Conjunct Vowels and Voiced Obstruents in Old and Early Middle Japanese Poetry

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1. Overview of the problem

1.1 Phonemes of Old and Early Middle Japanese

The phonemic inventory of Old Japanese[1] is characterized by a simple set of thirteen consonants on the one hand, and a relatively large set of eight vowels on the other.[2] Some of the Old Japanese texts use Chinese characters to represent Japanese pronunciation syllabically; this is called the *Jion-gana* system. While Old Japanese texts written in *Jion-gana* often distinguish voiced from voiceless obstruents by using characters with different onsets, Early Middle Japanese texts are recorded using two simpler syllabic alphabets called *Hiragana* and *Katakana* (called *Kana* together), which usually do not distinguish voiced from voiceless obstruents and do not give any clue to the phonetic value of the voiced obstruents.

One of the major differences between the phonemic systems of Old and Early Middle Japanese is the distinction between two kinds of syllables with the onset /k/, /g/, /s/, /z/, /t/, /d/, /n/, /y/ or /r/ (or /m/ in the *Kojiki*) followed by /o/, and between two kinds of syllables with the onset /k/, /f/ or /m/ followed by /i/ or /e/. These two kinds of syllables are conventionally called types A (甲 *koo*) and B (乙 *otsu*).[3] Old Japanese /iy/, /ye/, /ey/, and /wo/ are considered to originate respectively from coalescence of Pre-Old Japanese *ui or *əi, *ia or *iə, *ai, and *ua or *uə (Whitman 1985, Miyake 1999: 467-595), or synchronically from Old Japanese /uyi/ or /o̲yi/, /yia/ or /yio̲/, /ayi/ or /o̲yi/, and /ua/ or /uo̲/ (Yamaguchi 1985: 36ff.). So, the eight vowels in Old Japanese can be reconstructed as coming from four vowels at some stage preceding Old Japanese. In some period[4] of Middle Japanese, a coda nasal resulting from syncopation of an /mV/ or /nV/

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1 I use the term 'Old Japanese' for the language between Emperor Suiko's reign (593-612) and the end of the Nara period (710-794). 'Pre-Old Japanese' is used when the phonomenon in question is safely assumed from Old Japanese but is not attested in a written form. 'Early Middle Japanese' and 'Late Middle Japanese' refer respectively to the languages of the Heian period (794-1192) and of Kamakura, Muromachi and Adzuchi-Momoyama periods (1192-1603).

2 Matsumoto (1995: 113ff.) posits a five-vowel system instead, ascribing the contrasts to the features of the preceding consonants. See 3.1 for discussion.

3 Martin (1987: 49ff.) transcribes /i$_1$/ and /i$_2$/ as *yi* and *iy*, /e$_1$/ and /e$_2$/ as *ye* and *ey*, and /o$_1$/ and /o$_2$/ as *wo* and *o̲* respectively.

4 See Okumura (1972: 73ff.) for the controversy over the exact period of the phonemicization of the coda nasals.

syllable[5] starts being written, and I use the cover symbol /N/ for it.

Both Old and Early Middle Japanese have the following phonotactic restrictions. There are no conjunctions of consonants[6] until syncopation of vowels in nasal-initial syllables creates an overt coda nasal in Late Middle Japanese. Onsetless syllables usually occur only at the beginning of a morpheme, and vowel sequences or long vowels within a morpheme are not very common except in loanwords; one of the few exceptions are *kai* 'oar' (*Man'yoo* 2052. < **kakyi* 'paddling' ?), *mausu* 'to say' < *mawosu* 'id' (Okumura 1972: 116) and place names such as *kiyi* (Endoo 1976: 183ff.). Underlying **yi* and **wu* surface as *i* and *u: oi* 'old age' < **oyi, uu* 'to plant' < **uwu* (Takei 1999: 2). /ye/ was originally distinct from /e/ as in *ye* 'branch': *e* 'name of a plant (Celtis sinens)'. A word can begin only with the phonemes /a/, /e/, /o/, /i/, /u/, /k/, /s/, /t/, /n/, /f/, /m/, /y/ or /w/, and almost no voiced obstruent or /r/, begins a content word.

The phonemic status of voiced obstruents has been subject to question because of their distributional asymmetry. Being marked counterparts of voiceless obstruents, they almost never occur in the initial position of a content word in Old Japanese, although asymmetry itself does not make a crucial argument for denying phonemic status of the Old Japanese voiced obstruents, particularly if some word-initial obstruents were originally voiced in pre-Old Japanese as Takeo Miyake (1932: 142) argues. There are cases of spontaneous voicing of originally voiceless medial obstruents, while spontaneous devoicing is less common (Martin 1987: 86ff.). Given that some medial obstruents were already voiced in their earliest attested form in Old Japanese, it is impossible to prove philologically that all voiced obstruents were allophones of their voiceless counterparts. Furthermore, there are minimal pairs like OJ *saka* 'slope, boundary, crest': OJ *saga* 'nature', OJ *susu* 'soot': OJ *suzu* 'bell', OJ *sita* 'bottom, tongue': OJ (dialectal) *sida* 'time', OJ *ata* 'enemy': EMJ *ada* 'transient', OJ *futi* 'pool, speck': OJ *fudi* 'wisteria', OJ *tani* 'valley': EMJ *tani/dani* 'mite'.[7]

1.2 Question about the duration of voiced obstruents

One of the contexts under which obstuents are secondarily voiced in Old Japanese is in the sequence of a nasal, a vowel, and a voiceless obstruent as in the following examples.[8] Presumably, the vowel in between is first lost by syncopation, and then a cluster of a nasal and an obstruent becomes a voiced counterpart of the latter.

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5 I use the symbols V, C and K respectively for a vowel, a consonant, and an obstruent henceforth.

6 Unless, for example, a voiced obstruent was actually a nasal-obstruent cluster.

7 Since the contrast might have resulted from tonal contrast as in the case of Verner's law in Germanic by which devoicing is blocked by tonal contexts, existence of minimal pairs does not necessarily make a conclusive argument for a phonemic status of the voiced obstruents.

8 Lyman (1894: 172) even suggests that a nasal arising from apocope of postpositions like *ni* or *no* caused sequential voicing (rendaku) at compound boundaries.

OJ *kazasi* 'coronal' (*Man'yoo* 5:820: Okumura 1972: 131f.) < **kamyi-sasi*, through the intermediate stage **kaN-sasi*. *Shinsenjikyoo*, *Myoogishoo* *kamuzasi* 'hairpin'[9]

EMJ *kagura* 'holy dance' < **kamu-kura* (Shinmura, *Koojien*)

OJ *yugey* 'place name, originally bow makers' (*Man'yoo* 7:1385) < **yumyi-ke* (Okumura 1972: 132)

OJ *yuduka* 'grip of a bow' (*Man'yoo* 14:3567) < **yumyi-tuka* (Okumura 1972: 132)

OJ *siduye* 'lower branch' (*Man'yoo* 5:842) < *simwo tu ye* (Okumura 1972: 132)

OJ *nado* 'why' (*Man'yoo* 4:509) < *nani to* (Okumura 1972: 132)

OJ *nazo* 'why' (*Man'yoo* 3:409 15:3684) < OJ *nani so*

OJ *tabu* 'to grant' < OJ *tamafu*, through **taNfu*[10]

EMJ *ikaga* 'how' < *ika ni ka* (Hamada 1949: 47)

OJ? *fuda* 'card, plate' < *fumyita* < **fumyi-ita* (Arisaka 1955: 704)

OJ *murazi* 'kind of clan' < *mura-nusi* (Martin 1987: 488)

OJ *agwo* 'seiner' (*Man'yoo* 3:238) < *amyi-kwo*

In such cases of syncopation, it is quite conceivable that the ensuing voiced obstruent is actually a consonant cluster like [nd] rather than a contour segment like [ⁿd], and its nasal part still holds a timing slot. But there is no evidence that voiced obstruents originating from syncopation are written differently than other voiced obstruents. For Late Middle Japanese, Chinese and Korean travelers and captives record prenasalization of (or nasal segments before) voiced obstruents by using characters ending in nasals (Hamada 1952: 20f, Wenck 1959: 232, Martin 1987: 22): e.g. 松蘇利 for *suzuri* 'ink stone', 分直 for *fude* 'pen' (Chinese, 1252); 要温梁 for *yodo* 'place name', 也望仇知 for *yamaguti* 'place name' (Korean, 1420, Korean, 1471). According to Rodriguez (1604-08: 177f [358ff.] tr. in Doi 1955: 637), /d/ and /g/ in Kyoto Japanese in the early 17th century were accompanied by nasalization of the preceding vowel, and so were /b/ and /z/ to a lesser degree (Takayama 1993: 22f.). In the *Jion-gana* system of Old Japanese as well, there are suspected cases of writing voiced obstruents with a nasal coda of the preceding syllable such as *Harima Fudoki*, s.v. Kako county, 南毗都麻 *nabyituma* (name of an island), but there is no rule followed consistently to the best of my knowledge. For example, 安 *an* and 阿 *a* are used for /a/ in the *Man'yoo-shuu*, but both are used for the /a/-s before voiced and voiceless obstruents. Since the reconstruction of **[ŋg], **[nz], **[nd] and **[mb] for Old Japanese voiced obstruents by Marc Miyake (1999. See 1.4) is based on the phonetic value of the onset consonants of the Chinese characters, their prosodic status (i.e. whether they count as simplex or conjunct consonants) remains unclear. Pronunciation of Early Middle Japanese voiced obstruents is even less transpar-

9 *kazasi* and *kamu-zasi* are different words according to *JKDJ*.

