* 8.4.53, and then the *d*'s replacement subsequently by its corresponding palatal *j* in accordance with *A.* 8.4.40. (*jhalāṁ jas jhaśi iti sakārasya dakāras tasya ścutvaṁ jakāraḥ.*) The latter sequence is described in the derivation of *majjati* (3sa pre) from 6.123 *masj* too. (*'jhalāṁ jaś' iti sakārasya dakāraḥ, tasya cutvaṁ jakāraḥ.*)

Sāyaṇa explicitly mentions the direct replacement of *s* by *d* in accordance with *A.* 8.4.53 in his derivation of the gerundive *bhradgyaḥ* (m1s) from the root 6.4 *bhrasj* (*sakārasya jaśtve dakāraḥ*), and his derivation of the gerundive *madgyaḥ* (m1s), and nouns *madgaḥ* and *madguḥ* (m1s) from 6.123 *masj* (*madgyaḥ, madgaḥ--...jhalāṁ jaś jhaśi iti sakarasya dakāraḥ; madguḥ--...pūrvavat sakārasya dakāraḥ.*) He explicitly describes the replacement of the dental *s* in root 6.14 *vrasc* by the palatal *ś* in accordance with *A.* 8.4.40 in his derivation of the verb form *vṛścati* (*vṛścati--... stoḥ ścunā ścuḥ iti sakarasya śakāraḥ*). In his derivation of the gerundive *vraskyaḥ* and action noun *vraskaḥ* from this root, he states that the *s* of the root is not deleted due to the fact that it is not followed by a voiced stop. *ajhaśparatvāt* [*ajhalparatvāt* sic!] *salopo na bhavati*.

d.   Penultimate dental *d*.

Pāṇini expects that the canonical form of four roots, 1.236 *cudḍ*, 1.237 *adḍ*, 1.238 *kadḍ*, and 6.24 *udjh*, have penultimate dental *d* rather than the stop homorganic with the following stop (*cuḍḍ*, *aḍḍ*, *kaḍḍ*, and *ujjh*), even though *d* rarely appears in usage. [Locate them by entering "[qj]." in the Normalized root text box, entering "d." in the Root text box, and selecting 'suffix' from the pull-down menus to the right of each.] The penultimate dental *d* is replaced by the retroflex or palatal stop corresponding to the following retroflex or palatal by *A.* 8.4.41 or 8.4.40 respectively. These prosodic rules account for the homorganic stop in most desired forms derived from these prosodically unusual canonical roots. Although not listed by Monier-Williams, Sāyaṇa and other Pāṇinian grammarians do recognize several speech forms derived from these roots that require the penultimate dental stop. Sāyaṇa derives the agent nouns *cud*, *ad*, and *kad* from the first three roots with the addition of the suffix **k*vip*. He illustrates the third form as the first element in the karmadhāraya compound *kajjala* (< *kad-jala*, as Sāyaṇa analyzes it: *kac ca tat jalaṁ ca kajjalam*) which Monier-Williams defines as 'a cloud'. Sāyaṇa also derives the intensive verb form *acākat* (3sa ipf int) from *kadḍ*. The deletion

of the final *ḍ* in these forms occurs in accordance with *A.* 8.2.23 *saṁyogāntasya lopaḥ*. If the roots were not read in the *Dhātupāṭha* with penultimate dental stop rather than retroflex stop, there would be no mechanism to account for the final dental in the forms Sāyaṇa derives because the grammar includes no rule that replaces a non-nasal retroflex stop by a dental one.

Sāyaṇa also notes that the desiderative verb form *aḍḍiḍiṣati* (3sa pre des), derived from 1.237 *aḍḍ* requires that the root be read with penultimate dental *d* in order to prevent double *ḍḍ* in the second of the two reduplicated root-syllables. *A.* 6.1.3 *na ndrāḥ saṁyogādayaḥ* (see section IIIA4b) negates reduplication of dental *d* (as well as *n* and *r*) initial in a consonant cluster. However there is no mechanism to prevent reduplication of retroflex *ḍ*. Thus if the root were read with retroflex rather than dental penultimate, the erroneous form *aḍḍiḍḍiṣati would result.

