Tonal Notation of Indic scripts in Mainland Southeast Asia

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Introduction

Several mainland Southeast Asian languages which adopted Indic scripts are tonal languages, and some of their scripts have the devices of indicating their tones.

Neither the Brāhmī script which is the origin of Indic scripts, nor the Pallava script which is a descendent of Brāhmī and was imported to Southeast Asia, are the scripts for tonal languages, and naturally they do not have any tonal notation device. Hence if an Indic script has such devices, they must be either those newly invented in the course of the development of the script, or those passed down by the other script which has already acquired the tonal notation.

The earliest instances of the attempt to distinguish tones are found in Burmese and Thai scripts. The former was invented in 11c, based on Mon script, and the latter was invented in 13c, based on Khmer script. The methods of tonal notation of these scripts show a clear contrast.

The aim of this paper is to clarify the contrast between the tonal notation systems of these two scripts.

1 Tonal notation of Thai script

1.1 Tones of Modern Central Thai

Modern Central Thai (Mod.C.Th) shows the five-way tonal opposition. Each tone is characterized as below:

(1)

Tone 1.	Mid-level	/ / (unmarked)	
Tone 2.	Low-level	/ ̀ /	
Tone 3.	Falling	/ ̂ /	
Tone 4.	High-level	/ ́ /	
Tone 5.	Rising	/ ̌ /	(Sato2001:63)

1.2 Tone marks of Modern Thai Script

Modern Thai script has four tone marks:

(2)
- 1st tone mark (máy ʔèek) ◌่
- 2nd tone mark(máy thoo) ◌้
- 3rd tone mark (máy trii) ◌๊
- 4th tone mark (máy càttàwaa) ◌๋

The presence of either of the four tone marks, together with their absence, distinguish the five tones. However, it is not the case that each tone mark (including unmarked case as having 'zero-mark') uniquely marks a tone. Which tone a tone mark marks depends on the 'group' the consonant letter belongs. There are three 'group' of consonant letter, defined by the sound it supposedly represented when Thai accepted the script system. as below:

(3)
- Group H: letters supposed to have represented aspirated voiceless stops/affricates, fricatives, and voiceless sonants
- Group M: letters supposed to have represented non-aspirated voiceless stops/affricates, glottalized stops, and zero-consonant
- Group L: letters supposed to have represented voiced stops/affricates, and voiced sonants

Tone marks occur only in non-checked syllables, i.e. open rhymes and closed rhymes ending with a nasal. In checked syllables, the length of vowel functions as a determining factor of tone.

The relation of the groups of initial consonant, tone marks and tones is summarized below.

(4)

		Group H letters	Group M letters	Group L letters
non-checked syllables	unmarked	ขา khăa	กา kaa	คา khaa
	1st tone mark ◌่	ข่า khàa	ก่า kàa	ค่า khâa
	2nd tone mark ◌้	ข้า khâa	ก้า kâa	ค้า kháa
	3rd tone mark ◌๊	–	ก๊า káa	–
	4th tone mark ◌๋	–	ก๋า kăa	–
checked syllables	short vowel	ขัก khàk	กัก kàk	คัก khák
	long vowel	ขาก khàak	กาก kàak	คาก khâak

For example, 1st tone mark represents Low-level tone when the consonant is of group M or H, and Falling tone when the consonant is of group L. Falling tone is represented by 1st tone mark coupled with a consonant of group L, as well as 2nd tone mark with a consonant group M or H.

Such an intricate system of tonal notation is the result of the phonological change which occurred in Central Thai after the reception of writing system. The bifurcation of tones occured in compensation for the loss of opposition in voicedness of initial consonants, and it complicated the correspondence between tone marks and tones. (Usami1998: 32–35)

There is no cooccurrence restriction between tone marks and non-checked rhymes. In other words, a tone mark is independent of any non-checked rhymes.

1.3 Tone marks of Thai Script of the period of King Lithai

The oldest Thai script, called *Laisuthai*, is said to have been invented by King Ramkhamhaeng (reign AD 1279–1317) of Sukhothai Dynasty and realized in the inscription (AD 1292) attributed to him. *Laisuthai* is unique in the usage of vowel symbols: vowel symbols which are placed on the top of or under the consonant letter in all of later inscriptions are placed on the left of the letter in his inscription. Yet, in other points such as the set of consonant letters and their shape, that of vowel symbols and of tone marks used, it is almost the same as inscriptions of the period of King Lithai. (Sato2001:565)

In the period of King Lithai (AD 1354–1376), vowel symbols were placed just as in the modern orthography. There were two tone marks in common with *Laisuthai*.

(5) 1st tone mark ◌̀
2nd tone mark ◌́

The second tone mark became ◌̌ in the period of King Narai (AD 1657–1688). The four tone marks system like today is found in the literature in AD 1732.[1] (Sato2001:567)

Tones were not fully represented in texts in the period of King Lithai.[2] In *Nakhon Chun Inscription* (AD 1357), we find many instances where the tone marks which should be present are in fact omitted. Below is the list of frequent words unaccompanied by the necessary tone mark in all or many of their occurrence.

(6) **numerals:** /rɔ́ɔy/ ‘hundred’ (2nd tone mark); /sìi/ ‘four’ (1st);

/kâw/ ‘nine’ (2nd)

demonstratives: /níi/ ‘this’ (2nd); /nân/ ‘that one’ (2nd)

nouns: /phûu/ ‘person’ (2nd); /sîn/ ‘property’ (2nd); /câw/ ‘lord’ (2nd)

verbs: /dây/ ‘get’ (2nd); /rúu/ ‘know’ (2nd); /wâa/ ‘say’ (1st)

function words: /tháŋ/ ‘whole’ (2nd); /dûay/ ‘with’ (2nd); /thâw/ ‘as many as’ (1st); /tɛ̀ɛ/ ‘only’ (1st)

Such omittability of tone marks as examplified above is a consequence of the independence of tone marks from (non-checked) rhymes.

2 Tonal Notation of Burmese Script

2.1 Tones of Modern Burmese

Modern Standard Burmese (Mod.B) shows the three-way tonal opposition in non-checked rhymes: Level, Heavy and Creaky.[3] Wheatley (1982) states that “these three tones have a complex realization that includes features of pitch and phonation.” (pp.21–22)

(7)

1.	/ ´ /	“creaky”	high pitch with slight fall; relatively short; (tense) creaky phonation.
2.	/ ` /	“heavy”	high with long fall; relatively long; slight breathy phonation.
3.	/ / (unmarked)	“level”	low with slight rise; relatively long but less than “heavy”; normal phonation.

(Wheatley1982:p.22)

It is clear that there were already three distinctive tones even before the stage of Old Burmese (OB, the language of Bagan period (1044–1299)), which is confirmed by regular tonal correspondences between Burmish languages.

(8)

PBsh	BUR	ACH	XIA	ZAI	LEQ	LAN	BOL
-ϕ	1 = (=Level)	55 =	55 =	51 =	33 = *vd>31	31 =	55
-ɦ	2 = (=Heavy)	31 =	31 =	21 =	55 = *vd>33	35 = 55/_k	35 *vd>31
-ʔ	3 = (=Creaky)	35 = 31/_ʔ	35 = 55/_ʔ	55 =	53 = *vd>55	55 =	35 55/_ʔ

(Nishi1999c:p.53)

*PBsh=Proto Burmish, BUR=Burmese, ACH=Achang, XIA=Xiangdao, ZAI=Zaiwa, LEQ=Leqi, LAN=Langsu, BOL=Bolo

I shall refer to each tone class by the name in Mod.B, i.e. ‘Level’,

'Heavy' and 'Creaky': these names should always be complemented with the phrase 'the tonal class corresponding to ... of Mod.B'.

2.2 Tonal distinction in the current Burmese orthography

The three tones are fully distinguished for each rhyme in Modern Burmese script. However, the system of tonal notation is not so 'systematic' as that of Thai script. Below are the examples with initial consonant /k-/.

(9)

	/-a/	/-i/	/-u/	/-e/
/Level/	ကာ {kaa}	ကီ {kii}	ကူ {kuu}	ကေ {ke}
/Heavy/	ကား{kaa:}	ကီး{kii:}	ကူး{kuu:}	ကေး{ke:}
/Creaky/	က {ka}	ကိ {ki}	ကု {ku}	ကေ့ {ke.}

	/-ɛ/	/-ɔ/	/-o/	/-VN/
/Level/	ကယ်{kay'}	ကော်{ko'}	ကို {kui}	ကင် {VN} etc.
/Heavy/	ကဲ {kaY}	ကော {ko}	ကိုး{kui:}	ကင်း{VN:} etc.
/Creaky/	ကဲ့ {kaY.}	ကော့{ko.}	ကို့ {kui.}	ကင့် {VN.} etc.