10 According to Miyake (1932: 161), *tamafu* is derived from *tamu/tabu* with the suffix *-afu*.

ent, for the *Kana* system seldom makes a voicing distinction. Also, coda nasal is not written until a certain period of Middle Japanese, so for example, the syncopated form of **sinisi ko* 'the child who died' is written *sisi ko* (probably read /siNzi ko/) in the *Tosa Nikki* (Hamada 1949: 33).

One of the questions I ultimately wish to address in this paper is the articulatory duration of voiced obstruents in Old and Early Middle Japanese, and whether there was any difference between voiced and voiceless obstruents in their duration. If Old or Early Middle Japanese voiced obstruents did not accompany prenasalization, and if voiced obstruents derive from pre-Old Japanese nasal-vowel obstruent sequences as Ramsey and Unger (1972: 290) proposed, it follows that a cluster of a nasal and an obstruent first became a voiced obstruent losing its prenasalization, then regained it in Late Middle Japanese. This scenario is rather implausible as Marc Miyake (1999: 401) points out, but implausibility is not a conclusive reason to turn it down.

1.3 Hypothesis

The meter of poetry is not just a musical or recitational convention, but it reflects some, if not all, of the phonological restrictions of that language. This must be particularly so in periods like Old Japanese when the language of poetry was still close to the daily language. As the academic tradition is formed among court poets in the Heian period, more stock phrases, clichés and intended irregularities come into use, but there are still reflections of change in the daily language to some extent. In late Heian and Kamakura periods, poets start using hypermetrical verses, and some of them deliberately did so for aesthetic effects, as Hamaguchi (1969) shows in his study of the *Gyokuyoo-shuu*. By quantitatively analyzing the poetic anthologies in chronological order, we might be able to find some trace suggesting changes in the phonological structure of the language.

Against such methods of discussing phonology on the basis of the distribution of syllables in metrical composition, Kida (1988: 155) argues that scansion of conjunct vowels as one syllable is merely a poetic convention and is not to be viewed as a phonological phenomenon, because such scansion occurs mainly in the first, third and fifth verses of a *tanka* or a short stanza of 5-, 7-, 5-, 7- and 7-syllable verses, and usually not in the first four syllables of the second and fourth verses (Moori 1981: 44). However, it is cross-linguistically not uncommon that a language is subject to certain phonological restrictions only in some particular position of metrical composition. For example, overlong syllables tend to be avoided in the last three syllables but one of the Rigveda (Hoenigswald 1989). Similarly, I think it is possible to consider that syllables of the shape (C)V were preferred in the first four syllables of the even verses of a *tanka*. Prince and Smolensky (1993), furthermore, proposed a model of phonology consisting not of rules which are in principle unviolable, but of a set of constraints which are ranked in priority and can be violated when overridden by higher-ranked ones. According to this theory, it is not necessarily unnatural that there are phonological constraints which are

usually suppressed but surface only in certain metrical contexts which are particularly sensitive to prosodic well-formedness.

Except for the poetry in the *Kojiki* and the *Nihon-shoki* where verses containing only three, four or six nucleus-forming segments are fairly common, the vast majority of Old and Early Middle Japanese metrical texts consist of lines with five or seven nucleus-forming segments. There are also many verses which are apparently hypermetric, for example, *Man'yoo* 5:809.1 多陀尓阿波須 *tada ni afazu* which is the first verse but has six and not five nucleus-forming segments. In this case, the conjunct vowels *ia* probably counted as one metrical unit, although it might be too simplistic to conclude that these vowels were pronounced as diphthongs like [ia] or [ja]. On the other hand, there are as many conjunct vowels which count as two metrical units, e.g. *uu* in *Man'yoo* 15:3653.5 安可思都流宇乎 *akasi turu uwo*.

Since apparently hypermetric verses with more than five or seven nucleus-forming segments must take more time in pronouncing than regular verses do, such verses might reveal phonological preferences on what is or is not preferable in metrical text, which is generally more sensitive to syllable weight than in prose. For example, if two vowels followed by a voiceless obstruent count as one metrical unit, whereas two vowels followed by a voiced obstruent are more often treated as two, then it might be possible to interpret that the duration of a voiced obstruent is longer than that of a voiceless obstruent, and that the rhyme of the preceding syllable is too heavy to scan as one syllable.

1.4 Previous studies

1.4.1 Pronunciation of Old Japanese phonemes

The phonetic values of Old Japanese phonemes have been reconstructed based on the estimated pronunciation of the Chinese characters used to represent Old Japanese syllables. In the following phonemic table, I cite two sets of reconstructed phonetic values for Old Japanese phonemes; the reconstructed form in brackets on the left is by Marc Miyake (1999) and the one on the right is by Mabuchi (1999: 128f).

Old Japanese	velar	palatal ~ dental		labial
voiceless obstr.	k	s	t	p
	[k][k]	[s][ts/s/ʃ]	[t][t]	[p][p]
voiced obstruent	g	z	d	b
	[ŋg][ŋg]	[nz][nz/ndz]	[nd][d]	[mb][b]
nasal			n	m
			[n][n]	[m][m]
liquids & glides		y	r	w
		[i̯][i]	[r][l]	[u̯][u]

Early Middle J.	velar	palatal ~ dental		labial
voiceless obstr.	k [k]	s [s/ʃ]	t [t]	f [ɸ]
voiced obstruent	g [ʔ]	z [ʔ]	d [ʔ]	b [ʔ]
nasal		n [n]	(~N[ŋ̍/n̍/m̍]~)	m [m]
liquids & glides		y [i̯]	r [r]	w [u̯]

	Old Japanese			Early Middle Japanese	
	front	central	back	front	back
high	yi [i][i]	iy [ɨ][i̯ə]	u [u][i̯u]	i	u
mid	ye [e][ie]	o̲ [ə][o]	wo [o][uo]	e	o
low		a [a][ɑ]		a	
diphth.		ey [əy][ɛ]			

1.4.2 Conjunct Vowels

Resolving apparently hypermetric verses by counting conjunct vowels as one metrical unit was originally proposed by Norinaga Motoori (5.332f., 5.493f.). Satake (1946) conducted a statistical research of hypermetric verses in the *Man'yoo-shuu* and established three conditions under which more than five or seven vowels occur in one verse, i.e: i) conjunct vowels of which the latter is not /ye, ey/; ii) initial /iyV/, /iCi/, /uwV/, or /umV/; and iii) medial /iyV/, /eyV/, /uwV/ or /owV/ (Satake 1946: 193f). Kinoshita (1958: 31) discovered that conjunct vowels are treated as one metrical unit in odd verses of a *tanka* much more frequently than in even verses. Moori (1979) refined the condition of monosyllabic treatment of conjunct vowels by showing that conjunct vowels at the boundaries of univerbated or compounded morphemes tend to be treated as one syllable. The extensive survey of hypermetric verses in Early and Late Middle Japanese anthologies by Murayama (1979), among others, leaves little to be done in the statistics of conjunct vowels. Now that many electronic texts and programming tools are available, however, we can do quantitative research on our own in order to look into uninvestigated phonotactic conditions.

1.4.3 Syllable-based timing

Sakurai (1968: 32, 1974: 47) and Endoo (1974, 1976: 177) argue that scansion of conjunct vowels as one metrical unit in Old and Early Middle Japanese poetry reflects syllable-based timing, in contrast with Modern Tokyo Japanese in which the mora is the unit of timing. Shibata (1958: 43-45) groups the dialects of Modern Japanese into syllable-timed and mora-timed ones, a dichotomy Kida (1988:157ff.) questions as oversimplifying. Poser (1990) proposes existence of foot structure in some of the modern dialects. These proposals, taken together, show a change in the unit of timing in Japanese from the syllable, into the mora, and then into the moraic foot.

1.4.4 Voiced obstruents and rhythmic phenomena

With regard to the duration of voiced obstruents mentioned in 1.2, and particularly of the prenasalization accompanying them, Motoori (see Takeo Miyake 1932: 136), Moriyama (1962: 3) and Endoo (1981) give a rule which prohibits voicing of two obstruents in any adjacent syllables.

Motoori (*Kojiki-den* 3 = 9.146), and Lyman (1894: 162) for Modern Japanese, observe blocking of *rendaku*, or voicing of the initial obstruent of the second member of a compound, when the second member already has a voiced obstruent, e.g. *ofo* 'big' + sazakyi 'wren' > ofosazakyi, not **ofozazakyi*. In order to explain the puzzling non-locality of this rule,[11] Kamei (1971:130ff.) proposes a rhythmic autosegment (he uses the term 'prosodeme'), while Lyman (1894) and Hamada (1949: 38) trace the voicing back to a syncopated form of postpositions *no* or *ni*. The autosegmental explanation works synchronically, but historical reconstruction is done on the basis of phonemic segments and not of autosegments. Also, syncopation of the nV postpositions is not readily acceptable, for there are nouns which have no *rendaku* alternants like *kasi* 'oak', *kiy* 'tree', *kuni* 'country', *sifo* 'salt/ sea water', *sima* 'island', *two* 'door', *fyi* 'day/sun' as Moriyama (1962) points out.

2. Experiment

2.1.1 Material

2.1.1.1 Poems in the *Kojiki* and the *Nihon-shoki*, and *Jion-gana* part of the *Man'yoo-shuu*

Most of the poems cited in the *Kojiki* and the *Nihon-shoki* (henceforth the *Kiki* poetry) are written with strictly phonetic use of Chinese characters, and serve as an excellent source for reconstructing Old Japanese phonetics. The meter of the *Kiki* poetry, however, is still far from uniform:

	poems	*tanka*	total syll.	*tanka* syll.	ratio
Kojiki	112	39	5903	1200	20.3%
Nihon-shoki	128	66	5524	2029	36.7%

Long stanzas (*chooka*) account for more than half of the total number of syllables. Even short stanzas (*tanka*) contain many hypometric verses, e.g. *Kojiki* 68 *fyibari fa/ amey ni kakeyru/ takayuku ya/ fayabusawakey/ sazakyi torasane*, which has 4, 6, 5, 6 and 7 syllables in each verse. In order to ensure that the material can be mechanically analyzed by simple algorithm and can be compared with text from different periods, only short stanzas are sorted out. I used Okajima's electronic text for the *Kiki* poetry [2,3].