A. 3.1.115 *bhidyoddhyau nade* lays down the form *uddhya*, meaning a river, as produced with the agentive affix **kyap**. The *Kāśikā* explains that the form derives from the root *udjh* with irregular replacement of the final *jh* by *dh*. While there do not appear to be any regular derivations that require the dental penultimate in this root, the dental is the regular sandhi that would result from the preverb *ud* plus the root *hā* from which the root probably descends historically. It is therefore interesting that the canonical form of the root preserves one of the historically prior dentals in the penultimate sound.

Sāyaṇa explicitly states that all four of these roots are to be read with penultimate dental *d*, even though the edition lists the first three with retroflex. He writes, "This is *d*-penultimate" (*ayaṁ dopadhaḥ*) under 1.236 *cuḍḍ*, "This is also *d*-penultimate" (*ayam api dopadhaḥ*) under both 1.237 *aḍḍ*, and 6.24 *udjh* and refers to 1.238 *kaḍḍ*'s being such as a reason for the appearance of the dental in the intensive verb form *acākat* (3sa ipf int), and in the agent noun *kad* (*asyāpi dopadhātvād yaṅluki kvipi ca acākat, kad iti ca bhavati*). He also notes that the derivation of *ad* from the root 1.237 *aḍḍ* with the addition of the suffix **kvip** is a result of reading the root with dental penultimate (*ayam api dopadha iti kvipi at iti bhavati*). Sāyaṇa explains the appearance of the dental in the derivates discussed by reference to the deletion of the final sound of the root under 1.236 *cuḍḍ*, "The sound *t* is heard when there is deletion of the final of the conjunct by *A.* 8.2.23." (*saṁyogāntalope takārasya śravaṇaṁ bhavati.*)

e. Penultimate *c* before *ch*.

Eighteen roots are expected canonically without penultimate *c* before *ch* (*prach*) as opposed to normally with *c* (e.g. *pracch*). [Locate them by entering "cC" in the Normalized root text box and selecting 'suffix' from the pull-down menu to its right.] If penultimate *c* were already present, it would appear incorrectly in final forms derived by the grammar. When followed by a stop or spirant, the final *ch* in *ch*-final roots is subject to replacement by *ṣ* in accordance with *A.* 8.2.36 *vraścabhrasjasṛjamṛjayajarājabhrāja-cchaśāṁ ṣaḥ*. For example, the agent noun *praṣṭā* (m1s), the infinitive *praṣṭum*, and gerundive *praṣṭavyam* (n1s/n2s/m2s) are derived from the root 6.120 *prach* followed by the affixes *tṛ* marked with *c* (*tṛc*), *tum*, and *tavya* possibly marked with *t* (*tavyat*). When the final *ch* is replaced by *ṣ* in accordance with *A.* 8.2.36 before the initial *t* of these affixes, *prach* becomes *praṣ*. If 6.120 included penultimate *c* in the root, the penultimate

c would remain in the final forms; *pracch-t...* would become *pracṣ-t...*, and, after *t* is replaced by its corresponding retroflex *ṭ* in accordance with *A.* 8.4.41, the erroneous forms **pracṣṭā*, **pracṣṭum*, and **pracṣṭavyam* would result.

Five of the eighteen roots are marked with *i* which conditions the addition of the augment *n* (*num*) after the vowel of the root by *A.* 7.1.58 *idito num dhātoḥ*. The dental *n* is then subject to palatalization by *A.* 8.4.40 *stoḥ ścunā ścuḥ*, and the *c* is subject to optional deletion by *A.* 8.4.65 *jharo jhari savarṇe*. If the five roots marked with *i* were read with original penultimate *c*, the sequence *ñcch* would optionally appear incorrectly in derivates. In addition to the correct verb forms *lāñchati*, *vāñchati*, *āñchati*, *úñchati* and *uñcháti*, 3sa pre of the roots 1.125 *lāch*, 1.126 *vāch*, 1.127 *āch*, 1.133 *uch*, and 6.16 *uch* respectively, one would get the incorrect forms **lāñcchati*, **vāñcchati*, **āñcchati*, **úñcchati* and **uñccháti* as well. To prevent this undesirable eventuality, it is required that these roots be read without penultimate *c*.