*/V/=vowel, {V}=vowel symbol (including the case of zero),
{N}=nasal final consonant letters ◌င်{-ng'}, ◌ဉ်{-n˜'}, ◌န်{-n'}, ◌မ်{-m'}
and nasal final consonant symbol ◌ံ{-M}[4]

The occurrence of Burmese tone marks depends on the kind of (non-checked) rhyme, unlikely Thai tone marks. {-.} is shared by the spellings for rhymes /e/, /ɛ/, /ɔ/, /o/, /VN/, but not /a/, /i/, /u/, in Creaky tone. Similarly, {-:} is shared by the spellings for rhymes /a/, /i/, /u/, /e/, /o/, /VN/, but not /ɛ/, /ɔ/, in Heavy tone.

The patterns of tonal notation of each rhyme are summarized as below:

(10)

	I. /e/, /o/, /VN/	II. /a/, /i/, /u/	III. /ɛ/, /ɔ/
/Level/	vowel symbol 1	vowel symbol 1	vowel symbol 2
/Heavy/	vowel symbol 1 +{-:}	vowel symbol 1 +{-:}	vowel symbol 1
/Creaky/	vowel symbol 1 +{-.}	vowel symbol 2	vowel symbol 1 +{-.}

Note that the tonal distinction is partly represented by vowel symbols in II and III. In II, the vowel symbol 1 comes from 'short' vowel symbol, and the vowel symbol 2 comes from 'long' vowel symbol, of Brāhmī script respectively.[5]

2.3 Correspondence between modern and *Mahathenapati Anandathura Maunghnan Inscription*'s spellings

The intricate tonal notation system of Burmese script shown above is partly due to the diachronic change it has suffered since its birth. In the earliest stage of the script, how were the tonal opposition reflected in spellings?

The oldest Burmese inscriptions in existence are of the early 12th century. Inscriptions of the period including famous *Rajakumar (Myazedi) Inscription* (AD 1112) show spelling variance. It seems to be the late 12c or the early 13c when Burmese orthography was established for the first time.

Nishi (1999b) refers as the best model of the standard OB (=Old Burmese) orthography to the first pillar of *Mahathenapati Anandathura Maunghnan Inscription* (Great General Anandathura and His Consort Inscription) of four faces (585–7 ME/AD 1223–5), now in the inscription shed of Lehmyethna Temple in Bagan.[6] Despite the length of 229 lines, the inscriptions show the striking consistency in spelling.

Below we show the spellings of non-checked rhymes of Mod.B and the corresponding spellings of *Anandathura Inscription*.

(11)

Mod.B sounds	Mod.B spellings	*Anandathura* spellings[7]
/-a(L)/	◌ာ {-aa}	◌ာ {-aa}
/-a(H)/	◌ား {-aa:}	
/-a(C)/	◌ {-a}	◌ {-a}
/-i(L)/	◌ီ {-ii}	◌ီ {-ii}
/-i(H)/	◌ီး {-ii:}	
/-i(C)/	◌ိ {-i}	◌ိ {-i}
/-u(L)/	◌ူ {-uu}	◌ူ {-uu}
/-u(H)/	◌ူး {-uu:}	
/-u(C)/	◌ု {-u}	◌ု {-u}
/-ɛ(L)/	◌ယ် {-ay'}	◌ယ် {-ay'} ၊ ◌ာယ် {-ay'}
/-ɛ(H)/	◌ဲ {-aY}	◌ယ် {-ay'}
/-ɛ(C)/	◌ဲ့ {-aY.}	◌ည့် {-ay=@'}

/-o(L)/	◌ို {-ui}	◌ိုဝ် {-uiw’}
/-o(H)/	◌ိုး {-ui:}	
/-o(C)/	◌ို့ {-ui.}	◌ိုဝ္အ် {-uiw=@’}
	(When {V}={a} ex. ◌င်{-ang’})	
/-VN(L)/	◌င် {-ang’}	◌င် {-ang’} । ◌ာင်{-aang’}
/-VN(H)/	◌င်း {-ang’:}	◌င် {-ang’}
/-VN(C)/	◌င့် {-ang’.}	◌င္အ် {-ang=@’}
	(When {V}={i,u,o,ui}) ex. ◌ိန်{-in’})	
/-VN(L)/	◌ိန် {-in’}	◌ိန် {-in’}
/-VN(H)/	◌ိန်း {-in’:}	
/-VN(C)/	◌ိန့် {-in’.}	◌ိန္အ် {-in=@’}
/-e(L)/	ေ◌ {-e}	◌ိယ်{-iy’}
/-e(H)/	ေ◌း {-e:}	
/-e(C)/	ေ◌့ {-e.}	◌ိယ္အ်{-iy=@’} । ဧအ် {-e@’}
/-ɔ(L)/	ေ◌ာ်{-o’}	◌ဝ် {-aw’} । ◌ာဝ်{-aaw’} । ေ◌ာ{-o}
/-ɔ(H)/	ေ◌ာ{-o}	◌ဝ် {-aw’}
/-ɔ(C)/	ေ◌ာ့{-o.}	◌ဝ္အ် {-aw=@’}

In the above table, ◌် {-’} is so-called ‘vowel killer’, the symbol attached to a consonant letter to ‘kill the inherent vowel of the letter’. It is Mon-Burmese version of *virāma* in Brāhmī script. The obrigatory use of ‘vowel killer’ is an innovation of Mon script. {=} indicates that the following letter is subscripted to another letter.

In *Anandathura Inscription*, we find two patterns of the spelling of rhymes, not three patterns like Mod.B orthography:

(12)	I. Closed rhymes and /e/	II. /a/, /i/, /u/
/Level/	vowel symbol 1 (rarely, vowel symbol 2)	vowel symbol 1
/Heavy/	vowel symbol 1	vowel symbol 1
/Creaky/	vowel symbol 1 + {-@’}	vowel symbol 2

These two patterns share the following two characteristics:

1. Creaky tone is consistently differentiated from other tones by spelling.

2. The consistent discrimination in spelling between Level tone and Heavy tone is not observed.

In the next two sections, we shall examine the two characteristics in detail.

2.4 The differentiation of Creaky rhymes in the early 13c

As seen above, *Anandathura Inscription* makes a clear differentiation of the rhymes in Creaky tone from those in other tones. In other words, the spellings of these inscriptions are 'sensitive' to Creaky tone. However, it is not the case that all contemporary inscriptions are 'Creaky-sensitive'. As far as inscriptions made before 600 ME(AD 1238) are concerned, the number of 'non Creaky-sensitve' inscriptions and that of 'non Creaky-sensitive' inscriptions are almost equal. But even in 'non Creaky-sensitive' inscriptions the Creaky /a/, /i/, /u/ are spelled by 'short' vowel symbols ◌{a}, ◌ိ{i}, ◌ု{u} and thus differentiated from their non-Creaky counterparts, spelled by 'long' vowel symbols ◌ာ{aa}, ◌ီ{ii}, ◌ူ{uu}.

In other inscriptions than *Anandathura*, we find several instances of ◌အ်{-@'} cooccurring with 'short' vowel symbols.

(13)

မျှအ်	{mhya@'}	'only'	(*Tuyinhpahto Inscription* (AD 1147), Face A: l.13. *Ahtawlat Inscription* (AD 1165), A: l.7.)
cf. မျှ	{mhya}		(*Anandathura Inscription* Face A: 28.)
လွအ်	{lwa@'}	'PERSONAL NAME'	(*Ahtawlat* A: 22.)
cf. လွ	{lwa}		(*Anandathura* A: 44.)
ငအ်	{nga@'}	'my'	(*Ahtawlat* B: 18.)
cf. င	{nga}		(*Ahtawlat* B: 19, 26.)
အိအ်	{@i@'}	'PREFIX TO FEMALE NAMES'	(*Ahtawlat* A: 5, 8–19, 22–24; B: 1, 3, 5–12, 15–16.)

ပ္လုအ်	{plu@'}	'do, make'	(*Nabaydaw Temple Inscription* (early 12c): 7–9. *Shwekuncha Temple Inscription* (AD 1223), South face: 32.)
cf. ပ္လု	{plu}		(*Anandathura* A: 2, 7, 9–10, 12, 14–15, 18–21, 23, 25–30.)
ခုအ်	{khu@'}	'CLASSIFIER'	(*Nabaydaw*: 9. *Tuyinhpahto* B: 10.)
cf. ခု	{khu}		(*Anandathura* A: 1, 13–14, 53–54; B: 1, 31; C: 1; D: 1, 17, 30. *Ahtawlat* B:17.)

Provided that both 'Creaky-sensitive' inscriptions and 'non Creaky-sensitive' inscriptions are found in a fairly limited area and period, and the evidence from the tonal correspondence with other Burmish languages, it is unlikely that the two types of 'sensitivity' reflect the difference of tonal system. They simply reflect the difference of attitude toward transcribing sounds.