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11 Lyman shows, however, that majority of the second members have voiced obstruent in the second syllable.

For chapters 5, 14, 15, 17, 18 and 19 of the *Man'yoo-shuu*, which are mostly written in the *Jion-gana* system and make a distinction between the two classes of *i, e* and *o*, I used Okajima's electronic text [4], which in turn is based on Yoshimura's electronic text [5]. For the entire text of the *Man'yoo-shuu*, I used Murata's electronic text [6] which is based on the Oofuu edition. The editions of Murata and Okajima contain 4,325 and 899 *tanka*, and 133,093 and 28,208 syllables respectively.

There is a pitfall of circularity in using the *Man'yoo-shuu* as a source of metrical study. Since a large part of the text is written not in the *Jion-gana* system but in the *Kun-gana* system which uses Chinese characters mainly for expressing the meaning of each word, there is much room for interpretation in deciding the reading, and reading is often decided so that it fits the metrical norm. For example, Kinoshita (1958: 31) decides that the fifth verse of a *tanka* in the *Man'yoo-shuu* which contains conjunct vowels not counted as one unit is actually hypometric, and proposes to amend such verses by adding a syllable; for example, *Man'yoo* 2:125.5 妹尓不相而 should be read *imo ni afazusite* instead of *imo ni afazute*. Using lines written in *Kun-gana* in a metrical analysis might end up just tracing what the editors think the meter should be.

2.1.1.2 The Eight Anthologies

After the *Man'yoo-shuu*, composition in Japanese becomes inactive through the first half of the ninth century. In 905, the first royal decree of editing an anthology of Japanese poetry is issued by Emperor Daigo, and seven other royal anthologies are edited in the following three centuries. For this research, I prepared romanized electronic texts of these Eight Anthologies (*Hachidai-shuu*), which contain the following number of stanzas:

	decreed	submitted	stanzas	*tanka*	*tanka* syll.
Kokin	905	913?	1111	1094	34234
Gosen	951	955/8	1426	1410	44030
Shuui		1005/6	1351	1316	41074
Goshuui	1075	1087	1220	1196	37268
Kinyo		1124-6	716	691	21490
Shika	1144	1151	411	406	12639
Senzai	1183	1188	1285	1259	39207
Shinkokin	1201	1205-	1995	1975	61680

Since the extant manuscripts of the Eight Anthologies are written in *Hiragana* and Chinese characters, the reading admits of little ambiguity except in voicing, which is not written in the text itself. Voicing of obstruents in simplex words is known from *Jion-gana* text in Old Japanese, Middle Japanese dictionaries and other learning materials, but we can not be always sure about *rendaku* or sequential voicing at morpheme boundaries of compound words.

In order to analyze the Eight Anthologies in the same way as the Kiki poetry and the *Man'yoo-shuu*, we have two major difficulties: first, we need to read the Chinese characters according to their contexts; and second, to decide on the voicing status of each obstruent. I first obtained an electronic text of the Eight Anthologies typed in Chinese characters and *Kana* based on the *Kokka Taikan* edition, from the Japanese Texts Initiative at the University of Virginia [7]. Then I modified the dictionary files of the *ChaSen*, a Japanese morphological analyzer, so that it parses Early Middle Japanese correctly, and fed the electronic texts into it (See Appendix II for technical details.) The database of twenty-one anthologies by the National Institute of Japanese Literature [8] gives *Kana* reading separated in verses, but does not make voicing distinctions.

2.2 Vowel Sequences

The *tanka*s in the *Kiki* poetry contain the following verses with more than five (in verses 1 and 3) or seven nucleus-forming segments (in verses 2, 4 and 5). I tentatively call conjunct vowels counted as one metrical unit 'crasis', and ones counted as two units 'hiatus'. See Appendix I, table 1, for the number of conjunct vowels in *Kiki* poetry and the *Man'yoo-shuu*.

	cases of crasis	cases of hiatus
iV sequences		
yia	Koj 59.5 *isikyiaFamukamo* (=NS 11-52.5 *isikyiaFamukamo*), Koj 23.5 *samyinasiniaFare*	Koj 55.2 *nisiFukyiageyte*, Koj 94.3 *tukyiamasi*
yiye		NS 15-86.5 *myiyezukamoaramu*, NS 9-30.4 *meynisimyiyeneba*
yio	Koj 46.5 *uruFasimyiomoFu*, NS 16-93.2 *myiobyinosituFata* NS 16-93.5 *aFyiomoFanakuni*	NS 15-83.4 *nabyikyiokiytati*
Va sequences		
oa	Koj 54.5 *tanwosikumoaruka*, Koj 70.5 *sagasikumoarazu*, Koj 76.5 *tumagaiFyenoatari*, NS 11-49.5 *aniyokumoarazu*	
yia: See above		
aa	NS 11-48.5 *sonokwoFaarikyemey*	Koj 79.2 *utuyaarareno*, Koj 110.-3 *sigaareba*, NS 2-6.2 *FyikariFaarito*
ua	NS 2-6.5 *taFutwokuarikyeri*, Koj 7.5 *taFutwokuarikyeri*	Koj 54.2 *makyeruawonamo*, Koj 107.5 *iritatazuari*, Koj 110.2 *sibyitukuamayo*, NS 26-117.4 *wakakuarikyito*

Vi sequences

ai Koj 76.5 *tumagaiFyenoatari*, NS 2-6.3 *FyitoFaiFeydo*

ei Koj 59.3 *isikyeisikye*

The *Kiki* poetry

Although the number of *tanka* are not large enough for statistical analysis, the following three points are worth noting.

1. *oa, yia* and *yio* tend to be counted as one metrical unit.
2. Conjunct vowels of which the latter is *ye* or *ey* are never counted as one metrical unit, as Satake (1946: 184) points out on the *Man'yoo-shuu.*
3. *aa* is not counted as one metrical unit in three out of four cases.

The *Man'yoo-shuu*

In Okajima's text of the *Jion-gana* part of the *Man'yoo-shuu*, the following tendencies are observed:

1. iV sequences (*yia, iya, ia, yii, ii, yio, io, iu*) tend to be counted as one metrical unit.
2. oV sequences tend to be counted as one metrical unit.
3. Va sequences, particularly *oa* besides *ia* in 1 above, are often counted as one metrical unit.
4. Vi sequences except *ui* are counted as one metrical unit relatively often.
5. Of the sequences of the same vowels, about half of *aa*, *ii* and *uu*, and more than half of *o(o?)o*, are counted as one metrical unit. In this respect the *Man'yoo-shuu* might be different from the *Kiki* poetry, although the latter has only four examples of such a sequence.
6. Conjunct vowels of which the latter is *ye* or *ey* are not counted as one metrical unit (Satake 1946).

The *Man'yoo-shuu* and the *Kokin-shuu*

See Appendix I, table 2, for the conjunct vowels in the *Man'yoo-shuu* and the Eight Anthologies. While *ou* (*ou*), *ua* and *uo* tend to be counted as one metrical unit in the *Man'yoo-shuu*, this tendency is reversed in the *Kokin-shuu*, where they count more often as two units. So are *ea*, *ei*, *eo* and *io* to a lesser degree.

The Eight Anthologies

Conjunct vowels counted as one metrical unit decrease in number after the *Kokin-shuu*, as Endoo (1976: 193) points out.

1. In the *Kokin-shuu*, most often *ii, oa* and *oo*, then *ia, aa, ao, oi* and *ei*, tend to be counted as one metrical unit.

2. Of these vowel sequences, however, *oa* becomes more often two units than one after the *Goshuui-shuu* through the *Shin-kokin-shuu*.
3. Although smaller in number than *oa, ei* also becomes more often two units than one after the *Gosen-shuu*, and the same is true of *aa* after the *Shuui-shuu*.
4. *ao* and *oi* are often two units in the *Kokin-shuu*, but the ratio of the cases of crasis conspicuously decreases after that.
5. *oo, aa*, and *ii* show the highest ratios of counting as one unit throughout the Eight Anthologies.
6. So are *oa* and *ia* to a lesser degree.

2.3 Position of crasis and hiatus within a stanza and within a verse

In his paper on conjunct vowels in the *Man'yoo-shuu*, Moori (1990: 340, 345) notes that conjunct vowels tend to be counted as one metrical unit anywhere in the first, third and fifth verses of a *tanka*, and when a vowel-initial morpheme comes after the fifth vowel in the second and fourth verses of a *tanka*. In fact, counting the *tanka*s in Murata's electronic text shows that the sixth vowel is almost always counted as one metrical unit with the preceding vowel:

	vowel	2nd	3rd	4th	5th	6th	7th
Man'yoo	hiatus	7	86	546	534	8	2
	crasis	2	58	82	122	133	21
Kokin	hiatus	6	41	109	101	5	2
	crasis	1	30	7	13	29	2
Shinkokin	hiatus	27	84	230	246	18	2
	crasis	0	45	6	9	27	0

2.4 Genuinely hypermetric verses

Real hypermetric verses, or verses which contain more than five or seven vowels but have no conjunct vowels, are listed in Appendix II, list 1. There are no such verses in the *Kiki* poetry, where hypometric verses are still common, and very few in the *Man'yoo-shuu*. As Motoori points out (1.3), it is Saigyoo and other *Shinkokin* poets who start using hypermetric verses intentionally.