Sāyaṇa verifies that *ch*-final roots are to be read in the *Dhātupāṭha* without penultimate *c* by the fact that he explicitly mentions the addition of the augment *t* (*tuk*) to the end of the root vowel. Once added the *t* is subject to palatalization before *ch* by *A.* 8.4.40 *stoḥ ścunā ścuḥ*. Sāyaṇa explicitly cites *A.* 6.1.73 *che ca*, which accounts for the addition of the augment *t* to the end of a short vowel followed by *ch*, in accounting for the forms of five roots, and explicitly cites *A.* 6.1.75 *dīrghāt*, which accounts for the addition of the augment to the end of long vowels followed by *ch*, in accounting for the forms of one root. To account for the presence of *c* in *lacchati* (3sa pre), *lalaccha* (3sa prf), etc. derived from the root 1.125 *lach*, he states, "The augment *tuk* is present because *tuk* is added to a short vowel followed by *ch* in accordance with *A.* 6.1.73 *che ca*." (*'che ca' hrasyasya che paratas tug iti tuk.*). To account for the *c* in *pṛcchati* (3sa pre) derived from the root 6.120 *prach*, he refers to the rule of palatalization as well. He writes, "Once *tuk* has been added by *A.* 6.1.73 *che ca*, palatalization occurs by *A.* 8.4.40 *stoḥ ścunā ścuḥ*." (*pṛcchati--'che ca' iti tuki stoḥ ścunā ścuḥ iti ścutvam.*) He states *A.* 6.1.73 outright in deriving *uñcicchiṣati* (3sa pre des) from the root 1.133 *uch*, *ṛcchati* from the root 6.18 *ṛch*, and *vicchāyati* (3sa pre) from the root *vich* too. In the latter two he states *'che ca' iti tuk*; in the former, *'che ca' iti tuki* with the augment in the locative in the midst of a longer derivation. He cites *A.* 7.1.75 outright in his derivation of *mlecchati* (3sa pre), *mimleccha* (3sa prf), etc. from the root 1.124 *mlech* writing, "The augment *tuk* is present because when a long vowel precedes and the sound *ch* follows, *tuk* is added to the long vowel in accordance with *A.* 6.1.75 *dīrghāt*." (*'dīrghāt' dīrghāc chakāre parato dīrghasya tug iti tuk.*) He mentions the augment *tuk* more briefly in the course of discussing the derivation of *amīcchīt* (3sa aor) from the root 6.19 *mīch*, and *yucchati* (3sa pre) from the root 1.132 *yuch*. If the *Dhātupāṭha* read the roots with penultimate *c* to begin with, there would have been no occasion for Sāyaṇa to justify the presence of *c* by reference to the addition of the augment *tuk* and its palatalization.

B.   *Rules that normalize the root*

Several rules apply to the canonical form of roots to generate the form of the root cited in modern bilingual lexical sources and editions of the *Dhātupāṭha*. These rules include the replacement of initial retroflex *ṣ* (*A.* 6.1.64) and *ṇ* (*A.* 6.1.65) by their corresponding dentals, the addition of the augment *tuk* (*A.* 6.1.73, 75), the change of penultimate dental

n or *m* to anusvāra (*A*. 8.3.24) and then to the nasal homorganic with the following stop (*A*. 8.4.58), the assimilation of dentals to the place of articulation of adjoining palatals (*A*. 8.4.40) or retroflexes (*A*. 8.4.41), and regressive assimilation of voicing (*A*. 8.4.53, 55). The rules are shown in Table 2. 244 roots are affected out of 2669 roots and variants indexed in the *Mādhavīyā Dhātuvṛtti* and *Mādhavīyā Nāmadhātuvṛtti*. Table 3 provides copious examples.

Table 2
Pāṇinian rules that normalize roots.

