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RECONSTRUCTING THE KHITAN VOWEL SYSTEM AND VOWEL SPELLING RULE THROUGH THE KHITAN SMALL SCRIPT

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This paper reconstructs the Khitan vowel system by analysing materials concerning the Khitan Small Script. First, the approximate phonetic values of the graphemes were determined by systematically comparing Khitan transcriptions of Chinese words with their original Chinese sounds and by analysing Khitan rhymes. Next, an exhaustive survey of two adjacent graphemes in a corpus elucidated the script's spelling rule and thus were the accurate phonetic values determined. Finally, a comparative study based on the reconstructed values established regular vowel correspondences between Khitan and Mongolian. In conclusion, the author presents twelve Khitan vowel phonemes that are distinguished by four vocalic features.

Key words: Khitan language, Mongolic languages, Khitan script, vowel-overlapping phenomenon, primary long vowel, palatalised vowel, comparative linguistics, decipherment.

1. Introduction

In deciphering the Khitan Small Script (henceforth KSS), some materials (such as the ones shown below) are available to determine the phonetic values of the graphemes of KSS:

First, *transcriptions of Chinese words in the KSS*. Khitan inscriptions contain numerous Chinese words such as Chinese official titles and proper names. A systematic comparison of the Khitan transcriptions of these Chinese words with their original Chinese sounds provides an important clue for determining the phonetic values of KSS.

Second, *transcriptions of Khitan words in Chinese characters*. Some Chinese literatures like the *Liaoshi* 遼史 (the *History of Liao*) and contemporary entombed epitaphs (*muzhiming* 墓誌銘) written in Chinese contain various Khitan words transcribed

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in Chinese characters. Scholars have compared these Chinese transcriptions with the Khitan notations of the same words and have thereby reconstructed the phonetic values of the graphemes. Examples are given below:[1]

Chinese transcription		KSS notation	Kane (2009)	Meaning
沙里	**ša.li*	又月去	*ś-a-rí*	(a male title)
撻不也	**ta.bu.yä*	令生百爻	*t(e)-bu-ei-er*	(a person's name)
捏褐	**nyä.xe*	伏力	*ń(i)-qo*	'dog'

Such reconstructions, however, are quite problematic, because Chinese has strong restrictions on phonotactics, especially on codas. As a result, the Chinese transcriptions may contain additional vowels to transcribe Khitan codas such as **l*, **b*, **x* that are not allowed in Chinese. Chinese transcriptions therefore do not assure the accuracy of the reconstructed values.

Third, *cognates with the Mongolian languages*. Scholars have also compared Khitan notations of Khitan words with their cognates in its family languages (i.e. the Mongolian languages) to reconstruct grapheme phonetic values. See the examples below:

Middle Mongolian	Modern Mongolian	KSS notation	Kane (2009)	Meaning
sönï	*šən ~ sən*	仐杳	*s-uni*	'night'
morï	*mör*	又仉	*m-ri*	'horse'
basa	*bas*	丹冬	*b-as*	'again, also'
e'ülen	*uul*	土무	*eu-ul*	'cloud'

These reconstructions are also problematic in that they postulate both preservation and loss of short vowels in non-initial syllables in Khitan without considering sound changes. Since we do not know what changes Khitan has undergone, we cannot determine accurate values by comparing Khitan notations with their cognates.

Forth, *rhymes in Khitan inscriptions*. Like Chinese ones, Khitan entombed epitaphs have a section written in verse, which is introduced with a phrase equivalent to the Chinese "*ming yue* 銘曰" ('The inscription says'). An analysis of rhyming words confirms which graphemes share the same or similar segments in phonetic values.

Lastly, *orthographic restrictions in the KSS*. If a KSS spelling rule is elucidated, it may help determine the phonetic values of the graphemes.

In this paper, I reconstructed the Khitan vowel system by analysing the KSS. As stated above, the second and the third source materials are somewhat problematic for the purpose of determining phonetic values. Hence, I determined the values by using exclusively the first, the fourth, and the last source materials. By using cognates, I then established regular vowel correspondences between Khitan and Mongolian. Based on this, I will reconstruct the Khitan vowel system as shown in Table 1.

[1] Here the phonetic values reconstructed by previous studies are represented by Kane's (2009).