2.5 The sequence of conjunct vowels and a voiced obstruent

This section and the next address the problems of the skeletal structure and duration of the voiced obstruents. If a voiced obstruent was originally a nasal-obstruent cluster, there could have been a period when it was actually pronounced as such. In that case, if a voiced obstruent follows conjunct vowels, one metrical unit would become doubly longer than a unit of a single vowel plus a voiceless or a nasal consonant, and it is conceivable that such sequences tend to be treated as two metrical units instead of a superheavy one.

Appendix I, list 2, gives numbers of hiatus and crasis reading of conjunct vowels with contexts of the latter from the *Man'yoo-shuu* to the *Shinkokin-shuu*. The results are summarized in the following table. Conjunct vowels of which the latter is /e/ are excluded, as they are never counted as one metrical unit. Note that the statistics of voiced obstruents in the Eight Anthologies in this and the next section are not always accurate, because the romanization of the University of Virginia edition is based on my conversion table and ChaSen's dictionary for Modern Japanese, and it is often difficult to decide on the voicing status of some obstruents, typically the ones at compound boundaries.

	hiatus	crasis	major cases of crasis
Man'yoo	102	74	oag (27), iid (21), iag (12)
Kokin	24	40	iid (30), iag (3), eid,oid (2)
Gosen	36	22	iid (20)
Shuui	37	10	iid (4), eid,iag (2)
Goshuui	46	26	iid (19), oid (3)
Kin'yoo	35	8	iid (6)
Shika	9	6	iid (6)
Senzai	46	12	iid (12)
Shinkokin	69	41	iid (29), iag (4), eid,oid (3)

In the *Man'yooshuu*, most cases of crasis contain the words *aga* 'my', *idu* 'get out' or *agu* 'put up'. In the Eight Anthologies, on the other hand, the sequence of conjunct vowels and a voiced obstruent is counted as one metrical unit less often, and the combination of *i* and *idu* accounts for most of these cases.

2.6 Rhythmic distribution

If voiced obstruents were originally consonant clusters, another consequence to be considered would be the existence of a rhythmic rule as a means of avoiding consecutive syllables beginning with voiced obstruents.[12]

The ratio of voiceless to voiced obstruents is about 100 : 26~28, and there is little diachronical change in this ratio according to my electronic texts:

text	voiceless obstruents	voiced obstruents	ratio
Kiki	463	129	27.9%
Man'yoo	43567	11485	26.4%
Kokin	10812	2960	27.4%

12 The gradation rule in Finnish, for example, restricts occurrence of onset clusters in two consecutive syllables and simplifies a geminate in the stem-final syllable when a suffix-initial vowel is followed by a consonant cluster: e.g. nominative *mykkä* 'mute': essive *mykkä-nä*: inessive *mykä-ssä* nominative *hattu* 'hat' : essive *hattu-na*: elative *hatu-sta* (Kenstowicz 1994).

Gosen	13984	3792	27.1%
Shuui	13112	3607	27.5%
Goshuui	12053	3358	27.9%
Kin'yoo	6927	1944	28.1%
Shika	4095	1099	26.8%
Senzai	12734	3470	27.2%
Shinkokin	19707	5623	28.5%

The ratio of two consecutive syllables beginning with a voiced obstruent rises slightly, but still the overall ratio is disproportionately low, compared to the expected ratio of 7.29% = 27% × 27%.

text	any KVK context	$K_{[vcd]}$ $VK_{[vcd]}$ context	ratio
Kiki	214	2	0.9%
Man'yoo	20524	143	0.7%
Kokin	5117	74	1.4%
Gosen	6507	70	1.1%
Shuui	6127	71	1.2%
Goshuui	5715	92	1.6%
Kin'yoo	3297	41	1.2%
Shika	1894	23	1.2%
Senzai	5922	89	1.5%
Shinkokin	9299	142	1.5%

There are only two instances of such sequences in the *Kojiki*, 85 *tadu ga ne no* and 108 *sibyi ga fatade ni*, and none in the *Nihon-shoki*.

3. Discussion

3.1 Quality of vowels in Old Japanese

We saw above in 2.2 that in Old Japanese, /Va/ sequences such as /oa/ and /yia/, and /iV/ sequences (/yia/, /iya/, /ia/, /yii/, /ii/, /yio/, /io/, /iu/), particularly /yia/ and /yio/, tend to be treated as one metrical unit.

An interesting fact about /iV/ vowels is that they form one metrical unit more often when the first vowel is /yi/ than when it is /iy/. The reading of conjunct vowels beginning with /iy/ as two units might be related to its diphthongal origin. Whether or not /iy/ was still pronounced as a diphthong, the phonotactic distribution of /yi/ is different from that of /iy/, although we cannot draw any conclusion on the pronunciation of /iy/ without considering morpheme-specific reasons. Similarly, treatment of /yia/ and /yio/ as one metrical unit reminds us of the fact that these combinations are monophthongized in Old and pre-Old Japanese (Yamaguchi 1985: 37, Miyake 1999: 161).

Furthermore, there is a strong restriction against parsing Ve sequences as one

metrical unit. Cluster-final *e* is actually /ye/ in most cases, and Hashimoto (1950: 213) considers that /ye/ is generalized to the other cases of Ve, but the restriction against parsing might also be due to the diphthongal origin of /ye/ and /ey/.

On the other hand, most /o̲V/ sequences, particularly /o(o̲)a/, occur when postpositions *no̲, zo̲, to̲, do̲ and ko̲so̲* are followed by words beginning with a vowel. While /woV/ sequences are also counted as one metrical unit in a few cases such as *ywo-akasi*, *ywo otizu*, *ywo-oto̲, fyito̲-ywo imo ni*, and *kwo-uma*, they occur typically in inflectional forms of lower monograde y-stem verbs such as *koe* /koye/.

We saw in section 1.4 that Miyake (1999), Mabuchi (1999) and Matsumoto (1995) reconstruct a rounded mid back vowel, a labialized mid back vowel and a rounded mid back vowel preceded by a labialized consonant for /wo/, and [ə], an unlabialized rounded mid back vowel and a rounded mid back vowel for /o̲/, respectively. Although our statistical data do not provide enough evidence to evaluate these reconstructions, /o̲/ in /o̲V/ context might have been a vowel which does not have many marked feature values and hence was easy to merge with the following vowel, as pre-Old Japanese developments such as *to̲ ari* > *tari* suggest. Markedness of the roundedness of /wo/, which I think all three reconstructions imply, does not conflict with the distribution of /wo/ in Old Japanese metrical texts.

As to Matsumoto's theory that /yi/ and /iy/ are in complementary distribution and there is no difference in their pronunciation, I could not find any supporting argument.

3.2 Conjunct vowels in Early Middle Japanese

Most of the Old Japanese conjunct vowels counted as one metrical unit are combinations of vowels with different height. While /Vi/ sequences are counted as one metrical unit relatively often, /ui/, a combination of two high vowels, is not, as table 1 in Appendix I shows.

In the *Kokin-shuu*, however, the sequence of the same vowels, like /oo/, /aa/, and /ii/, are mainly treated as one metrical unit, while /oa/, /ia/, /oi/ and /ei/ are still counted as one unit as in Old Japanese. As shown in Appendix I, table 2, and discussed above in 2.2, later texts of the Eight Anthologies count the sequence of different vowels as one unit less and less often, and /oo/, /aa/ and /ii/, which are repetitions of the same vowel, account for higher ratio of the cases of crasis.

Based on these facts, we can roughly characterize Old Japanese conjunct vowels as diphthongs, and the ones in Early Middle Japanese as long vowels.

3.3 Implication of our data to the syllable structure of Old and Early Middle Japanese

If the differences between /yi/ and /iy/ and between /e/ and other vowels reflect diphthongal origin of /iy/ and /ye, ey/, as we suggested in 3.1, the following restriction can be drawn on verse-internal vowel sequences; namely, a nucleus vowel of a metrical unit should be a monophthong, or a diphthong if the unit is not in final position, and conjunct vowels one of which comes from a diphthong are ill-formed as a metrical unit. I

used the word 'metrical unit' in this formulation and in previous sections of this paper, but this restriction on nucleus length is perfectly natural as formulation of syllable well-formedness. I think, therefore, that treating a vowel sequence as one metrical unit is not a mere metrical convention or poets' wild card, but reflects well-formedness of actual syllables in Old and Early Middle Japanese.

The result of 2.5 can be interpreted as suggesting another restriction on syllable weight, particularly in Early Middle Japanese. In the *Man'yoo-shuu*, I could not find any significant difference between the sequence of conjunct vowels plus a voiceless obstruent and the sequence of conjunct vowels plus a voiced obstruent, except that most cases of the latter sequence is /oag/, /iid/ and /iag/.

Of the Eight Anthologies, however, later texts have fewer cases of the sequence of conjunct vowels and a voiced obstruent counted as one metrical unit, and the sequence /iid/, which consists of an infinitive (*ren'yoo-kei*) ending *i* and the stem of the verb *idu* 'get out', becomes almost the only case of such sequences. Since the initial /i/ of *idu* starts disappearing after Middle Japanese by aphaeresis,[13] /iid/ might actually have been different from other sequences of conjunct vowels and a voiced obstruent, and possibly shorter in duration. The number of conjunct vowels treated as one metrical unit becomes smaller as well, but there is still an indisputable tendency to avoid /VVK$_{[vcd]}$/ sequences in later anthologies such as the *Shika-shuu* and the *Senzai-shuu*.