2.4.1 ◌် {-@'} in phonologically open rhymes

Nishi (1999c) argues that {-@'} and 'short' vowels represented the glottal stop in OB and it was later weakened to the creaky phonation of the preceding vowel. (p.53) Nishi (1999b) mentions another interpretation of {-@'}, i.e. it indicates laryngealization, as well as the former interpretation. (p.24)

Since Mod.B ဘ {@a} as an initial consonant letter represents /ʔ-/, it is highly probable that OB {@a} also represented /ʔ-/, and OB ◌် {-@'} again represented a final glottal stop or laryngealization of the preceding vowel.

To support his argument, Nishi (1999c) quotes Pulleyblank(1963)'s comment on Mon usage. (p.53)

> 'One can possibly explain the spelling convention in terms of Mon usage, in which the short vowels were always accompanied by a final glottal stop when not followed by any other final consonant and the final long vowel signs were used only for open syllables in foreign loan words. In Old Burmese a small *a* was used as a marker for the final glottal stop (=creaky tone).' (Pulleyblank1963:215)

According to a footnote in Pulleyblank (1963), he obtained comments and advice about problems of the Burmese and Mon writing

system from H. Shorto. In his dictionary of Mon inscriptions (1971), Shorto gives the sounds of Old Mon (OM) and Middle Mon (MM) inscription forms. He reconstructed the sounds based on the spellings of inscription forms themselves, the corresponding modern spellings and their sounds. Ferlus (1983) and Diffloth (1984) reconstructed proto Mon, using Shorto's data and the data of Nyah Kur, another Monic language still spoken in central Thai. Though Pulleyblank shows no actual examples of Mon, we can get the examples from their works.

First, let us examine the cases of {-o@'} and {-e@'} in OM. Instances of them in Mon script go back to 7c at latest. In Lopburi inscription, examples such as {wo@'} 'this', {ya_mo@'} 'name', {go@'} 'get' are attested. (Halliday1930:83–85)

Below are the data from Ferlus (1983): Sets of Mod.M rhymes, Nyah Kur rhymes, internally reconstructed OM and PM rhymes are extracted from the related columns in table 5 (p.72). Each OM rhyme is supplied with spellings from examples in Section 5, Chapter VIII (pp.44–47).[8]

(14)	PM -ɔɔʔ	OM -ɔʔ{-o@'}		Mod.M -ɔʔ– -òʔ		—
	PM -uoʔ	OM -ɤʔ{-o@' – -u(@')}		Mod.M -ɒʔ– -ɜ̀ʔ	NK -oo – -òoʔ	
			after nasal,	Mod.M -ùʔ		—
	PM -ɛɛʔ	OM -ɛʔ{-e@'}		Mod.M -eʔ– -èʔ	NK -ɛɛʔ– -ɛ̀ɛʔ	
			after nasal,	Mod.M -ìʔ	NK -ɛ̀ɛʔ	

Though the correspondences are complicated by the opposition in register, both Mod.M and Nyah Kur have /-ʔ/.

The case of vowel signs {-a}, {-i}, {-u} is a little complex. We observe the alternation such as {-a@'}∼{-a}, {-i@'}∼{-i}, {-u@'} ∼{-u} in inscriptions of the same period, and sometimes even in a inscription. {-@'} seldom cooccurs with the 'long' vowel symbols {-aa}, {-ii}, {-uu}.

(15)	{da@'}∼	'PREDICATIVE	(*Rajakumar Inscription*, Pillar A (1113), Mon face: l.16.)
	{da}	PARTICLE'	(*Shwezigon Inscription* (late 11c), Face A: 29, 41; B: 2, 5; F: 38; G: 38–39; H: 42–43.)
	{tirˆla@'}∼		(*Myakan Inscription* (late 11c) A: 10, 17, 24, 28; B: 27. *Rajakumar*: 15–17, 21.)
	{tirˆla}∼	'lord, master'	(*Shwezigon* F: 12. *Myakan* B: 25–26. *Palace Inscription* (late 11c) A: 5–6.)
	{tarˆla}		(*Shwezigon* B: 41–42; C: 34; F: 20. *Phayre Museum Inscription* (late 11c): 46.)

{ti@'}∼ {ti}	'earth, land'	(*Myakan* D: 3, 5.) (*Shwezigon* A: 22. *Rajakumar*: 22.)
{cu_ti@'}∼ {cu_ti}	'die'	(*Myakan* A: 14.) (*Myakan* A: 27. *Rajakumar*: 7.)
{s=cu@'ti}∼ {s=cu_ti}	'die' (hypothetical form[9])	(*Myakan* C: 6.) (*Shwesandaw Inscription* (late 11c) I: 22. *Rajakumar*: 11)

Again, I show the data from Ferlus (1983) (pp.44–47,72).

(16)	PM -aaʔ	OM -aʔ{-a(@')}	Mod.M -aʔ – -ɛ̀ʔ	NK -aaʔ– -àaʔ
	PM -iiʔ	OM -iʔ {-i(@')}	Mod.M -ɔeʔ/-iʔ – -ìʔ	NK -iiʔ– -ìiʔ
	PM -uuʔ	OM -uʔ{-u(@')}	Mod.M -aoʔ/-uʔ– -ùʔ	NK -uuʔ– -ùuʔ

The spellings with {-@'} were gradually replaced by those without {-@'} during the reign of King Kyanzittha (1084–1113) of Bagan Dynasty.[10] They are never used in Mod.M.

The situation of the spellings {-a@'}, {-i@'}, {-u@'} in Burmese inscriptions before 600 ME (=AD 1238) resembles that in Mon inscriptions during King Kyanzittha's reign. It does not seem to be a mere coincidence. Obviously Burmese script inherited the spelling variance from Mon script.

As for {-e@'} and {-o@'}, the final consonant letter {-@'} is indispensible to transcribe the rhymes in Creaky tone. In fact, the occurrence of {-e@'} and {-o@'} in inscriptions before 600 ME are very limited, except proper names and {e@'} 'SENTENCE MARKER/GENITIVE MARKER', which has ample instances in various inscriptions.

Note that phonologically open rhymes in Creaky tone are transcribed as if closed rhymes. It maybe tells us that Burmese of the time determined how to transcribe Creaky rhymes based on its phonetic similarity with OM rhymes ending with /-ʔ/.

2.4.2 Subscript ◌ၢ် {@} in phonologically closed rhymes: the formation of 'graphical final cluster'

The strategy of Burmese script of Bagan period to transcribe closed rhymes in Creaky tone was the use of small {@} under the final consonant letter. At first sight, it might seem inconsistent with the case of (phonologically) open rhymes. In this section I argue that it is not so.

As I said in the previous section, phonologically open rhymes in Creaky tone are graphically treated as closed rhymes. If the treatment is extended to the case of (phonologically) closed rhymes, they must be

treated as rhymes with a final consonant cluster. However, Mon script provided no device for it, because there has been no final cluster in Mon.

Mon script utilizes the vowel killer obligatorily to transcribe final consonants[11]. Therefore, the existance of a vowel killer implies that the syllable is 'closed' there. Burmese seems to have taken over the implication coupled with the obligatory use of the vowel killer, because Burmese did not use two concatenated consonant letters with a vowel killer each to achive the 'graphical final cluster'. Instead, they achieved it by the combination of a vowel killer with a ligature.

Most of Indic scripts have a set of ligatures, i.e. combinations of consonantal glyphs transcribing a consonant cluster. In Indic scripts of Southeast Asia, consonantal glyphs in a combination are usually distinct from each other,[12] and stacked vertically.[13] The inherent vowel of a letter, so to speak, is 'killed' by the addition of a subscript letter. Ligatures are used to transcribe intersyllabic clusters of Sanskrit/Pāli loanwords, and the intrasyllabic clusters.

Old Mon script also has the device of ligatures to transcribe consonant clusters.[14] Some combinations are the innovation of Mon script to transcribe clusters unique to the language, not found in Sanskrit/Pāli loanwords.

(17)	လ္ဍိမ်	{l=ngim'}	'thousand'	(*Rajakumar*: 2.)
	သ္ဘုတိ	{s=cu_ti}	'die' (hypothetical form)	(*Rajakumar*: 11.)
	စ္နာမ်	{c=naam'}	'year'	(*Rajakumar*: 2.)
	ကိ္မန်	{k=min'}	'rule'	(*Rajakumar*: 10.)
	မ္ဃုန်	{m=Suun'}	'five'	(*Shwezigon* A: 31.)
	ကိ္ဒိမ်	{k=@im'}	'smile'	(*Shwezigon* A: 20, 21.)
	ဇ္ဒေင်	{c=@eng'}	'other'	(*Rajakumar*: 31.)
	သ္ဒော်ရ်	{s=@or'}	'cause' (hypothetical form)	(*Shwezigon* B: 52.)