Table 1

	Front		Back	
	Unrounded	Rounded	Unrounded	Rounded
Close	*i* [i]	*ü* [y]	(*ı* [ɨ])	*u* [u ~ ʉ]
Near-close				*ʊ* [ʊ]
Mid	*ë* [e]	*ö* [ø]	*e* [ə ~ ɤ]	*ɵ* [o ~ ɵ]
Open	*ä* [ɛ]	*ö* [œ]	*a* [ɑ]	*o* [ɔ]

2. Correspondence to Chinese Sounds

First, we have no material on Northern Chinese during the Liao period (916–1125) to know its phonology systematically. I thus tentatively refer to Yuan Chinese phonology (13th–14th centuries) which is mainly reconstructed from the rhyme books *Zhongyuan yinyun* 中原音韻 (henceforth ZY) and the *Menggu ziyun* 蒙古字韻 (henceforth MZ).[2]

The results below ensue from comparing Khitan transcriptions of Chinese words with their Yuan Chinese forms. We found three types of graphemes: vowel graphemes, consonant + vowel graphemes, and vowel + consonant graphemes.[3] It should be noted that comparisons with Chinese sounds only revealed the grapheme types and their approximate phonetic values.

2.1. Vowel Graphemes

Table 2 shows the vowel graphemes (V graphemes) that correspond to Yuan Chinese (M)Vs in (I)(M)V syllables or (I)(M)VE syllables (I = initial, M = medial, V = vowel, E = ending). I assumed that Khitan did not allow rising diphthongs like [i̯a] and thus Chinese MVs were adapted for monophthongs in Khitan. This assumption is supported by other evidence which will be presented in Section 4.2.

[2] This paper employs the author's notational system of ZY. Note that *p*, *t*, *c*, *č*, *k* represent aspirated [pʰ, tʰ, tsʰ, tʃʰ, kʰ] while *b*, *d*, *z*, *ǰ*, *g* represent unaspirated [p, t, ts, tʃ, k]; *v*, *ž* represent approximants; *ä*, *e*, *ı*, *o*, *ô*, *ü* represent [ɛ, ə ~ ɤ, ɨ, ɔ, o, y].

Previous studies like Shen (2006, 2007) have shown that the phonological characteristics of Liao Chinese are similar to those of Yuan Chinese, although some archaic characteristics have been preserved.

[3] Beside these three types, we also found consonant + vowel + consonant graphemes, e.g. 介 = 后 ZY **xew*, 圭 = 皇 ZY **xwaŋ*.

Table 2[4]

Grapheme		ZY final	Example	ZY final	Example
为$_{189}$	‹aa›	家麻 *-a	又为 馬 *ma	寒山 *-an	为夭 安 *an
				監咸 *-am	仐为乃 三 *sam
斗$_{335}$	‹ää›	家麻 *-ya	九斗 家 *gya	寒山 *-yan	穸斗夯 顔 *[ŋ]yan
				監咸 *-yam	九斗仌 監 *gyam
芬$_{348}$	‹ee›	歌戈 *-e	九芬 哥 *ge		
交$_{327}$	‹ëë›	車遮 *-yä	伞交 姐 *zyä	先天 *-yän	丙交夯 延 *yän
				廉纖 *-yäm	九交仌 檢 *gyäm
及$_{186}$	‹oo›	歌戈 *-wô	伞及 左 *zwô	桓歡 *-won	尘及不 亂 *lwon
芡$_{082}$	‹öö›			先天 *-ɥän	穸芡凼 元 *[ŋ]ɥän
伅$_{226}$	‹ɵ̈ɵ̈›			先天 *-ɥän	穸伅公 元 *[ŋ]ɥän
亥$_{131}$	‹uu›	魚模 *-u	公亥 奴 *nu		
仐$_{245}$	‹ʊʊ›	魚模 *-u	伞仐 祖 *zu		
火$_{289}$	‹üü›	魚模 *-ü	火 禹 *ü		
关$_{339}$	‹ii›	齊微 *-i	关 夷 *i		
谷$_{353}$	‹ıı›	支思 *-ı	伞谷 子 *zı		

2.2. Consonant + Vowel Graphemes

Table 3 shows the consonant + vowel graphemes (CV graphemes) that correspond to Yuan Chinese I(M)Vs in I(M)V syllables or I(M)VE syllables.