Although we do not have enough information to nail down the reason for this tendency, it is possible that a voiced obstruent changed from a contour segment like [^{n}d] into a cluster like [nd] between Old Japanese and Middle Japanese, and /VVK$_{[vcd]}$/ came to be gradually avoided as it contains a rhyme heavier than just /VV/, which is tolerated.

3.4 Rhythmic rule

In 1.4, I mentioned that occurrence of two voiced obstruents in adjacent syllables was avoided in Old and Middle Japanese. The result of 2.6 shows that the domain of this rule is not limited to words but extends over to the utterance level.

The results in section 2.3 confirms Moori's observation that the fifth and the sixth vowels in the second or the fourth verses of a *tanka*, when not intervened by a consonant, are usually counted as one syllable nucleus. In the second syllable as well, conjunct vowels are often counted as one syllable nucleus.

There is little evidence as to how to reconstruct the rhythmic structure underlying the *tanka*. Sakano (1996: 67-86), for example, postulates a theory parsing four bimoraic feet from the left end of each verse, but it is difficult to find philological argument supporting such theories. If Old Japanese meter was based on syllable timing, as Sakurai (1968, 1974) and Endoo (1974, 1976) consider, Moori's observation leads us to thinking of well-formed cadences. The second and the fourth verses are called cadences, for they are sensitive to syllable weight, and they can end in a combination of tribrach and

13. Man'yô 20:4336 己芸豆流 *kogiduru* 'which rows off' already has *duru* instead of *iduru*.

dactyl: ⏑⏑⏑⏑⏑⏑/, ⏑⏑⏑⏑–⏑⏑/, ⏑–⏑⏑⏑⏑⏑/ and ⏑–⏑⏑–⏑⏑/.

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Appendix I: Lists and Tables

List 1. Genuinely hypermetric verses:

1. *Kiki tanka*: nil
2. Okajima's *Man'yooshuu*: 14: 3516.1 *tusima no ne fa*, 17: 3932.2 *umyifye tune sarazu,* 18: 4081.5 *fyito katafamu kamo*, 18: 4130.2 *obyitutu keynagara*, 19: 4151.1 *kyefu no tamey to*
3. The *Kokin-shuu*: 273.4 *itusika titose wo*, 456.1 *nami no woto no*, 694.3 *tuyu wo womomi*, 718.1 *wasurenaN to*, 774.1 *imafa kozi to*, 891.3 *ure wo womomi*, 1043.1 *idete yukamu*
4. The *Gosen-shuu*: 30.4 *todomarazu kiyuru*, 306.2 *tatinarasu wono no*, 378.2 *aki ni mo naru kana*, 781.1 *wasurenamu to*, 821.1 *kofite femu to*, 1153.1 *wasurenamu to*, 1393.5 *kago dani nakaraN*
5. The *Shuui-shuu*: 152.2 *imo nezaruraN to*, 637.1 *nagakarazi to*, 1222.1 *fito sirezute*, 1333.2 *iro fa ware nomi to*
6. The *Goshuui-shuu*: 81.2 *sakaba tirinamu to*, 140.2 *tirimo todomarade*, 416.2 *yuki tumoruramu to*, 512.2 *kasumi mazaranamu*, 574.1 *sutefatemu to*, 747.2 *kagiri naruraN to*, 759.1 *wasurenamu to*, 760.1 *wasurenamu to*, 773.2 *kori ya sinuramu to*, 784.3 *turakaramu to*, 1107.3 *mukasi kikisi*
7. The *Kin'yo-shuu*: 632.1 *afaremamu to*
8. The *Shika-shuu*: 202.2 *sifite wasuremu to*, 282.2 *kume no sarayama to*
9. The *Senzai-shuu*: 42.2 *fana sakinuramu to*, 224.1 *ofarafi suru*, 729.4 *kafemu fodo made to*, 740.1 *omofu koto wo*, 1020.3 *ututu fasamu*, 1116.3 *sutefatemu to*, 1132.2 *tuyu nomi zo kasi to*, 1238.4 *uresikumo midu no*
10. The *Shinkokin-shuu*: 80.2 *sakaba madu miN to*, 256.3 *kaze no woto ni*, 343.1 *wokite miN to*, 380.1 *nagamewabinu*, 433.1 *aki no tuyu ya*, 470.1 *tuyu fa sode ni*, 506.3 *mine no kumo wo*, 603.3 *konofa tireba*, 679.1 *nifa no yuki ni*, 885.3 *nagameyaraN*, 888.2

fodo wo tigiramu to, 979.3 *kari no yado ni*, 988.4 *tuyu wakuru sode no*, 1039.1 *ame mokoso fa*, 1152.2 *afu ni si kafeba to*, 1296.2 *ikeraN mono ka to*, 1323.1 *sode no tuyu mo*, 1332.4 *yosifofinokatano*, 1338.1 *nobe no tuyu fa*, 1362.1 *wasururaN to*, 1482.1 *wono ga nami ni*, 1526.1 *nagamewabinu*, 1535.1 *sutu to naraba*, 1615.1 *kaze ni nabiku*, 1741.3 *koke no sita ni*, 1827.3 *aruka nakika*

List 2. Conjunct vowels before voiced obstruents: hiatus and crasis

Ve sequences are not counted.

The *Man'yoo-shuu*:

	hia.	cra.	cases of crasis
aag	4	3	kuyaaga, nikaaga, niyaaga
aid	15	2	fanaide, wagaide
eag	3	1	mafeaga
eid	0	3	moeidu, reteidu, reteidu
eug	2	1	madeugo
iad	0	1	fumiada
iag	12	12	kamiage (3), miniaga, rasiaga, sekiaga, sekiage, tamiaga, tobiaga, tokiaga, toriage, yoriaga, kamiage (3), miniaga, rasiaga, sekiaga, sekiage, tamiaga, tobiaga, tokiaga, toriage, yoriaga
iid	25	21	fofiide, foniidu, iriidu, matiide, nisiide, noniide, roniide (7), sasiidu, taniide (2), teriidu, toniide, toriide, utiide (2)
iob	0	1	yukiobi
oag	9	27	fizoaga (6), kezoaga, kizoaga (2), kosoaga, kotoage (2), mezoaga, mizoaga (3), nezoaga, nizoaga, rizoaga, setoaga, tetoaga, tezoaga (3), tozoaga, wozoaga (2), fizoaga (6), kezoaga, kizoaga (2), kosoaga, kotoage (2), mezoaga, mizoaga (3), nezoaga, nizoaga, rizoaga, setoaga, tetoaga, tezoaga (3), tozoaga, wozoaga (2)
uid	0	2	rokuide (2)
Subtotal	70	74	

Other cases of hiatus in the *Man'yoo-shuu*: aad: 2, aib: 1, aiz: 1, aob: 3, aub: 1, aug: 3, iab: 1, iug: 1, oaz: 1, oib: 4, oid: 4, oiz: 1, oob: 3, oud: 3, oug: 1, uag: 1, uaz: 1.

Total: hiatus: 102, crasis: 74.

The *Kokin-shuu*:

	hia.	cra.	cases of crasis
aid	5	1	nifaide
eid	0	2	gareidu, moteide
iag	0	3	foniage, fukiage, giniage
iid	5	30	foniide (5), foniidu, furiide (2), iofiidu, kabiidu, kiniide, kogiide (2), matiide, mofiide (3), mofiidu (2), noniide, ofiide, roniide (3), roniidu, tatiide (2), toniide, utiide, utiidu
oid	2	2	nimoide, yakoide
oob	0	1	tanoobi
uid	0	1	sokuidu
subtotal	12	40	

Other cases of hiatus in the *Kokin-shuu*: aug: 1, eug: 1, oad: 1, oaz: 1, oig: 1, oiz: 2, oud: 2, oug: 1, uad: 1, uug: 1.

Total: hiatus: 24, crasis: 40.

The *Gosen-shuu*:

	hia.	cra.	cases of crasis
aid	5	1	nifaide
eid	1	1	gareidu
iid	11	20	foniide, foniidu (2), ifiidu, matiidu, mofiide, mofiide (6), mofiidu, nakiide, roniide, siniide, soniide, tatiide (2), utiidu, foniide, foniidu (2), ifiidu, matiidu, mofiide (7), mofiidu, nakiide, roniide, siniide, soniide, tatiide (2), utiidu
Subtotal	17	22	

Other cases of hiatus in the *Gosen-shuu*: aoz: 1, ead: 1, oad: 2, oaz: 1, oid: 3, oig: 1, oiz: 1, oob: 1, oud: 1, oug: 4, ouz: 1, uud: 1, uug: 1.

Total: hiatus: 36, crasis: 22.

The *Shuui-shuu*:

	hia.	cra.	cases of crasis
aid	1	1	yamaide

eag	0	1	semeage
eid	2	2	gareidu, nareide
iag	0	1	subiage
iid	10	4	bikiide, miide, mofiide, roniide
oid	2	1	natoidu
Subtotal	15	10	

Other cases of hiatus in the *Shuui-shuu*: aoz: 1, aud: 1, aug: 1, eiz: 1, iug: 1, oab: 1, oig: 1, oiz: 1, oob: 1, ooz: 1, oud: 2, oug: 4, ouz: 1, uad: 1, uiz: 2, uud: 1, uug: 1.

Total: hiatus: 37, crasis: 10.