A. 6.1.64   *dhātvādeḥ ṣaḥ saḥ*   Retroflex *ṣ* initial in a root is replaced by dental *s*.
A. 6.1.65   *ṇo naḥ* Retroflex *ṇ* initial in a root is replaced by dental *n*.
A. 6.1.73   *che ca* A short vowel, followed by the unvoiced aspirated palatal stop *ch*, receives the final augment *t* (which invariably becomes *c* by *A*. 8.4.40).
A. 6.1.75   *dīrghāt* A long vowel, followed by the unvoiced aspirated palatal stop *ch*, receives the final augment *t* (which invariably becomes *c* by *A*. 8.4.40).
A. 8.3.24   *naś cāpadāntasya jhali* Before a stop or spirant, non-word-final *n* or *m* is replaced by anusvāra.
A. 8.4.40   *stoḥ ścunā ścuḥ*   A dental stop or sibilant in conjunction with a palatal stop or sibilant is replaced by its corresponding palatal.
A. 8.4.41   *ṣṭunā ṣṭuḥ*   A dental stop or sibilant in conjunction with a retroflex stop or sibilant is replaced by its corresponding retroflex.
A. 8.4.53   *jhalāṃ jaś jhaśi*   Before a voiced stop, a non-nasal stop or spirant is replaced by its corresponding voiced unaspirated stop.
A. 8.4.58   *anusvārasya yayi parasavarṇaḥ*   Non-final *anusvāra* is replaced by the nasal corresponding to the following stop.

Table 3
Examples of the transformation of the canonical root to the normalized root, with citation forms as given in Monier-Williams' *A Sanskrit-English Dictionary* (MW), and the text (as opposed to the indices) of Shastri's editions of the *Mādhavīyā Dhātuvṛtti* and *Nāmadhātuvṛtti* (MDhV).

The table is segmented under headings consisting of the numbers of the sūtras by which the root is transformed from its canonical form to its normalized form, and a brief description of the relevant feature changed. In the latter two columns, x indicates that the root is not listed in any form, 'can.' that it corresponds to the canonical form, and 'norm.' that it corresponds to the normalized form. Where the root is listed differently in different places, references to the class and sūtra of each root are provided in parenthesis. Where MW lists a nominal (from which a denominative root is formed) rather than a root, the gender is put in parenthesis. A hyphen ('-') appears where there is no difference between the canonical and normalized form.

a.   *A. 6.1.64 Initial retroflex ṣ*

Can.	Norm.	MW	MDhV
ṣag	*sag*	norm.	can.
ṣagh	*sagh*	norm.	can.
ṣac	*sac*	norm.	can.
etc.			
ṣo	*so*	norm.	can.

ṣṭak	*ṣṭak*	norm.	*ṣṭak*
ṣṭag	*ṣṭag*	x	*ṣṭag*
ṣṭan	*ṣṭan*	norm.	*ṣṭam*
ṣṭabh	*ṣṭabh*	x	*ṣṭabh*
ṣṭam	*ṣṭam*	norm.	*ṣṭam*
ṣṭigh	*ṣṭigh*	norm.	*ṣṭigh*
ṣṭip	*ṣṭip*	norm.	*ṣṭip*
ṣṭīm	*ṣṭīm*	norm.	*ṣṭīm*
ṣṭu	*ṣṭu*	norm.	*ṣṭu*
ṣṭuc	*ṣṭuc*	norm.	*ṣṭuc*
ṣṭup	*ṣṭup*	x	*ṣṭup*
ṣṭubh	*ṣṭubh*	norm.	*ṣṭubh*
ṣṭṛh	*ṣṭṛh*	norm.	norm.
ṣṭep	*ṣṭep*	norm.	*ṣṭep*
ṣṭai	*ṣṭai*	norm.	*ṣṭai*
ṣṭyai	*ṣṭyai*	norm.	*ṣṭyai*
ṣṭhal	*ṣṭhal*	norm.	*ṣṭhal*
ṣṭhā	*ṣṭhā*	norm.	*ṣṭhā*
ṣṇas	*ṣṇas*	norm.	*ṣṇas*
ṣṇā	*ṣṇā*	norm.	*ṣṇā*
ṣṇih	*ṣṇih*	norm.	*ṣṇih*
ṣṇu	*ṣṇu*	norm.	*ṣṇu*
ṣṇus	*ṣṇus*	norm.	*ṣṇus*
ṣṇuh	*ṣṇuh*	norm.	*ṣṇuh*
ṣmi	*ṣmi*	norm.	can.
ṣvad	*ṣvad*	norm.	can.
ṣvap	*ṣvap*	norm.	can.
ṣvalk	*ṣvalk*	x	can.
ṣvid	*ṣvid*	norm.	can.