As seen in the above examples, a vowel symbol attached to a ligature always modifies the lower glyph of it. The same thing must apply to a vowel killer. When a vowel killer {-'} attached to a ligature containing a subscript {@}, the inherent vowel of upper consonant letter is 'killed' by the addition of the subscript, and the inherent vowel of subscript is 'killed' by {-'}. As a result we get a 'graphical final cluster'. Compare the below examples from OM and OB.

(18)

 {m=@iir'}

 {@am=@'}

Mon 'forsake the world and become a monk' (*Ananda Plaque* No.34) (Duroiselle1921:17)

Burmese 'FUTURE' (*Rajakumar*: l.35)

Only interpreted as such, the case of (phonologically) closed rhymes is consistent with that of (phonologically) open rhymes.

In transcribing closed rhymes in Creaky tone, Burmese made a half step out of the framework of Mon script. All elements are served in Mon script system. Burmese combined them and created a new type of notation.

2.5 Heavy rhymes vs. Level rhymes in the early 13c

Another characteristics of *Anandathura Inscription* is the lack of consistent discrimination in spellings between Heavy and Level rhymes.

In this point, almost all inscriptions of Bagan period are on a par with *Anandathura Inscription*. Only one exception is *Ahtawlat Inscription*(527 ME/AD 1165) referred by Nishi (1999b). This inscription is not only 'Creaky-sensitive' but also fairly sensitive to Heavy/Level discrimination. Below are the rhyme notation system of the inscription summarized by Nishi (1999b), his roman transliteration system of Burmese spellings being replaced by the author's.

(19)

/0/ :	{-ii}	{-aa}	{-uu}	{-iiy'}	{-aay'}	{-eiiw'}	{-uuy'}	{-aaw'}	{-VN}[15]
/´/:	{-ih'}	{-ah'}	{-uh'}	{-iy'}	?{-ay'}	{-eiw'}	{-uy'}	{-o}	{-VN}
/ˆ/:	{-i(@')}	{-a(@')}	{-u}	{-iy=@'}	?{-ay=@'}	{-eiw=@'}	{-uy=@'}	?	{-VN=@'}
/?/:	-VC(Stops)								

(Nishi1999b:22)

In *Ahtawlat Inscription*, the vowel symbols used to transcribe rhymes in Heavy tone are basically the same as those used to transcribe rhymes in Creaky tone. Where the 'short'/'long' opposition of symbols exists, the 'short' symbols are chosen. Only in the case of /-o/, not {-aw'} containing a 'short' vowel symbol but {-o} is used. In the case of /a/, /i/, /u/, the final consonant letter {-h'} is used, in addition to the selection of the 'short' vowel symbol, not 'long', as in most inscriptions of the period.

Note that the above generalization is applied rigidly only to the obverse of the inscription, as Nishi (1999b) refers. (p.22–23) The reverse of the inscription often deviates from the 'norm', and employs 'long' vowel symbols without {-h'} like other inscriptions such as *Anandathura*.

(20)

Ahtawlat				*Anandathura*
မိယဟ် ~ မီယဟ် {mi_yah'~mii_yah'} 'wife'	(obverse: 8, 11, 13, 19, 20, 23; reverse: 1.)	cf.မိယာ{mi_yaa}	(reverse: 3, 6, 8–9, 11–12.)	မျာ{myaa}
သဟ်{sah'} 'son'	(o.: 12, 14, 16, 17, 21, 22, 25.)	cf.သာ{saa}	(r.: 3–4, 7, 11, 14, 20, 26.)	သာ{saa}
နွဟ်{nwah'} 'cow'	(r.: 17, 19.)			နွာ{nwaa}
သ္မိဟ်{s=mih'} 'daughter'	(o.: 6, 8, 9, 10, 11, 15, 18, 19, 22.)	cf.သ္မီ ~ သ္မိ {s=mii ~ s=mi}	(r.: 1, 5, 7, 12.)	သ္မီ ~ သ္မိ {s=mii ~ s=mi}
ကြိဟ်{krih'} 'big'	(o.: 14; r.: 16.)			ကြီ{krii}
ဖုဟ်{phuh'} 'AUXILIARY'	(o.: 4, 5.)			—

The vowel symbols used to transcribe rhymes in level tone are 'long' vowel symbols, or digraphs containing a 'long' symbol.[16] I will show instances of closed rhymes.

(21) Closed rhymes in Level tone:

လာင်	{laang'}	'husband'	(obverse: 8.)
ကျွာင်	{kywaan'}	'slave'	(obverse: 7; reverse: 3, 19.)
ဤမ်	{iim'}	'house'	(r.: 21.)
လှာ	{lhaaM}	'spear'	(r.: 22.)
ငါယ်	{ngaay'}	'small'	(o.: 18; r.:15–16.)
ဤယ်	{iiy'}	'this'	(r.: 18.)
ဖုန္တာဝ်	{phun=taaw'}	'royal merit'	(o.: 18.)
ကေဝ်	{keiiw'}	'ACCUSATIVE'	(r.: 22–23.)

Closed rhymes in Heavy tone:

ထ္မင်	{th=mang'}	'rice'	(r.: 21.)
မ္လိယ်	{mliy'}	'grandchild'	(r.: 20, 26.)
မိထုယ်	{mi_thuy'}	'mother's elder sister, mother-in-law'	(r.: 5.)

ပါယ်	{paay'} (Level)	'unit of measurement'	(r.: 18.)
ပယ်	{pay'} (Heavy)	'bean'	(o.: 6.)
ရီယ်	{riiy'} (Level)	'water'	(r.: 21.)
ရိယ်	{riy'} (Heavy)	'write'	(o.: 4–5, 7.)

There are some obvious exceptions and variance.

(22)

သွိင်	{s=khing'} (Level)	'lord'		(r.: 18.)
ကွယ်	{k=may'} (Level)	'widow'		(o.: 13, 15, 17, 19, 21; r.: 1, 5, 9.)
ထိုဝ်~	{theiw'}~	(Heavy)	'pierce'	(r.: 23.)
ထီဝ်	{theiiw'}			(r.: 22.)
စီယ်~	{ciiy'}~	(Level)	'CAUSATIVE'	(r.: 22, 24, 27.)
စိယ်	{ciy'}			(r.: 23.)

In closed rhymes with a vowel symbol {-o}, there is no way of discriminating Heavy and Level rhymes.

(23)

ပေါင်	{pong'}	'sum' (Heavy)	(r.: 2.)
ကျောင်	{klong'}	'monastery' (Heavy)	(r.: 19.)
မောင်	{mong'}	'elder brother (of a female)' (Level)	(o.:11; r.: 10, 13.)

As mentioned above, *Ahtawlat Inscription* presents the system of rhyme notation absolutely unique in inscriptions of Bagan period. However, the marked notations characterizing its system are found also in other inscriptions, though sporadically. Below we shall examine such marked notations.

2.5.1 ◌ဟ် {-h'} / ◌း {-:} in phonologically open rhymes

The instances of {-h'} The combinations of {-h'} with a 'short' vowel symbol representing open rhymes in Heavy tone are found in other inscriptions only sporadically. We even find the combinations of {-eh'}, {-oh'} etc., not found in *Ahtawlat Inscription*, again sporadically.

- *Rajakumar Inscription*, pillar A (474 ME/AD 1113), Burmese face:

  {teh'} 'EMPHATIC' (l. 9, 11, 14, 17, 19, 21, 22, 26, 30, 35, 38.); {ta_mu_leh'} 'as for' (l.7.); {rwoh'} 'village' (l.8, 11, 19, 30–32.)

  cf. (instances of open rhyme in Heavy tone represented by 'long' vowel symbols) {paay'ma_yaa} 'queen' (l. 5, 7, 9–11, 15.); {saa} 'son' (l.7, 12, 15, 27, 33, 36.);
  {mang'grii} 'great king' (l.16.); {brii_ra_kaa} 'after –ing' (l.3, 27, 29.); {phuu} 'behold' (l.39.)

- *Amatkyi-Theingadhur Inscription*, obverse (552 ME/AD 1190):

  {soh'} 'ATTRIBUTIVE MARKER' (l.3, 4.)

  cf. {kraa} 'in-between' (l.14.); {mi_yaa} 'wife' (l.22.); {saa} 'son' (l.23); {krii} 'big, great' (l.1, 2, 13, 16, 21.); {so} 'ATTRIBUTIVE MARKER' (l.3, 4, 6, 7, 12–16, 26–29.)

- *Inscription about the dedication of Tripitaka* {pi_Ta_kat' lhuu_so kyok'caa} (559 ME/AD 1197):

  {@ah'} 'power?' (in a woman's name) (l.5.)

  cf. {miy=yaa} 'wife' (l.8, 13, 14.); {may=yaa} 'wife' (l.5, 10, 13, 15, 16.); {myaa} 'wife' (l.9.); {ku_laa} 'Indian?' (in a woman's name) (l.8.); {saa} 'son' (l.5.)