The *Goshuui-shuu*:

	hia	cra	cases of crasis
eid	2	1	amoeidu
iag	0	2	fukiage, subiage
iid	8	19	foniidu, ifiidu, kariidu, mofiide, mofiide, mofiide, mofiide, mofiide, mofiide, mofiide, mofiidu, mofiidu, mofiidu, mofiidu, ofiidu, sasiidu, tatiide (2), utiide, foniidu, ifiidu, kariidu, mofiide (7), mofiidu (4), ofiidu, sasiidu, tatiide (2), utiide
oid	4	3	yakoide (2), yakoidu
Subtotal	14	25	

Other cases of hiatus in the *Goshuui-shuu*: aib: 1, aid: 7, aog: 1, aoz: 3, iad: 1, iod: 1, ioz: 1, oib: 1, oiz: 1, oob: 3, oog: 1, ooz: 1, oud: 1, oug: 5, ouz: 1, uaz: 1, uib: 1, uug: 1.

Total: hiatus: 46, crasis: 26.

The Kin'yoo-*shuu*:

	hia	cra	cases of crasis
aid	3	1	yamaide
eid	2	1	gareidu
iid	8	6	mofiide (3), mofiidu, ofiide, roniide
Subtotal	13	8	

Other cases of hiatus in the Kin'yoo-*shuu*: aiz: 1, aoz: 2, oad: 1, oaz: 1, oid: 6, ood: 3, oog: 1, ooz: 1, oub: 1, oud: 1, oug: 1, uib: 1, uiz: 1, uud: 1.

Total: hiatus: 35, crasis: 8.

The *Shika-shuu*:

	hia.	cra.	cases of crasis
iid	0	6	kogiide, mofiide (4), sasiide
Subtotal	0	6	

Other cases of hiatus in the *Shika-shuu*: aid: 4, eid: 2, oob: 1, ouz: 1, uud: 1.

Total: hiatus: 9, crasis: 6.

The *Senzai-shuu*:

	hia.	cra.	cases of crasis
iid	11	12	kogiidu (2), mofiide (8), mofiidu, tofiide
Subtotal	11	12	

Other cases of hiatus in the *Senzai-shuu*: aid: 3, aob: 1, aog: 1, aoz: 2, eid: 3, iad: 1, iag: 1, ioz: 1, oad: 1, oaz: 1, oib: 1, oid: 6, oig: 1, oiz: 1, oog: 1, ooz: 5, oud: 1, oug: 3, uud: 1.

Total: hiatus: 46, crasis: 12.

The *Shinkokin-shuu*:

	hia.	cra.	cases of crasis
aid	10	2	kifaide, nifaide
eid	5	3	gareide, moeidu, moreidu
iag	0	4	fukiage (3), subiage
iid	11	29	beniide, foniide (2), kabiide, matiide, mofiide (15), mofiidu (5), roniide, sasiidu, ukiidu, utiide, utiidu
oid	6	3	kinoide, kiyoide, yakoide
Subtotal	32	41	

Other cases of hiatus in the *Shinkokin-shuu*: aib: 1, aob: 4, aog: 5, aoz: 4, eiz: 2, iob: 2, iod: 1, iud: 1, oib: 1, oig: 2, oob: 2, oog: 4, oud: 2, oug: 1, uad: 1, uid: 2, uog: 1, uud: 1.

Total: hiatus: 69, crasis: 41.

Appendix II: Technical details of romanization

1. 本文においても述べたが、本研究の一つの目的は国語の音韻・音声の研究のために電子テキストをローマ字化し、細かな検索需要に応えるための基盤をつくることにあった。古典文学の電子テキストは近年急速に整備されており、入手先などの情報は岡島のウェブサイト [1,2] に詳しい。

本研究では、電子テキストを処理するために、Linux オペレーティング・システム（Vine Linux 2.5）上でプログラミング言語 Perl 5 を使用した。

2. 古事記と日本書紀の歌謡部分（記紀歌謡）と、万葉集のうち5, 14, 15, 17, 18, 19の６巻分については、岡島によって公開された電子テキスト [3] があり、またおうふう版万葉集を底本とする電子テキストも村田 [5] によって公開されている。前者には甲乙類を区別したカナの訓、後者には甲乙類を区別しないカナの訓とそのローマ字転写が付けられている。本研究では、村田版と岡島版の電子テキストをまずそれぞれ以下のようなタブ区切りのテキストファイルに整形し、各行（レコード）が 巻番号、歌番号、句番号、原文、訓読、ローマ字というタブ文字で区切られたフィールドから成るようにした（上が村田版、下が岡島版）。

15　3599　004 伊素未乃宇良由　いそみのうらゆ　isominourayu
15　3599　005 船出須和礼波　ふなですわれは　FunadesuwareFa

15　3599　004 伊素未乃宇良由　礒廻の浦ゆ　iso1mi2no2urayu
15　3599　005 船出須和礼波　船出す我れは　FunadesuwareFa

3. 記紀歌謡と万葉集については、このようにカナもしくはローマ字の表記が加えられた電子テキストが公開されており、本研究ではそれらをそのまま利用させていただいた。一方、上代から中古までの和歌を通時的に調査するためには、そのほかに八代集に代表される平安時代の和歌集のローマ字もしくはカナで転写された電子テキストが必要となるが、今回必要としたような清濁を区別した形で訓じた電子テキストは本研究の時点では入手できなかった。

ヴァージニア大学図書館日本語テキストイニシアチヴ [6] では、八代集の漢字カナ混じり文の電子テキストをHTMLファイルとして公開している。筆者は同プロジェクトのコーディネータの岩渕祥子氏の御承諾を頂き、これをダウンロードしてローマ字化した。ヴァージニア大学版八代集テキストのうち、古今集から千載集については『国歌大観』を底本としており、新古今集は冷泉為相の写本と新日本古典文学体系本に基づいているとのことである。ただし古今集に関しては、九州大学T. Higuchi氏のウェブページ（http://www.rc.kyushu-u.ac.jp/~higuchi/）に公開されている古今集のテキストが句切れを表示しているため、こちらを使用させていただいた。

これらの漢字カナ交じり文をローマ字化する作業のために、奈良先端技術大学の松本研究室で開発された形態素分析プログラムである「茶筌」(http://chasen.aist-nara.ac.jp/) を使用した。「茶筅」は、その元となった京都大学工学部長尾研究室の JUMAN と同様、現代語の漢字かな混じり文を高い精度でかなに変換するので、「茶筌」の辞書を平安時代国語に合うように変更することで ローマ字化ができるのではないかと考えたからである。しかし作業を始めてみて、古文の漢字かな混じり文には「茶筌」で正確にかな変換しにくい点があることに気がついた。そ

の問題は以下の六点に要約される。

a) 歴史的仮名遣いの問題:「茶筌」の辞書をすべて歴史的仮名遣いに直すのは容易ではない。また「お」と「を」の使い分けなど、原文自体が混乱していることが少なくない。

b) 送り仮名の慣習の違い: 必（かならず）、思出て（おもひいでて）、知ぬ（しりぬ、しらぬ）のように 送り仮名をあまり使わない傾向、さ夜（さよ）、鳥べ山（とりべやま）、すみの江（すみのえ）のように一部をかなで書く場合や、覧（らむ）、剣（けむ）、南（なむ）、社（こそ）のように 助詞・助動詞を漢字で書く慣習が見られる。

c) 中古と現代で読み方の違う語: 一日（ひとひ）、一方（ひとかた）、百年（ももとせ）、早晩（いつしか）、少女（をとめ）、天地（あめつち）、明日（あす）、味気（あぢき）、生憎（あやにく）、代（よ）、夜半（よは）、故郷（ふるさと）、終夜（よもすがら）、蓮（はちす）、蟋蟀（こゆるぎ）、世間（よのなか）、詠む（ながむ）、妬く（ねたく）などは現代語版の「茶筌」に処理させると正しく処理されない。

d) 複数の読みのある語: 夜（よ、よる）、音（風のおと、滝のおと、鐘のおと、鳥のね、琴のね、虫のね、鹿のね、斧のね）、上（うへ、かみ）、下（した、しも）、頭（あたま、かしら、かふべ）、此（この、ころ）、葛（かづら、つづら）、外（そと、ほか）。夕（ゆふ、ゆふべ）、庵（いほ、いほり）、如何（いか、いかが）などは文脈で読みを判断せねばならず、「茶筌」では処理しにくい。

e) 活用の違い: 寝、出づ、来といった動詞は活用や読み方が現代語と異なるので、活用型を定義せねば処理できない。「らむ」など定義されていない助動詞が接続すると、活用形が活用形として「茶筌」に認識されない。

f) 旧字体の使用: 筆者が使用した「茶筌」の辞書では旧字体はほとんど処理できなかった。

b) c) d) は、「茶筌」の辞書を書き換えるか、それで対応できないものは手作業もしくは変換フィルタを使って前処理した。f) については、qkan という変換プログラムによって前処理をかけた。e) については、「茶筌」の文法ファイルで動詞と助動詞の活用型を新たに定義することによって 解決すべきであったが、うまく定義できなかったので、「茶筌」が知らない活用形のうちよく出るものは 変換フィルタで前処理した。以下に変換フィルタで処理した語を挙げる。

a) 名詞: 朝霜（あさしも）, 朝露（あさつゆ）, 朝（あした）, 足引・足曳・葦引（あしびき）, 明日（あす）, 東路（あづまぢ）, 逢期（あふご）, 蜑（あま）, 天つ（あまつ）, 天河（あまのがは）, 在処（ありか）, 青柳（あをやぎ）, 怒猪（いかりゐ）, 疾病（いたつき）, 入相（いりあひ）, 上毛（うはげ）, 梅花（うめのはな）, 起居（おきゐ）, 思（おもひ）, 織女（おりひめ）, 神無月（かみなづき）, 神代（かみよ）, 唐（から）, 象（きさ）, 梔子（くちなし）, 雲路（くもぢ）, 今日（けふ）, 烟（けぶり）, 心ち（ここち）, 去年（こぞ）, 今宵・今夜（こよひ）, 此（ころ）, 桜花（さくらはな）, 敷妙（しきたへ）, 賤機（しづはた）, 寂寞（じゃくまく）, 白露・白つゆ（しらつゆ）, 験（しるし）, 好物（すきもの）, 末（すゑ）, 棚機（たなばた）, 玉蔓（たまかづら）, 玉梓（たまぼこ）, 玉藻（たまも）, 強面き（つれなき）蝶（てふ）, 鳥立（とたち）, 夏引（なつひき）, 蓴（ぬなは）, 子日（ねのひ）, 蓮（はちす）, 柞（ははそ）, 楸（ひさぎ）, 故郷（ふるさと）, 時鳥・不如帰・郭公・子規（ほととぎす）, 滌（みそぎ）, 水沫（みなわ）, 都（みやこ）, 御幸（みゆき）, 乳母（めのと）, 物思袖（ものおもふそで）, 物故（ものゆゑ）, 諸人（もろひと）, 紅葉（もみぢ）, 八重葎（やへむぐら）, 山賤（やまがつ）, 行末（ゆくすゑ）, 世中・世間（よのなか）, 喚子鳥（よぶこどり）, 終夜（よもすがら）, 夜ゐ（よゐ）, 我恋（わがこひ）, 我背子（わがせこ）, 我袖