i.   Initial retroflex *ṣ* remaining in usage

Can.	Norm.	MW	MDhV
ṣṭhiv	*ṣṭhiv*	-	-
ṣṭhiv	*ṣṭhiv*	norm.	norm.
ṣvaṣk	*ṣvaṣk*	-	-

b.   *A. 6.1.65 Initial retroflex ṇ*

Can.	Norm.	MW	MDhV
ṇakṣ	*ṇakṣ*	norm.	can.
ṇakh	*ṇakh*	norm.	can.
ṇaṭ	*ṇaṭ*	norm.	can. (1.207)/norm. (1.515)
ṇad	*ṇad*	norm.	can.
ṇabh	*ṇabh*	norm.	can.
ṇam	*ṇam*	norm.	can.
etc.			
ṇeṣ	*ṇeṣ*	norm.	can.

c.   *A. 6.1.73 and 8.4.40 Palatalization of the augment tuk before ch after a short vowel*

Can.	Norm.	MW	MDhV	
uch	*ucch*	can.	can. (1.133, 6.16)	[marked with *i*]

uch	*ucch*	can.	norm. (1.134, 6.17)	
ṛch	*ṛcch*	can.	can.	
pich	*picch*	can.	norm.	
prach	*pracch*	can.	norm.	
mich	*micch*	can.	can.	
yuch	*yucch*	can.	norm.	
lach	*lacch*	can.	norm.	
vich	*vicch*	can.	norm.	

d.   A. 6.1.75 and 8.4.40 *The augment tuk palatalized before ch after a long vowel*

Can.	Norm.	MW	MDhV	
āch	*ācch*	x	can.	[marked with *i*]
lāch	*lācch*	x	can.	[marked with *i*]
vāch	*vācch*	x	can.	[marked with *i*]
mlech	*mlecch*	can.	norm.	
hrīch	*hrīcch*	can.	norm.	

e.   A. 8.3.24 *Dental n before a spirant*

Can.	Norm.	MW	MDhV
ansa	*aṁsa*	norm.	norm.
kansavadha	*kaṁsavadha*	norm. (m.)	norm.
tṛnh	*tṛṁh*	x	can.
danś	*daṁś*	norm.	norm.
dhvans	*dhvaṁs*	norm.	norm.
pums	*puṁs*	norm.	norm.
bhranś	*bhraṁś*	norm.	norm.
śans	*śaṁs*	norm.	norm.
srans	*sraṁs*	norm.	norm.
hansa	*haṁsa*	norm.	x

f.   A. 8.3.24 and 8.4.58 *Dental n before a non-dental stop*

Can.	Norm.	MW	MDhV
anka	*aṅka*	norm.	norm.
anga	*aṅga*	norm.	norm.
anc	*añc*	norm.	norm.
anj	*añj*	norm.	can.
uncha	*uñcha*	norm.	? *ucchyati*/*ucchiḥ*
udanc	*udañc*	norm.	norm.
unbh	*umbh*	norm.	can.
ṛnph	*ṛmph*	x	can.
kuṭunb	*kuṭumb*	*kuṭumba* (n.)	norm.
kunc	*kuñc*	norm.	norm.
krunc	*kruñc*	norm.	norm.
gunph	*gumph*	norm.	can.
glunc	*gluñc*	norm.	norm.
canc	*cañc*	norm.	norm.
tanc	*tañc*	norm.	norm. (1.119)/can. (7.28)
tanj	*tañj*	norm.	tanj
tunp	*tump*	norm.	can. (6.28)/norm. (1.281)
tunph	*tumph*	x	can. (6.28)/norm. (1.281)