- Inscription No. 22, Inscription shed, Mandalay Palace (560 ME/AD 1198):

  {teh'} (l.1.)

  cf. {nwaa} 'cow' (l.8, 24.); {saa} 'son' (l.6.); {te} (l.15.); {so} 'ATTRIBUTIVE MARKER' (l.2, 3, 7, 8, 10–13, 17–19, 21–23.)

- *Thin-Ngahnitlothin Inscription*, reverse (568 ME/AD 1206):

  {phyak'chiih'} 'destroy, ruin' (the vowel symbol is exceptional) (l.24.); {soh'} 'ATTRIBUTIVE MARKER (l.24.)

  cf. {nwaa} 'cow' (l.12.); {myaa} 'wife' (l.6.); {saa} 'son' (l.4, 5, 6, 9.); {su_krii} 'headman' (l.14, 24.); {phyak'chii} 'destroy, ruin' (l.14–15.)

- *Saw-Yahan-Thein Inscription* (574 ME/AD 1212):

  {puih'} 'insect?' (in a man's name) (l.3.)

  cf. {kraa_ra_kaa} 'when (he) heard' (l.5.); {mang'krii} 'great king' (l.4, 5.); {prii} 'finish' (l.13.); {kwaM_sii} 'betel nut' (l.20, 21.)

The instances of {-:} {-:}, Mon-Burmese version of *visarga*, also appears in the spelling of open rhymes in Heavy tone, though *Ahtawlat Inscription* has no instances of it. {-:} is usually used in combination with 'long' vowel symbols, not 'short'. {-:} appears more often than {-h'}, but its occurrence is still sporadic. {-:} cooccur also with {-e}, but not {-o}.

- *Sakhiphuna Inscription* (530 ME/AD 1168):

  {@aa:} 'TEMPORAL' (l.2, 3); {sa:} 'son' (with an exceptional vowel symbol) (l.4, 5);

- *Thingyi-Nganaingthin Inscription* (555 ME/AD 1193):

  {phwaa:} 'be born' (in a women's name) (l.7); {@aa:} 'TEMPORAL' (l.10); {te:} 'EMPHATIC' (l.12, 14, 15)

  cf. {kaa} 'CONTRASTIVE' (l.10,13); {pu_rhaa} 'Buddha, pagoda' (l.1, 5, 11)

- *Thingyi-Nyaung-ot Inscription* (563 ME/AD 1201):

  {kaa:} 'CONTRASTIVE' (obverse:22); {pu_rhaa:} 'Buddha, pagoda' (obverse:17, reverse:11, 12); {tan'thaa:} 'bridge' (r.:4); {@aa:} 'TEMPORAL' (r.:12)

  cf. {kaa} (o.:6, 10, 19, r.:11); {kraa} 'hear' (o.:10, 13, 15); {pu_rhaa} (r.:1); {saa} 'son, man' (o.:8, 15, r.:19); {@aa} 'to' (o.:19); {krii} 'big, great' (o.:14, 15, r.:19); {prii} 'finish' (r.:1, 2, 3); {mii} 'fire' (r.:3, 5)

- *Thin-Ngahnitlothin Inscription*, reverse

  {@aa:} 'TEMPORAL' (l.2)

- *Ngasanthin Inscription* (570 ME/AD 1208):

  {te:} 'EMPHATIC' (l.9, 10–11)

  cf. {kaa} 'CONTRASTIVE' (l.8, 9, 10, 11); {nwaa} 'cow' (l.9,17); {mi_yaa} 'wife' (l.10, 18, 19, 20); {pu_rhaa} 'pagoda' (l.8–9, 18); {saa} 'son' (l.5); {@aa} 'TEMPORAL' (l.2); {te} (l.16, 18, 20, 21)

- *Saw-Yahan-Thein Inscription*:

  {pyaa:} 'bee' (l.26)

- *Ngatathin Inscription* (587 ME/AD 1225):

  {@a:} '*interjectory sentence final particle*' (with an exceptional vowel symbol) (l.18)

  cf. {kaa} 'CONTRASTIVE' (l.4, 6, 7, 12, 18, 19); {kraa} 'hear' (l.7,12); {miy'yaa} 'wife' (l.4, 5, 6); {pu_rhaa} 'Buddha' (l.6–7); {saa} 'man' (l.12)

- *Inscription in Theindawmin Monastery* (587 ME/AD 1225):

  {krii:} ‘great’ (l.2); {sa:} ‘son?’ (with an exceptional vowel symbol) (l.4, 5)

  cf. {@aa} ‘*temporal*’ (l.3); {krii} (l.3, 9)

From the examples above, the spellings of open rhymes in Heavy tone with {-h’}/{-:} are obviously marked. We can never think that there simply occurred the drop of {-:} and especially {-h’}. The rhyme notation system of *Ahtawlat Inscription* is unique in that these ‘marked’ spellings are normalized.

{-h’}/{-:} in Mon script As well as {-@’}, both {-h’} and {-:} appear in Lopburi inscription, which serves such instances as {N˜a:} ‘people’, {(j)N˜ah’} ‘win’, {smac’yu_graah’} ‘*proper name*’. (Halliday1930:83–85) Below I show some instances from inscriptions in the late 11c.

(24)	{si_s=gi:}	‘rich, become rich’ (hypothetical form)	(*Shwezigon* E: 22, 24.)
	{san=de:}	‘doubt; to doubt’	(*Shwezigon H*: 43.)
	{m=guu:}	‘to be stiff, rigid’	(*Shwezigon* B: 38.)
	{mirˆgu:}	‘stoutness, inflexibility’	(*Shwezigon* B: 11)

In some words, {-h’} and {-:} are interchangeable. Sometimes {-:} and {-h’} cooccur in this order.

(25)	{De:}∼	‘3RD PERSON’	(*Shwezigon* A: 21, 22, 24, 40, 44, 46, 47 etc.; *Myakan* A: 16, B: 11.)
	{Deh’}		(*Rajakumar*: 33.)
	{N˜a:}∼	‘person, people’	(*Shwezigon* A: 10, B: 17, 18, 29, 31, 50, 51 etc.; *Myakan* A: 11.)
	{N˜a:h’}		(*Rajakumar*: 26.)
	{go:}∼	‘that’	(*Shwezigon* A: 11, 12, 13, 14, 19, 20, 22 etc.; *Myakan* A: 10, 16, B: 11, 18, C: 6, 24 etc.; *Rajakumar*: 8, 10, 11, 12, 17, 22, 23, 25, 27.)
	{go:h’}		(*Rajakumar*: 4, 5, 6, 7, 10, 15.)

Therefore, Shorto (1971) as well as Ferlus (1983) reconstructed that both {-h’} and {-:} represent the final consonant /-h/.[17]

2.5.2 'Long' vowel symbols in the spellings of closed rhyme in Level tone

We find several instances of a 'long' vowel symbol with a final consonant letter in *Anandathura Inscription*.

(26)	လျှောင်	{khlyaang'}	'want to'	(A: 5–6.)
	အစီအရျောင်	{@a_cii_@a_ryaang'}	'arrangement'	(A: 29.)
	လျှောင်	{lhyaang'}	'EMPHATIC'	(A: 7, B: 11.)
	ပူဇော်	{jaaw'}	'make a devotional offering'	(A: 11.)
	ဤယ်	{iiy'}	'this'	(A: 2, 6, 17, 26, 28–29; B: 12, 31, D: 6, 20, 22, 25, 39.)

However, vast majority of closed rhymes in Level tone are spelled with a 'short' vowel.

(27)	ဝန်ကျင်	{wan'kyang'}	'environs'	(A: 21, 23.)
	ပင်	{pang'}	'tree'	(A: 7; B: 11.)
	ပြည်	{pra˜'}	'country, abode'	(A: 5, 26.)
	မည်	{maN˜'}	'name, to name'	(A: 6, 55; B: 1; C: 3, 27, 40, 53; D: 4, 21, 42.)
	ကုန်	{kun'}	'entirely'	(B: 11.)
	မောင်နှမ်~	{mong'nham'}~	'couple'	(A: 2, 31.)
	မောင်နံ	{mong'nhaM}		(A: 28, 29.)
	ခံ	{khaM}	'accept'	(A: 17, 20, 31; D: 4, 23, 31.)
	စုံ	{cuM}	'complete'	(A: 42, 48, 53; B: 8; C: 21, 27, 35, 51, 58; D: 37.)
	ကွယ်	{k=may'}	'widow'	(A: 41, 42, 43; B: 21, 22, 34, 35, 36, 40, 41, 50, 51; C: 34, 35.)