(わがそで), 我為 (わがため), 我身 (わがみ), 我宿 (わがやど), 吾妹子 (わぎもこ), 忘草 (わすれぐさ), 忘水 (わすれみづ), 綿津海・わたつ海 (わたつうみ), 少女 (をとめ)

b) 数詞を含む語: 一声 (ひとこゑ), 一度 (ひとたび), 一日 (ひとひ), 一節 (ひとふし), 一重 (ひとへ), 一人 (ひとり), 二度 (ふたたび), 八十氏 (やそうぢ), 八重 (やへ), 九日 (ここのか), 九重 (ここのへ), 百敷 (ももしき), 百年 (ももとせ), 千年・千歳 (ちとせ), 千度 (ちたび), 千世・千代 (ちよ), 万世・万代 (よろづよ)

c) 地名: 逢坂・相坂 (あふさか), 近江 (あふみ), 春日山 (かすがやま), 葛城 (かづらき), 志賀 (しが), すみの江 (すみのえ), 鳥部山・鳥べ山 (とりべやま), 三笠 (みかさ), 尾上 (をのへ)

d) 助詞、助動詞、副詞: 許多・数多 (あまた), 早晩 (いつしか), 最ど (いとど), 未だ (いまだ), 且 (かつ), 哉 (かな), 必ず・必 (かならず), 予て (かねて), 鳧 (けり), 剣 (けん), 社 (こそ), 偖も (さても), 邂逅 (たまさか), 迚 (とて), 共 (とも), 乍ら・乍 (ながら), 微りせば (なかりせば), 南 (なむ), 也 (なり), 計り・計・許 (ばかり), 遥に (はるかに), 只管 (ひたすら), 一向 (ひたふる), 儘 (まま), 諸共 (もろとも), 稍 (やや), 覧 (らん)

e) 代名詞: 争で (いかで), 幾世 (いくよ), 何方・孰方 (いづかた), 孰く (いづく), 孰れ・孰 (いづれ), 己が (おのが), 己れ・己 (おのれ), 斯る (かかる), 斯く・斯 (かく), 爰 (ここ), 此の・此 (この), 是 (これ), 其 (その), 其と (それと), 誰が (たが), 誰 (たれ)

f) 形容詞: 危し (あやふし), 憂し (うし), 嬉し (うれし), 覚束な (おぼつかな), 恋し (こひし), 繁し (しげし), 涼し (すずし), 千早振る・千早振 (ちはやぶる), 長し (ながし), 妬し (ねたし), 惜し (をし)

g) 動詞: 集む (あつむ), 逢ふ (あふ), 敢へ (あへ), 非ず (あらず), 荒る (ある), 出づ (いづ), 厭ひ (いとひ), 言ふ・云ふ (いふ), 祝ふ (いはふ), 受く (うく), 強ひ (しひ), 植ゑ (うゑ), 生ふ (おふ), 負ふ (おふ), 思ふ (おもふ), 思出づ (おもひいづ), 隠る (かくる), 叙 (かざ), 重ぬ (かさぬ), 潜く (かづく), 変は (かは), 更へ (かへ), 通ふ (かよふ), 来に (きに), 来し (こし), 消ゆ (きゆ), 聞こゆ (きこゆ), 答ふ (こたふ), 恋ふ (こふ), 恋る (こふる), 咲ける (さける), 誘ふ (さそふ), 定む (さだむ), 忍ぶ (しのぶ), 据ゑ (すゑ), 備へ (そなへ), 添ふ (そふ), 違ふ (たがふ), 尋ぬ (たづぬ), 頼め (たのめ), 譬へ (たとへ), 給ふ (たまふ), 絶ゆ (たゆ), 問ふ (とふ), 訪ふ (とふ), 灯す (ともす), 詠む (ながむ), 眺む (ながむ), 准へ (なぞらへ), 歎く (なげく), 流る (ながる), 成に (なりに), 成む (ならむ), 成べ (なるべ), 成ぬ (なりぬ), 成行 (なりゆ), 成果て (なりはて), 長ら (ながら), 習ふ (ならふ), 匂ふ (にほふ), 寝る (ぬる), 果つ (はつ), 払ふ (はらふ), 隔つ (へだつ), 交り (まじり), 盛り (さかり), 紛ふ (まがふ), 迷ふ (まよふ), 惑ふ (まどふ), 燃ゆ (もゆ), 宿す (やどす), 行く (ゆく), 別る (わかる), 忘る (わする), 忘つ (わすれつ), 忘な (わすれな)

このヴァージニア大学版の八代集電子テキストでは 句の切れ目はマークされていないので、母音数が31を超える歌をリストアップして、字余りのある句の 前後に手作業で / を入力してから、機械的に 57577 に分解した。

ヴァージニア大学版のHTMLファイルは各歌が次のように書かれている。

```
<br><hr color="#800000" width="50%"><br><div1 type="poem" id="n1053">
<center>
<p>皇太后宮大夫俊成</p></center>
<p><blockquote>遁世の後はなのうたとてよめる</blockquote></p><br>
```

雲のうへの春こそ更に忘られね花は數にも思ひいでじを

ここからまず番号、作者、本文を Perl によって次のルーチンで抽出し、タブ区切りテキストファイルに整形した。

```
while(<>){                              # 一行ずつ読みこむ
 chomp;                                 # 行末の改行文字を取り除く
# 歌番号が出てきたら歌モードの旗を立て、変数を初期化する
   if ($_ =~ / id \ = \ "n( \ d+) \ " \ >/){
    $utamode = 1;
    $utabango = 0;
    $kajin = "";
    $honbun = "";
    $utabango = sprintf ("%04d", $1);   # 歌番号を変数に格納する
# <center> タグが出てきたら歌人名の旗を立てる
  } elsif ($_ =~ / \ <center \ >/) {
  $kajinmode = 1;
# 歌人名の出る行の処理
  } elsif ($kajinmode == 1 && $_ =~ / \ <p \ >(.+) \ < \ / center \ >/) {
   $kajin = $1;
     $kajin =~ s/ \ <.+ \ >//g;   # タグを外す
     $kajinmode = 0;              # 歌人名の旗を下ろす
# 歌本文の出てくる行を判断し、番号、本文、歌人から成るレコードを出力する
  } elsif ($utamode == 1 &&
   $_ =~ /^ \ <p \ >([^a-z \ < \ >]*) \ < \ /p \ >$/ && length($1) > 36) {
   $honbun = $1;
   printf ("Se %04d \ t%s \ t%s \ n", $utabango, $honbun, $kajin);
   $utamode = 0;                    # 歌モードの旗を下ろす
  }
}
```

次にこのスクリプトの出力(上)と、それを前処理したもの(中)、そしてそれを「茶筌」にかけてローマ字化し句ごとに切ったもの(下)を挙げる。

```
Se 1053  雲のうへの春こそ更に忘られね花は數にも思ひいでじを  皇太后宮大夫俊成

Se 1053  雲のうへの/春こそ更に忘られね花は数にもおもひいでじを  皇太后宮大夫俊成

Se 1053  1  kumonouFeno
Se 1053  2  Farukososarani
Se 1053  3  wasurarene
```

```
Se 1053  4  FanaFakazunimo
Se 1053  5  omoFiideziwo
```