Table 3

Group	Grapheme		ZY form
‹Caa›	丕$_{160}$	‹baa›	丕 八 *ba
	冎$_{375}$	‹čaa›	冎 察 *ča
	丏$_{003}$	‹xʷaa›	丏 化 *xwa
	亻乃$_{229}$	‹taa›	亻乃夭 檀 *tan
			亻乃气 唐 *taŋ
	六$_{214}$	‹daa›	六卆 大 *day
	力$_{139}$	‹naa›	力乃 男 *nam
	廾$_{150}$	‹ǰaa›	廾气 章 *ǰaŋ
	厷$_{053}$	‹xaa›	厷夭 韓 *xan
‹Cää›	不$_{130}$	‹xää›	不 下 *xya
‹Cee›	叔$_{283}$	‹kee›	叔 可 *ke
‹Coo›	币$_{017}$	‹doo›	币 多 *dwô
	夹$_{057}$	‹xoo›	夹 和 *xwô
	生$_{213}$	‹too›	生不 團 *twon
	尚$_{298}$	‹soo›	尚不 攢 *cwon

Group	Grapheme		ZY form
‹Cuu›	个$_{241}$	‹puu›	个 府 *fu
	半$_{358}$	‹muu›	半 墓 *mu
	为$_{202}$	‹tuu›	为 徒 *tu
	仃$_{237}$	‹duu›	仃 都 *du
	攴$_{208}$	‹luu›	攴 盧 *lu
	仉$_{233}$	‹kuu›	仉 哭 *ku
	北$_{036}$	‹xuu›	北 虎 *xu
	刁$_{147}$	‹ǰuu›	刁火 中 *ǰuŋʷ
	几$_{178}$	‹kuu›	几火 孔 *kuŋʷ
‹Cii›	付$_{225}$	‹bii›	付 畢 *bi
	王$_{037}$	‹tii›	王 帝 *di
	友$_{087}$	‹ǰii›	友 知 *ǰi
‹Cıı›	廿$_{083}$	‹sıı›	廿 司 *sı
	与$_{—}$	‹ǰıı›	与 旨 *ǰı
	兆$_{180}$	‹šıı›	兆 使 *šı

[4] The subscript number after a KSS grapheme indicates the grapheme number assigned by Qingge'ertai *et al*. (1985). The value in angle brackets ‹ › refers to the phonetic value that is ultimately proposed in this paper.

2.3. Vowel + Consonant Graphemes

Table 4 shows the vowel + consonant graphemes (VC graphemes) that correspond to Yuan Chinese (M)VEs in (I)(M)VE syllables. We also found other VC graphemes which correspond to Middle Chinese (M)VEs in *rusheng* 入聲 syllables (see Table 5).[5] Note that Khitan inscriptions reflect two Chinese varieties in respect of *rusheng* syllables: one preserved Middle Chinese *rusheng* codas **-p*, **-t*, **-k*, **-k^{w}* as *-b*, *-r*, *-g*, *-g^{w}* and the other lost them like Yuan Chinese. These two varieties are used together in inscriptions.

Table 4

Grapheme	ZY final	Example
丰$_{122}$ ‹ay›	皆來 **-ay*	爪丰 開 **kay*
东$_{197}$ ‹äy›	皆來 **-yay*	爪东 客 **kyay*
夭$_{107}$ ‹oy›	皆來 **-way*	戈夭 帥 **śway*
百$_{020}$ ‹ey›	齊微 **-ey*	尘百 德 **dey*
火$_{262}$ ‹uy›	齊微 **-uěy*	公火 內 **nuěy*
禾$_{011}$ ‹an›	寒山 **-an*	为禾 安 **an*
方$_{073}$ ‹än›	寒山 **-yan*	攵彐方 顏 **[ŋ]yan*
	先天 **-yän*	百文方 延 **yän*
业$_{324}$ ‹ön›	先天 **-ụän*	伞夾业 宣 **sụän*
公$_{251}$ ‹een›	先天 **-ụän*	仲公 院 **ụän*
	桓歡 **-won*	冂公 觀 **gwon*
尕$_{154}$ ‹on›	桓歡 **-won*	土尕 團 **twon*
朴$_{140}$ ‹en›	真文 **-en*	又朴 門 **muěn*
禹$_{018}$ ‹in›	真文 **-iěn*	伞禹 進 **ziěn*
尖$_{273}$ ‹un›	真文 **-uěn*	尘尖 敦 **duěn*
亦$_{329}$ ‹ün›	真文 **-üěn*	九亦 軍 **güěn*
火$_{345}$ ‹uŋʷ›	東鍾 **-uŋ^{w}*	九火 公 **guŋ^{w}*
主$_{357}$ ‹oŋʷ›	東鍾 **-uŋ^{w}*	伞主 宗 **zuŋ^{w}*
爪$_{181}$ ‹üŋʷ›	東鍾 **-üŋ^{w}*	丰爪 龍 **lüŋ^{w}*