tṛnph	*tṛmph*	norm.	can.
trunp	*trump*	norm.	norm.
trunph	*trumph*	norm.	norm.
tvanc	*tvañc*	norm.	norm.
danbh	*dambh*	norm.	can.
dṛnph	*dṛmph*	x	can.
panpas	*pampas*	x	norm.
pratyanc	*pratyañc*	norm.	norm.
bhanj	*bhañj*	norm.	can.
mṛdvangī	*mṛdvaṅgī*	norm.	norm.
mrunc	*mruñc*	norm.	norm.
mlunc	*mluñc*	norm.	norm.
ranj	*rañj*	norm.	norm.
lunc	*luñc*	norm.	norm.
luṇṭ	*luṇṭ*	norm.	norm.
luṇṭh	*luṇṭh*	norm.	norm.
vanc	*vañc*	norm.	norm.
vilanb	*vilamb*	norm.	norm.
śanb	*śamb*	norm.	norm.
śunbh	*śumbh*	norm.	norm. (1.287)/can. (6.33)
śranbh	*śrambh*	norm.	norm.
samyanc	*samyañc*	norm.	norm.
sānb	*sāmb*	norm.	norm.
sṛnbh	*sṛmbh*	x	norm.
skanbh	*skambh*	norm.	can.
skunbh	*skumbh*	norm.	can.
stanbh	*stambh*	norm.	can.
stunbh	*stumbh*	norm.	can.
sranbh	*srambh*	norm.	norm.

g.   *A. 8.3.24, 8.4.58, and 6.1.64 Dental n before a non-dental stop and initial retroflex ṣ*

Can.	Norm.	MW	MDhV
ṣanj	*sañj*	norm.	*ṣañj*
ṣanb	*samb*	norm.	*ṣamb*
ṣinbh	*simbh*	x	*ṣimbh*
ṣunbh	*sumbh*	norm.	*ṣumbh*
ṣṛnbh	*sṛmbh*	x	*ṣṛmbh*
ṣvanj	*svañj*	x	*ṣvañj*

h.   *A. 8.4.40 Palatalization of penultimate s*

Can.	Norm.	MW	MDhV
vrasc	*vraśc*	norm.	norm.
sasc	*saśc*	norm.	norm.

i.   *A. 8.4.40 and 8.4.53 Palatalization of penultimate s and replacement by homorganic nasal*

Can.	Norm.	MW	MDhV
bhrasj	*bhrajj*	norm.	can.
masj	*majj*	norm.	can.
lasj	*lajj*	norm.	can.

ṣasj	*sajj*	norm.	can.

j.   *A. 8.4.40 or 8.4.41 Palatalization or retroflection of dental d*

Can.	Norm.	MW	MDhV
cuḍḍ	*cuḍḍ*	norm.	norm.
aḍḍ	*aḍḍ*	norm.	norm.
kaḍḍ	*kaḍḍ*	norm.	norm.
udjh	*ujjh*	norm.	can. (6.24)/norm. (*nāmadhātu* p. 587)

C.   *Orthographic conventions of representing roots in Monier-Williams' A Sanskrit-English Dictionary.*

Monier-Williams' A Sanskrit-English Dictionary (MW) consistently adopts the normalized form of roots in every feature except the addition and palatalization of the augment *tuk* before *ch*, in which case it consistently adopts the canonical form of the root without the augment. This is the norm in modern bilingual lexical and grammatical sources published outside of India.