ဝယ်	{way'}	'buy'	(A: 42, 43; B: 37, 38, 50; C: 21, 24, 38; D: 28, 32, 45, 50, 57.)
နိုယ်	{niy'}	'live'	(A: 4, 20, 21, 24.)
သိယ်	{siy'}	'die'	(B: 1, 4, 5, 7; C: 3, 6, 9, 13, 14, 20, 28, 29, 30, 41, 42, 46, 50.)
ကိုဝ်	{kVw'}	'ACCUSATIVE'	(A: 5, 6, 11, 12, 18, 20, 21, 31; B: 9, 10, 12, 13, 14, 15, 25; D: 3, 41, 49, 50.)
လိုဝ်	{lVw'}	'want, need'	(A: 6, 20, 24, 25, 28.)

Some words show spelling variance.

(28)

ကာန်~	{kaan'}~	'pond'	(A: 6, 22–23.)
ကန်	{kan'}		(A: 22.)
ကျွာန်~	{kywaan'}~	'slave'	(A: 42, 43, 54–55; B: 13, C: 3, 22, 26, 39.)
ကျွန်	{kywan'}		(A: 31; B: 1, 9–10, 15–16, 30–32, 37, 50; C: 24, 40, 53, D: 3–4, 6–7, 18, 21, 23–24, 26–28, 32, 34, 40, 42, 47–48, 57.)
ငါယ်~	{ngaay'}~	'small'	(A: 34, 38, 42; B: 2, 4, 8, 26, 40, 47; C: 21, 35, 50–51, 58; D: 5, 37.)
ငယ်	{ngay'}		(A: 39, 48, 53; C: 46.)
တာင်~	{taang'}~	'put'	(B: 12.)
တင်	{tang'}		(A: 30.)
တာဝ်~	{taaw'}~	'royal'	(A: 3, 20; B: 11–13, 25, 28–29; D: 2, 18–19, 31.)
တဝ်	{taw'}		(A: 24–25.)
ရာည်~	{raaN˜'}~	'liquid'	(A: 14.)
ရည်	{raN˜'}		(A: 17.)

ဤမ်∼ {iim'}∼ 'house' (A: 32–39, 49; B: 8–9, 28.)
ဣမ် {im'} (A: 39–42, 44; B: 22, 34, 37.)

The same thing more or less applies also to the other inscriptions before 600 ME.

- *Rajakumar Inscription*, pillar A (474 ME/AD 1113), Burmese face:

  {paay'ma_yaa} 'queen' (l.5, 7, 9–11, 15.); {siiy'} 'die' (l.10.); {iiy'} 'this' (l.3.); {chaay'} 'ten' (l.2, 13.)

  cf. {pay'ma_yaa} (l.27, 32.); {siy'} (l.14.); {iy'} (l.17, 18, 28, 29, 31, 33, 34, 37.); {ciy'} 'PRECATIVE' (l.39.); {riy'} 'water' (l.26, 33.); {rhuy'} 'gold' (l.16, 18, 28.); {thiw'} 'that' (l.5, 7–11, 21, 27, 28.);

- *Tuyinhpahto Inscription* (509 ME/AD 1147):

  {ngaay'} 'small' (o.: 18–19.); {paay'} 'unit of land measure' (o.: 11–12, 14–15, r.: 3, 5, 8, 10.); {laay'} 'rice field' (o.: 11–17, 19, r.: 3, 5, 8, 10.)

  cf. {s=khing'} 'lord' (r.: 15.); {kraN˜'} 'clear' (r.: 17.); {cuM} 'complete' (r.: 18.); {cuMm'} 'complete' (r.: 14.); {ciy'} 'CAUSATIVE' (r.: 13, 17.); {riy'} 'water' (r.: 16.)

- *Amatkyi-Theingadhur Inscription*, obverse: (552 ME/AD 1190):

  {paay'} 'unit of land measure' (l.28.); {iiy'} 'this' (l.11, 27.);

  cf. {khlyang'} 'want to' (l.26.); {s=khing'} 'lord' (l.7–11, 29.); {maN˜'} 'name' (l.2, 3, 15.); {saN˜'} 'AGENT NOMINAL HEAD' (l.2, 17–20, 22.); {mran'maa} 'Burmese' (l.20.); {taw'lhan'} 'resist' (l.29.); {lay'} 'rice field' (l.28.); {ciy'} 'CAUSATIVE' (l.30.); {liy'} 'EUPHONIC' (l.25.)

- Inscription No. 22, Inscription shed, Mandalay Palace: (560 ME/AD 1198):

  {laang'} 'husband' (l.11.); {paay'} 'unit of land measure' (l.10.); {laay'} 'rice field' (l.8–10, 13.)

  cf. {s=khing'} 'lord' (l.10, 15, 20.); {saN˜'} 'AGENT NOMINAL HEAD' (l.2.); {ciy'} 'CAUSATIVE' (l.12–13.); {luw'} '*want*' (l.19.)

2.5.3 What the 'marked' notations aim at?

{*-h'*}/{*-ː*} Nishi (1999b,c) counts {-h'} and {-:}, like {-@'}, as representing tonal distinctions. He assumes that both {-h'} and {-:} represented the phonation type of the preceding vowel, not the segmental {-h'}, and that the contrast between tones 1 and 2 must have been phonatory at the stage of Pre-OB, which was later transphonologized to pitch contrast in OB. (Nishi1999c:p.52)

As for the fact that they are found only with open rhymes, he gives three possible interpretations below:

> first, breathiness was not very conspicuous for the non-open vocalic and nasal rhymes;
>
> second, when Burmese began to be *graphized*, the tonal contrast of tones 1 and 2 was not that of pitch, but that of both the phonatory features, clear/normal (or modal) voice and breathy voice (or murmured voice), and the pitch registers, high and low(/mid) for open rhymes, to an extent that it was difficult even for the OB speakers to decide that either one of the features was less significant (or redundant), ...;
>
> and third, the contrast in pitch was already established, but the breathy phonation of tone 2 remained as its redundant feature though still phonetically conspicuous for open rhymes. (Nishi1999b:p.59)

It is prausible enough that {-h'} and {-:} transcribed the breathiness in OB. However, Nishi's argument that {-h'}/{-:} were meant to represent tonal distinction, i.e. to distinguish Heavy tone from others is open to question. As far as we see the limited occurrence of {-h'}/{-:} even in open rhymes. we can never say that the tonal distinction between Heavy tone and others is systematically reflected in spellings.

As mentioned in 2.1, It is clear that there were already three distinctive tones in the stage of Old Burmese. OB spellings do not distinguish Heavy rhymes from Level rhymes in most cases, maybe because the principal phonetic feature distinguishing Heavy tone from Level tone could not be represented by any glyphs existing in Mon script, and/or because Burmese people of the time usually did not feel the necessity of representing the feature. Rhymes in Heavy tone were spelled with {-h'} and {-:} when breathiness, which was a concomitant feature of the tone, was very conspicuous enough to draw the hearer's attention.

{-h'} and {-:} do not occur in spellings of closed rhymes[18], seldom occur in open rhymes with {-i} and {-u} which represent close vowels, and not always occur even in open rhymes with {-a} and {-e} representing vowels with high degree of aperture. The facts are explained if we assume that breathiness of a vowel in OB increased its intensity toward the end of the vowel.

The line of my argument has in common with the third possibility of Nishi (1999b)'s quoted above. The difference of the two is whether {-h'}/{-:} are regarded as having distinguished a tonal class from others or not.

Problems on 'long' vowel symbols in closed rhumes Nishi (1999b) regards the spellings of closed rhyme in Level tone with a 'long' vowel symbol in *Anandathura Inscription* as exceptional, and suggests that some of them are the popular spellings of familiar words of high frequency of occurrence.

Recall that 'short' and 'long' vowel symbols in closed rhymes represent Heavy tone and Level tone respectively in *Ahtawlat Inscription*. Indeed, *Ahtawlat* is an exceptionally over-normalized inscription, it is inconceivable that it introduced the notation without any phonetic support. Since the spellings in question are found also in several inscriptions earlier than *Ahtawlat*, I think they also are phonetically motivated.

In its straightforward interpretation, the 'long' vowel symbols, in contrast with their 'short' counterpart, would represent the length of vowel/rhyme. However, the interpretation has two potential problems.

The first problem is about the identification of the language which provided the ground for transcribing Burmese sounds. Shorto (1965) mentions the possibility that {i} and {ii} were not used distinctively, neither {u} and {uu}.