4．国文学研究資料館による正保版本の「二十一代集」データベースには、句ごとに「／」で区切った仮名標記が付けられており、各歌集をファイルとしてエクスポートしてから次のPerlスクリプトで整形することで3と同様の出力が得られた。

```
#!/usr/bin/perl
# 各歌集のファイルは 01 から 21 という名前なので、それらを順に開く
for ($ct = 1; $ct < 22; $ct++) {
  $ct = sprintf ("%02d", $ct);    # 一桁の数字を 01 など二桁に直す
  open ($ct, "$ct");              # 同じフォルダにある歌集ファイルを開く
  while (<$ct>) {                 # 開いたファイルを一行ずつ読みこむ
    chomp;                        # 行末の改行文字を取り除く
#  歌番号が出てきたら歌モードの旗を立て、歌人、本文を初期化
   if ($_ =~ /￥N(.*)/) {
    $utamode = 1;
    $utabango = $1;
    $utabango =~ s/０/0/g; $utabango =~ s/１/1/g; ..... # 全角数字を半角に変換
    $kajin = "";
    $honbun = "";
#   ￥Ｉタグが出てきたら歌人名を取得
  } elsif ($utamode == 1 && $_ =~ /￥Ｉ(.*)/) {
    $kajin = $1;
#   ￥Ｘタグで始まる行が歌本文
  } elsif ($utamode == 1 && $_ =~ /￥Ｘ(.*)/) {
    $honbun = $1;
    $utamode = 0;                 # 歌モードの旗を下ろす
    $honbun =~ s/あ/a/g; $honbun =~ s/い/i/g; ..... # かなをローマ字に変換
    @ku = split (/／/, $honbun); # 各句を／で切って配列に格納
    $kukazu = @ku;                # 句数を数える
    if ($kukazu == 5) {           # 短歌のみを出力
      for ($i = 0; $i < 5; $i++) { # 各句ごとに処理・出力
        $vcnt = 0; while ($ku[$i] =~ /[aiueoN]/g) {$vcnt++;} #母音を数える
        $kubango = $i + 1; # 句番号 = 配列添字 + 1
#       歌番号、句番号、句本文、音節核数を1レコードとして出力
        printf ("%02d \ t%04d \ t%d \ t%s \ t%d \ n",
              $ct, $utabango, $kubango, $ku[$i], $vcnt);
      }
    }
```

```
    }
  }
  close ($ct);                    # 開いたファイルを閉じる
}
```

このデータベースの仮名表記は手作業で入力しチェックしたものであるため、自動的に訓じたものより当然精度が高いが、その一方底本にない清濁の区別は電子テキストでもなされておらず、濁音に関することを調査するのは容易でない。このデータベースの漢字かな混じり表記の部分を「茶筌」を用いてローマ字化しようとしたが、分量が多くチェックしきれないので今回は断念した。「茶筌」の文法ファイルと辞書を古文用に全面的に改造するというのは ぜひ取り組んでみたい研究テーマではあるが、時代やジャンル、作者などによって文法も用字法も多種多様なので 古典コーパス全体を解析できるようなものを作ることは難しいし、一種類のテキストだけのためにその作業を行うのでは労働コストが あまりに高くなってしまうので、現時点ではあきらめざるを得ない。

なおヴァージニア大学版、国文学資料館版どちらのテキストのローマ字化においても、「ん」は仮にNで転写した。平安時代の「ん」は通常「む」と同じであろうと考えられるが、原表記の区別を残しておく方がよいと思ったからである。

5. 母音連続を数えるに当たっては、次のアルゴリズムを用いた。

a) 第一句もしくは第三句の母音が７文字以上か、第二句、第四句、第五句の母音が９文字以上の場合
   まず Ve 以外の母音連続を crasis として扱う
   次に Ve があればそれを crasis として扱う
   そのどちらもなければ真の字余りとして扱う
b) 次に第一句もしくは第三句の母音が６文字か、第二句、第四句、第五句の母音が８文字の場合
   まず Ve 以外の母音連続を crasis として扱う
   次に Ve があればそれを crasis として扱う
   そのどちらもなければ真の字余りとして扱う
c) 次に第一句もしくは第三句の母音が５文字か、第二句、第四句、第五句の母音が７文字の場合
   母音連続があればそれを hiatus として扱う

6. 本研究で用いた主要なスクリプトは、
http://www.hakuoh.ac.jp/~masatok/masatok.html に置いている。

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Appendix 1, Table 1 Conunct vowels ın Old Japanese *tanka*-s

Kikı	aa	ae1	ae2	ai	au	e1i	i1a	i1e1	i1o	ia
hıatus	3	2	1	0	3	0	2	1	1	0
crasıs	1	0	0	2	0	1	2	1	3	1

	iu	o1e1	o1i	o2a	ɔ2e2	o2o	o2u	oa	oi	ua	ue1
hıatus	1	2	1	0	2	2	1	2	1	4	2
crasıs	0	0	0	2	0	1	0	1	0	2	0

Manyo	aa	ae1	ae2	ai	ao	au	e1a	e1i	e1o	e2a	ə2e1	ea	ei	eo	eu	i1a
hıatus	13	1	31	14	8	10	1	1	0	0	1	1	2	5	2	2
crasıs	12	0	2	15	10	4	0	0	1	1	0	6	7	3	0	9

	i1e2	i1i	i1o	i1u	i2a	ia
hıatus	18	4	1	2	0	13
crasıs	0	5	6	0	1	48

	io	iu	o1a	o1e2	o1i	o1o	o1u	o2a	ɔ2e2	o2i	o2o	o2u	oa	oe1	oe2	oi	oo	ou	ua
hıatus	7	1	1	12	1	1	2	12	7	13	14	19	17	1	4	7	10	1	15
crasıs	17	3	1	4	1	0	1	26	0	14	16	43	19	0	0	5	6	0	14

Kikı	ie1	ie2	ii
hıatus	1	1	1
crasıs	0	0	0

	ui
hıatus	2
crasıs	0

Manyo	ie2	ii
hıatus	6	9
crasıs	0	9

	ue2	ui	uo	uu
hıatus	5	20	2	2
crasıs	0	1	6	2

in this table	Yale method
e1	*ye*
e2	*ey*
i1	*yi*
i2	*iy*
o1	*wo*
o2	*o̲*

Appendix 1, Table 2: Conjunct vowels in the Man'yo and the Eight Anthologies

	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
Manyo																									
crasis	101	2	72	61	12	29	0	24	32	1	292	8	60	115	9	269	14	147	146	171	123	0	10	27	2
hiatus	64	142	96	42	53	17	2	16	16	17	100	129	74	52	16	161	137	122	96	139	76	15	87	12	11
Kokin	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	18	0	6	6	1	1	0	5	2	0	14	0	12	4	1	41	0	19	41	13	3	0	1	0	2
hiatus	11	16	19	6	10	2	0	4	5	3	13	34	3	7	6	21	22	26	6	26	6	1	4	0	1
Gosen	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	20	0	4	5	1	1	0	2	2	0	16	0	18	12	2	70	0	18	79	18	1	0	0	1	3
hiatus	14	39	34	12	19	10	0	2	3	4	28	73	21	24	12	51	44	54	21	47	26	5	8	12	3
Shui	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	8	0	4	1	1	0	0	0	0	0	8	0	2	1	0	19	0	9	37	6	3	0	0	0	0
hiatus	11	16	12	5	9	1	0	7	3	3	10	40	10	5	4	21	4	30	11	16	8	1	5	0	1
Goshui	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	9	0	2	2	1	1	0	1	1	0	10	0	16	1	2	48	0	15	36	9	0	0	0	0	0
hiatus	12	30	24	4	5	6	0	1	5	2	31	45	12	9	7	47	17	59	13	44	24	5	6	3	2
Kinyo	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	8	0	4	2	0	0	0	2	1	0	14	0	13	1	0	26	0	6	32	9	0	0	0	0	1
hiatus	16	42	22	5	11	5	0	7	2	2	27	54	15	18	15	38	15	49	15	46	6	4	9	4	7
Shika	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	0	0	1	0	0	0	0	0	0	0	2	0	1	2	0	4	0	3	10	1	0	0	1	0	0
hiatus	6	5	8	0	2	0	0	1	1	0	4	14	1	0	0	5	6	12	5	7	4	0	3	2	2
Senzai	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	5	1	0	7	0	0	0	2	3	0	15	0	10	5	3	37	0	8	39	8	0	0	1	1	0
hiatus	13	46	25	15	9	3	0	9	7	2	36	36	21	19	8	63	21	56	27	63	7	3	6	6	4
Shinkokin	aa	ae	ai	ao	au	ea	ee	ei	eo	eu	ia	ie	ii	io	iu	oa	oe	oi	oo	ou	ua	ue	ui	uo	uu
crasis	24	1	8	9	1	4	0	5	8	0	42	1	26	15	1	43	0	29	59	30	0	0	3	0	2
hiatus	33	69	34	23	13	5	0	13	8	8	86	87	27	48	17	101	32	92	56	89	34	2	18	13	12

上代・中古の和歌における母音連続と有声閉塞音

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本論においては、すでにローマ字化された、または新たにローマ字化した記紀歌謡、万葉集と八代集の電子テキストを利用し、上代と中古の短歌においてどのような音連続上の制約があったかを史的音韻論の立場から論じた。まず短歌の字余りについて、どのような母音が連続した場合字余りとして許容され、どのような母音連続が二音として扱われるかについて、従来の研究成果を数量的に確認し、通時的に解釈することを試みた。その結果、上代においては/oa (o$_2$a)/, /yia (i$_1$a)/, /yio (i$_1$o)/といった高さの異なる二重母音的な連続が一音として扱われる傾向にあるのに対し、中古においては/ii/, /aa/, /oo/といった同一音の連続を一音として扱う場合が多く、異なる母音の連続が一音と数えられる場合が著しく減少してゆく傾向が確認された。

韻文での制約の変化が言語全体の変化を反映したものであったと仮定すれば、上代から中古にかけて音節の構造に変化が起こり、二重母音を一音節のライムとして扱わなくなったと解釈することができる。また上代における母音連続の分布は、母音/i/と/o/の甲乙の別が母音の発音の違いを反映していた可能性があることと、二母音の連続から生じたとされる/ye (e$_1$)/と/ey (e$_2$)/, /yi (i$_1$)/, /wo (o$_1$)/を含む母音連続は上代においても一音と数えられることが少ないことを指摘した。次に母音連続に有声閉塞音が後続する例を調べ、中古においてはこの位置での有声閉塞音の出現が無声閉塞音に比べて相当に制限されていることを指摘し、このことが中古において両者の調音時間に相違が生じたり、音節ライムの長さに新たな制約ができたことを反映している可能性があると論じた。