D.   *Orthographic conventions of representing roots in Shastri's editions and indices.*

Shastri's set of root indices adopts the canonical form of a root more often than the text of his edition of the *Mādhavīya Dhātuvṛtti* and *Nāmadhātuvṛtti* does, but neither does so throughout. The text usually does not adopt the canonical form of the root. It does do so, however, in several types of cases. The text lists roots whose initial *s* or *n* is subject to retroflection with the retroflex *ṣ* or *ṇ* (Table IIIa, g, and b). The two notable exceptions confirm the general principle of listing roots with the canonical initial retroflex. The only *s*-initial root subject to retroflection that the text lists in its normalized form with dental is 6.57 *stṛh*. Although it is so listed, Sāyaṇa comments on the forms *tarīṣṭṛhyate* (3sm pre int) and *tarīṣṭarḍhi* (3sa pre int) that retroflex *ṣ* has replaced *s* in the stem due to *A.* 8.3.59 *ādeśapratyayayoḥ* because the dental *s* of the root is a replacement of canonical *ṣ* (*ādeśapratyayayor iti prakṛteḥ ṣatvam*). The second notable exception is in 1.515 *naṭ* in the list *ghaṭādi*. The root in this location is a reference to the root 1.207 *ṇaṭ* which is listed with initial retroflex. Although the text preserves canonical initial retroflex *ṣ* and *ṇ*, it consistently normalizes the canonical dental stop following an initial retroflex *ṣ*, listing *ṣtak*, ..., *ṣthā* rather than *ṣṭak*, ..., *ṣṭhā* (see Table IIIa).

Regarding other canonical features of roots, Shastri's text is inconsistent. While his text does adopt the canonical form of roots in listing roots with penultimate *s* before *j*, for example *lasj* (see Table IIIi), the text adopts the normalized palatal *ś* before *c* instead of canonical dental in *vrasc* and *sasc* (see Table IIIh). The text is likewise inconsistent about inserting the augment *t* before *ch*, sometimes including it (*praccha*) and sometimes omitting it (*uchi*) (see Table IIIc, d). Notably the text consistently adopts the canonical form of *ch*-final roots marked with *i*; such roots condition insertion of the augment *n* after the root-vowel by *A.* 7.1.58 thereby eliminating conditions for the augment *t* in most forms (see section IIIA4e). Elsewhere the text usually adopts the normalized form of the root with anusvāra or homorganic nasal before spirants (Table IIIe) and non-nasal stops (Table IIIf, g), and palatalization or retroflection of *d* before palatal and retroflex stops,

but not palatalization before a palatal stop in one of the two cases where this occurs in the root *udjh*. The text has 6.24 *udjh* but *nāmadhātu ujjh* on p. 587 (see Table IIIj).

Shastri's index is similarly inconsistent but adopts the canonical form of the root more often than the text does. The index usually adopts the canonical form with dental *n* where there is a penultimate nasal. For example, where the text has normalized *śaṁsu*, the index has canonical *śansu*. Yet the index is not entirely consistent in adopting the canonical form; it still has normalized *aṁsa* like the text. Where the canonical form has a penultimate dental and the text gives the root with homorganic stop (1.236 *cuḍḍa*, 1.237 *aḍḍa*, 1.238 *kaḍḍa*, nāmadhātu *ujjha* p. 587), the index usually puts the canonical form in parenthesis after the normal form (*cuḍḍa*, *aḍḍa*, *kaḍḍa*), but it lists the canonical form and puts the normalized form in parenthesis in one case (*ujjha*).

E.   *Other orthographic conventions of Shastri's text and indices.*

The orthography and sandhi in Shastri's text and indices is not entirely consistent, either internally within each or with each other, just as their conventions for representing roots are not entirely consistent. The indices and text generally employ certain close sandhi options within words (including compounds of preverb with a following compound element). For example, for the nasal final in preverbs, they employ a nasal homorganic with the following stop rather than an anusvāra, writing *saṅghāte* rather than *saṁghāte*, in accordance with *A.* 8.4.59 *vā padāntasya* (*anusvārasya yayi parasavarṇaḥ* 58). Yet they maintain the use of the dot (*bindu*), representing an anusvāra, before semivowels rather than using a nasalized semivowel provided by the same rule. Hence the text and indices write *saṁvaraṇa* rather than *savvaraṇa*. The dot appears throughout at other word boundaries, e.g *kuṭilāyāṁ gatau*.[Our canonical index adopts the same inconsistent pattern consistently.] Yet even close sandhi within words is not held to consistently between the text and indices. Where the text writes *aṅka* and *aṅga* for the roots in 10.313-314 using close sandhi, for instance, the root index writes *aṁka* and *aṁga*.