> A quite summary study of the texts is sufficient to reveal the existence of a number of allographic alternances, of the type seen in {cup, cip, cap}. Among words of frequent occurrence, alternance is more common than invariance. From the evidence of these it seems that {i, ii} and {u, uu} are never absolutely distinctive, although {ii} will be preferred to {i} and {uu} to {u} where other alternants are not permitted, while {ii} and {uu} are relatively rare as terms of the alternance (exhaustively listed) {i/u/a/ii/uu/ui/ei}. (Shorto1965:95)
>
> (Roman transliteration by the author's)

The case of {-a} and {-aa} are more problematic. Shorto thought that {-a} and {-aa} in OM usually represent two distinct vowels, their value depending on the final consonant. Below are the generalization from entries in his dictionary (1971).

(29)	{-a}	{-aa}	
	/-a/	/-ai/	with {-k'}, {-ng'}
	/-ɔ/	/-a/	with {-c'},{-N˜'},{-t'},{-n'},{-p'},{-m'},{-r'},{-l'},{-s'}
	—	/-a/	with {-y'}, {-w'}
	/-a/	—	with {-@'}, {-h'}
	(/-aʔ/)[19]	/-a/	without any final consonant

If Burmese of the time had determined the usage of {-a} and {-aa} in reference to the phonogramic relation between Mon script and the sound of Mon language, it would lead us to an improbable consequence that such pairs as {taang'}/{tang'} 'put', {kaan'}/{kan'} 'pond' do not represent an identical syllable.

To clear the problem, we must assume that the phonogramic relation of Mon script referred in determining the spellings for these OB sounds is not to Mon sounds, but to Pāli sounds, as far as Shorto's reconstruction is correct. It does not necessarily mean that Burmese did not make reference to the phonogramic relation between Mon script and Mon sounds at all. It must have been referred in such cases as final glottal stop we saw in 2.4.1.

Another potential problem is that the interpretation might cause the inconformity between OB and Mod.B situations: in Mod.B, a syllable in Heavy tone is usually heard longer than the same syllable in Level tone. But it might not constitute a problem, because it is not always the case that the phonetic feature of a tone maintains throughout its history.

2.6 Development of tone marks after 13c

2.6.1 From ◌် {-@'} to ◌့ {-.}

The spellings for /-a/, /-i/, /-u/ in Creaky tone were unified into {-a}, {-i}, {-u} by around 600 ME (AD 1238). The occurrence of {-@'} is limited to closed rhymes, with exception of ေအ် {-e@'} 'SENTENCE MARKER/ GENITIVE MARKER'.

အ {@} of Bagan period had the shape like H. When used as a subscript, its horizontal stroke tends to be omitted. The instances of {@} without the horizontal stroke is already seen in the obverse of *Taingchut Temple Inscription* (541 ME/AD 1179), but it again is around 600 ME when the shape of {@} became popular.

The balance of 'Creaky-sensitive' inscriptions and 'non Creaky-sensitive' inscriptions began to be lost after 600 ME. Which marked a turning point is a series of *Inscriptions of King Kyazwa's Royal Order* dated 611 ME (AD 1249), found at several places of Upper Burma. After that, 'non Creaky-sensitive' inscriptions became the mainstream,

The tendency remained unchanged during the rest of Bagan period as well as Innwa period (AD 1287–1555), although there still were several 'Creaky-sensitive' inscriptions. The use of 'short' vowel symbols to represent an open rhyme in Creaky tone was kept even in 'non Creaky-sensitive' inscriptions.

In the ink inscription written on the south wall of the praying hall of Uyingyi Temple (1130 ME/AD 1768) we cannot see {-@'} any more. We find ့ {-.} and ◌့◌ {-..} instead. (Ba Shin1964:112–113)

(30) ခ့{khaY..} (l.6.); ဖြင့့{phrang'..} (l.6.); တင့်တယ်{tang'.tay'} (l.9.)

{-.} and {-..} seem to be non-distinctive. Some words are written with either mark. There also exists spellings of rhyme in Creaky tone without neither of them.

(31) နှင့်{nhang'.}(l.8) ~ နှင့့်{nhang'..}(l.12) 'COMITATIVE, INSTRUMENTAL'

တို့{tui.}(l.3,5,6) ~ တို့့{tui..}(l.11) ~ တို{tui}(l.12) 'PLURAL'

ကဲ့သို့{kaY.sV.}(l.4,9) ~ ကဲ့့သို့{kaY..sui.}(l.9) ~ ကဲသို့{kaY_sV.}(l.6) 'like, as'

ရဲရင့်{raY_rang'} (l.2) 'brave'

Interestingly, even when {-..} cooccur with vowel sign ေ◌ {-e} placed on the left of the consonant letter, it is written under {-e}.

(32) ဋ့့လ{le..} 'habit' (l.1, 3.)

Another instances of similar marks are attested in *Miàn Diàn Yì Shū* (緬甸譯書), dated AD 1798, in Wade collection of Cambridge University. Nishida (1972) mentions that the use of {-..} is attested in spellings of the Burmese-Chinese Vocabulary. (p.45) He also quoted the instances of {-..} in a inscription dated AD 1683 from Stewart (1933–5).

Thaung Lwin (1972) mentions that such a change as ◌့် > ◌့့ > ◌့ occurred (pp.367–8), and it was motivated by the existence of ◌း{-:} and ◌ံ{-M}. (pp.364)

It is not before 19c that the use of ◌့ {-.} as in Mod.B has established.

2.6.2 The regularization of ◌း {-:}

{-h'} became unused in spellings of open rhyme in Heavy tone in the middle of 13c. Also 'long' vowel symbols became obsolete in the late 13c. Though the instances of {-:} are attested also in inscriptions after 13c, its occurrence is sporadic as before.

The 'indifference' of the script to Heavy tone began to change in *Tetkale-Taungkyaung Temple Inscription* (873 ME/AD 1511) slightly. In this inscription, open rhymes /-a/ in Heavy tone are unexceptionally written as {-a:}. The same thing is applied to *Kaunghmudaw Temple Inscription*(998 ME/AD 1636). However, other rhymes than /-a/ in Heavy tone are still indistinctive from those in Level tone.

Again, the first case of spreading {-:} to rhymes other than /-a/ is found in the ink inscription of Uyingyi Temple mentioned in the previous section. In the ink inscription, {-:} cooccurs not only with open rhymes, but also with closed rhymes.[20]

(33) အစွမ်း{@a_cwam':} 'ability' (l.1.)
ထိုင်း{thVw':} 'poke' (l.6.)

Moreover, the inscription is epoch-making in that {-:} cooccurs with not 'short' but 'long' vowel symbols in open rhymes.

(34) ကြီး{krii:} 'big, great' (l.11.)
ဘုရား{bhu_raa:} 'Buddha' (l.6, 8, 10.)
အားထုတ်{@aa:thut'} 'strive' (l.1.)
ချော်ချား{khyo(k')khyaa:}[21] 'be alarmed' (l.3.)
ပျား{pyaa:} 'bee' (l.4.)
ထား{thaa:} 'put' (l.8.)
ပြစ်မှား{prac'mhaa:} 'wrong' (l.10.)
ကား{kaa:} 'CONTRASTIVE' (l.12.)

Regrettably, {-:} in spellings of open rhymes other than /a/ has not fully regularized yet.

(35) စီပွား{cii_pwaa:} ‘prosperity’ (l.1.)

နှလုံ{nha_luM} ‘heart’ (l.2.)

သီတင်သုံ{si_tang’suM} ‘(of monks) reside at a certain place’ (l.5.)

တိုက်တွန်း{tuik’twan’} ‘urge’ (l.7.)

ကောင်{kong’} ‘good’ (l. 7,9.)

တောင်{tong’} ‘ask, beg’ (l.10.)

ကျွှလွန်{kyuu_lwan’} ‘violate’ (l.10.)

In the ink inscription, also the tonal distinction of the open rhymes /-ɛ/, /-ɔ/ had already been reflected in the spellings. Here we will get the tonal notation system almost same as in modern orthography, with the difference that {-:} has not been extended to other rhymes yet.

Conclusion

In Modern Thai script, the indication of tone class are done exclusively by a distinct set of tone marks. Indeed one-to-one correspondence between tone marks and tones was lost due to the tonal bifurcation, but each tone mark uniquely represents a tone, as far as a single group of initial consonant is concerned. Tone marks are independent of notations of (non-checked) rhyme.

On the other hand, in Burmese script tone classes are indicated partly by the selection of a vowel sign, and partly by the addition of a tone mark. Unlike Thai script, the occurrence of tone marks depends on the (non-checked) rhyme.

The difference in nature of two tonal notation systems stems from their different provenances. Since none of Thai tone marks find its source in the Khmer script, they must be newly invented to represent tones not found in Khmer language. Although new members were added to the set, the nature of tone marks has remained unchanged.

On the other hand, tone marks of Modern Burmese script trace back to glyphs for segmental sounds in Mon script. To transcribe some phonetic feature of a tone, putting aside whether it is principal or concomitant, Burmese of the time utilized the notation of Mon segmental sound which is heard similarly.