IV.   Features of the Canonical Index

The Sanskrit Library's Canonical Index to Dwarikadas Shastri's edition of the *Mādhavīyā Dhātuvṛtti* and *Nāmadhātuvṛtti* indexes several types of elements. In the order shown in the search panel at the left of the Index window, these are: normalized roots, preverbs, premarkers, canonical root, marker, sense, class, and variants. Classes are numbered 1-14. The well-known ten major divisions of the *Dhātupāṭha* proper are numbered 1-10; the less famous four divisions of Sāyaṇa's *Nāmadhātuvṛtti* (*kaṇḍvādi*, *sautra-dhātu*s, *nāma-pratyaya-dhātu*s, and *ṇij-anta-nāma-dhātu*s) are given a number 11-14 displayed with an asterisk. Searches may be conducted on any combination of these items. Searches may be entered in the text box using any of three input methods (Sanskrit Library Phonetic (SLP), Harvard Kyoto, or ITrans) selected from the Input pull-down menu. Results may be displayed in Devanagari Unicode or Roman Unicode as well as in any of the three input encodings. Searches entered in the text boxes may be in the form of regular expressions, or partial regular expressions or characters in combination with further restrictions selected from the pull-down menus to the right of

the text boxes. The three parameters regarding variants are shown beside radio buttons. Selecting the plus sign at the right of the pull-down menus displays further search choices for each of the other elements. Complete listings of available choices are shown for premarkers, preverbs, markers, and sense. Pre-formulated phonological categories are shown for normalized roots and canonical roots. Display may be sorted on any of the following fields by selecting the appropriate choice from the Sort pull-down menu: normalized root, premarker, canonical root, marker, sense, class, sutra. Searches are implemented by clicking the green "Refresh" button. If no other search criteria are selected, all roots are displayed sorted on the normalized root. Navigational characters are displayed across the top of the Index display area. Elements are displayed in columns from left to right in the order they are listed in the search panel. Since there are only five roots with preverbs and none of them has premarkers, preverbs are displayed in the Premarker field; they are distinguished from premarkers in that they appear in square brackets. The number of the *Dhātupāṭha* sutra in which the root is read and the page on which it occurs in Shastri's edition are displayed in columns between the class and variant columns. In the sense field, variant readings are shown in curved braces; sense terms inherited by anuvṛtti, in square brackets. Alternate readings found in the commentary are indicated by displaying *pā°* in the rightmost Variant field. The page number displayed in the Page column is a link to the PDF file of the page on which the entry begins in Shastri's edition. Clicking it opens an image file of the page. For further details regarding the use of the index, see the Help file linked to the *Mādhavīyā Dhātuvṛtti* Canonical Index under "Sayana's *Madhaviya Dhatuvrtti*" under "Reference works" at http://sanskritlibrary.org/.

V.   Development, responsibility, and acknowledgements

The Canonical Index to Shastri's edition of the *Mādhavīyā Dhātuvṛtti* was developed by Peter Scharf and Jim Funderburk from the digital index to Shastri's edition of the *Mādhavīyā Dhātuvṛtti* developed by Scharf, Funderburk, Chandrashekar, and Rosenfield. For the responsibility and history of the latter, see the *Introduction to the digital emulations of Dwarikadas Shastri's indices* in the "about" link under "Digital emulations of Dwarikadas Shastri's indices" on the "Sayana's *Madhaviya Dhatuvrtti*" page under "Reference works" at http://sanskritlibrary.org/. Scharf is responsible for editorial decisions and contributed to design decisions. Scharf manually edited the canonical and normalized roots, then wrote regular expressions in an XML file representing the rules in Table 2. Funderburk adapted a framework developed by Malcolm Hyman to convert such an XML file of regular expression rules to Perl executable code. The code was used to verify that the rules do indeed systematically produce the normalized root forms from the canonical root forms. Funderburk developed the software and designed and implemented the web display. He also contributed to the content of the indices by conducting numerous systematic analyses and comparisons of the data and presenting them to Scharf for review, and by maintaining the data.

VI.   References

A.   Aṣṭādhyāyī

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