To transcribe the phonetic feature of Creaky tone, whether glottal stop or laryngealization, Burmese script introduced ‘short’ vowel symbols and/or {-@’} from Mon script, together with variance among them. To breathiness, the phonetic feature of Heavy tone in open rhymes, it introduced {-h’}/{-:} which were used for /-h/ in Mon script.[22]

The consistent use of the latter notations is not attested in inscriptions until 18c, except {-h'} in *Ahtawlat Inscription*. It suggests that breathiness was not always conspicuous to hearers, and {-h'}/{-:} simply transcribed particular instances of breathiness discernible to them.

In contrast, 'short' vowel symbols are normally used for open rhymes in Creaky tone even in 'non Creaky-sensitive' inscriptions, and {-@'}, though solely in 'Creaky-sensitve' inscriptions, shows the consistent use unlike {-h'}/{-:}. {-@'} is also extended to the case of closed rhyme, producing 'graphical final clusters'. Those facts suggest that the Glottal stop/laryngealization as a phonetic feature of Creaky tone is always conspicuous. Under the condition, 'short' vowel symbols and {-@'}, unlike {-h'}/{-:}, can be regarded as the notation of a tone. In Brāhmī script, only vowel symbols for /a/, /i/, /u/ show 'short' vs. 'long' opposition. That reflects the vocalic system of Pāli language which Brāhmī script was designed for. 'Aryan vocalic constraint' as such still influences many Indic script in South and Southeast Asia.

In most cases, 'Aryan constraint' influences vocalic notation system, more specifically how to distinguish short vowels and long vowels. Where there is no graphic 'short'/'long' distinction available, either lengthening symbol or shortening symbol is introduced. Vocalic notation system of Thai script can be regarded as an instence of the latter case. Here -ะ , Thai version of *visarga*, functions as shortening symbol. (Sato2001:561–2)

(36)	V=	/a/	/i/	/ɯ/	/u/	/e/	/ɛ/	/o/	/ɔ/	/ə/
short /Vʔ/[23]		□ะ	□ิ	□ึ	□ุ	เ□ะ	แ□ะ	โ□ะ	เ□าะ	เ□อะ
long /VV/		□า	□ี	□ือ	□ู	เ□	แ□	โ□	□อ	เ□อ

In Burmese script, 'Aryan constraint' influences its tonal notation system. It is because Burmese accepted Mon script whose vocalic system was influenced by 'Aryan constraint', and used 'short'/'long' distinction of vowel symbols as representing tonal distinction. It is the highly unique instance of 'Aryan constraint'.

Notes

[1] The occurrence of the 3rd and 4th tone marks limited to the case of Group M consonants tells us that they were introduced to transcribe the combination of a voiceless unaspirated consonant and either High-level tone or Rising tone, maybe from Chinese words, which could not be represented by the system of the time.

[2] In *King Ramkhamhaeng's Inscription*, tones are represented more consistently than inscriptions in the period of King Lithai.

[3] Checked rhymes, which ending with a glottal stop, show no opposition in tone. Some scholars set up

the fourth tone, and others regard that they are in Tone 3 or 2.

[4] Burmese script has another nasal final consonant letter ◌ည်{-N˜}. In Mod.B, {-aN˜} is pronounced as /-ɛ/, /-i/ or /-e/.

[5] Originally, vowel symbols 1 and 2 for each rhyme in III were orthographic variants.

[6] There is another inscription bearing the name in the inscription shed of Lehmyethna. Its serial number in the shed is No.6, whereas the one referred in this section is assigned No.2. Nishi (1999a) argued that the inscription No.6 is not original, and it was inscribed not earlier than 16c, based on the spellings and an erroneous date.

[7] We might think that the spellings of the inscription represents sounds of the language inscribed in it almost straightforwardly. As for the sound of {-uiw'} which is somewhat controversial, see fn.15.

[8] Shorto reconstructed that {-o@'} was the spelling for two different rhymes, based on the patterns of allographic alternance in OM. See Shorto (1965), pp.93–95. Ferlus also accepted his view, though his reconstruction is slightly different from Shorto's.

[9] Shorto notes that verbs may be combined with the prefix {s(i)-} to yield the hypothetical form which in particular denotes futurity. (Shorto1971:22)

[10] The official language of the period was Mon.

[11] There are a few exceptions: ◌ံ{-M}, ◌း{-:} discussed later, and a superscript ◌ဲ{r^} do not need ◌်{-'}.

[12] There exist several inseparable ligatures such as ဿ {s=sa} of Mon and Burmese scripts.

[13] An exception is the glyph for /-r/ in such scripts as Javanese, Khmer, Mon and its descendents (Burmese, Shan, Tham etc.), which is not placed under the consonant letter, but embraces it.

[14] Some clusters represented by these ligatures might not be true clusters, but quasi-consonant clusters in the form of /CəC-/.

[15] In connection with the examples presented with the table, {VVN} seems more appropriate. Here {VV} indicates a 'long' vowel symbol, if available.

[16] Digraphs ◌ေ◌ီ◌ ◌ေ◌ီ◌ {-eiw'/-eiiw'} are the counterparts of ◌ို◌ {-uiw'} in *Anandathura Inscription*. In fact, the rhyme corresponding Mod.B /o/ has a wide variety of spelling in OB: ◌ို◌ ◌ို◌ {-uiiw'} ～ ◌ေ◌ီ◌ ◌ေ◌ီ◌ ～◌ီ◌ {-iw'} ～◌ု◌ ◌ူ◌ {-uw'/-uuw'}, some of which might be simply erroneous. Probably the rhyme was a central vowel /ɨ/ ～/ə/ with lip rounding off-glide, and the vowel allowed a wide range phonetic variation. (Sawada2002:157)

[17] The order of {-:} and {-h'} when they cooccurs leads us to the possibility that {-h'} and {-:} represent the different realization of /-h/ respectively. It might be the case that {-:} represents the breathiness of vowel, and {-h'} represents the final voiceless glottal fricative.

[18] The impossibility of the cooccurrence of {-h'} with another final in OM is not counted as the reason of the fact. Given that Burmese invented the combination ◌ိ္ဒ {C=@'}(C is a consonant letter) in the case of {@'}, they could have introduced the combination *◌ိ္ဟ {C=h'} or *◌ိ္ဠ {Ch'} in the case of {h'} as well, if they feel the necessity of introducing it.

[19] See p.9.

[20] Nishida (1972) mentions that *Miàn Diàn Yì Shū* mentioned above shows the instances of {-:} under the consonant letter, in addition to the normal instances where it is placed on the right of the letter. (p.45)

[21] ◌ံ in ချံ is the abbreviation of ◌က်(Ba Shin1964:111)

[22] And perhaps, 'long' vowel symbols were used to reflect in spelling the relative length of closed rhymes in Level tone to closed rhymes in Heavy tone.

[23] In Modern Thai, short rhymes are obligatorily accompanied by a glottal stop final, as in Mon.

Roman transliteration for OB and OM scripts

Consonant letters

က	ခ	ဂ	ဃ	င
{k-}	{kh-}	{g-}	{gh-}	{ng-}
စ	◌	ဇ	စျ(OB)|ဇျ(OM)	ည | ဉ
{c-}	{ch-}	{j-}	{jh-}	{N˜- |n˜-}
ဋ	ဌ	ဍ	ဎ	ဏ
{T-}	{Th-}	{D-}	{Dh-}	{N-}
တ	ထ	ဒ	ဓ	န
{t-}	{th-}	{d-}	{dh-}	{n-}
ပ	ဖ	ဗ	ဘ	မ
{p-}	{ph-}	{b-}	{bh-}	{m-}
ယ	ရ	လ	ဝ	သ
{y-}	{r-}	{l-}	{w-}	{s-}
ဟ	ဠ	ၜ	အ	
{h-}	{L-}	{B-}	{@-}	
ၑ	ၐ			
{S-}	{sh-}			

Subscript consonant symbols

◌ျ	◌ြ	◌ွ	◌ှ	◌ြွ	*other subscripts*
{-y-}	{-r-}	{-l-}	{-w-}	{-h-}	{=C}

Vowel letters

(အ)	ဣ	ဥ
({@a})	{i}	{u}

(ဪ)	ဤ	ဦ	ဧ	ဩ
({@aa})	{ii}	{uu}	{e}	{o}

Vowel symbols

◌	◌ိ	◌ု
{-a}	{-i}	{-u}

◌ာ	◌ီ	◌ူ	◌ေ	◌ော
{-aa}	{-ii}	{-uu}	{-e}	{-o}

Symbols participating in rhyme notation

superscript letters		*anusvāra*	*visarga*	*vowel killer*
◌ၚ	◌ၛ	◌ံ	◌း	◌်
{ng^}	{r^}	{-M}	{-:}	{-’}

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