Grapheme	ZY final	Example
夾$_{161}$ ‹aw›	蕭豪 **-aw*	九夾 高 **gaw*
劣$_{362}$ ‹äw›	蕭豪 **-yaw*	九劣 校 **gyaw*
	蕭豪 **-yäw*	伞劣 小 **syäw*
土$_{067}$ ‹ew›	尤侯 **-ew*	九土 狗 **gew*
丙$_{019}$ ‹ëw›	尤侯 **-iěw*	丰丙 留 **liěw*
乃$_{184}$ ‹am›	監咸 **-am*	力乃 男 **nam*
尘$_{270}$ ‹äm›	監咸 **-yam*	九彐尘 監 **gyam*
	廉纖 **-yäm*	九尘 檢 **gyäm*
金$_{257}$ ‹em›	侵尋 **-em*	戈金 瀋 **šiěm*
又$_{133}$ ‹im›	侵尋 **-iěm*	九又 金 **giěm*
与$_{072}$ ‹üm›	真文 **-iěn*	业与 品 **piěn*[6]
乌$_{199}$ ‹aŋ›	江陽 **-aŋ*	丰乌 郎 **laŋ*
并$_{314}$ ‹äŋ›	江陽 **-yaŋ*	伞并 將 **zyaŋ*
杰$_{071}$ ‹oŋ›	江陽 **-waŋ*	九杰 廣 **gwaŋ*
並$_{062}$ ‹ëŋ›	庚青 **-eŋ*	戈並 省 **šeŋ*
	庚青 **-iěŋ*	九並 耿 **giěŋ*[7]
攴$_{264}$ ‹eŋ›	庚青 **-eŋ*	伞攴 僧 **seŋ*
同$_{303}$ ‹iŋ›	庚青 **-iěŋ*	爪同 興 **xiěŋ*

[5] This paper uses the author's notational system of Late Middle Chinese (LMC). Note that *a*, *ȧ*, *ä*, *e*, *o*, *ô*, *ü* represent [ɑ, a, ɛ, ə ~ ɤ, ɔ, o, y]; *ś*, *ṣ* represent [ɕ, ʂ].

[6] 品 (LMC **p'iěm*, MZ *p'im*) is also transcribed as 业又 in the KSS, therefore the dissimilation of labial coda **-m* > *-n* has not yet occurred in Liao Chinese.

[7] In the KSS, Middle Chinese division-II syllables of the *geng* 梗 rhyme class (e.g. 省 LMC **ṣäŋ* and 耿 LMC **käŋ*) have not yet merged into the *zeng* 曾 rhyme class (Shen 2006, p. 495). These syllables are transcribed with 並 (062) which is not used for the *zeng* rhyme class.

Table 5

Grapheme		LMC final	Example
生$_{196}$	‹ab›	咸 *-*ap*	屮为生 臘 ZY **la* < LMC **lap*
丹$_{311}$	‹eb›	深 *-*ep*	㐅丹 十 ZY **ši* < LMC **śiĕp*
关$_{127}$	‹ib›	深 *-*iĕp*	㐅关 十 ZY **ši* < LMC **śiĕp*
刃$_{137}$	‹ür›	臻 *-*üĕt*	叉刃 密 ZY **muĕj* < LMC **müĕt*
勺$_{165}$	‹ig›	梗 *-*yäk*	仐勺 積 ZY **zi* < LMC **cyäk*
久$_{172}$	‹ug^{w}›	通 *-*ôk^{w}*	屮久 祿 ZY **lu* < LMC **lôk^{w}*
非$_{282}$	‹üg^{w}›	通 *-*yok^{w}*	关穴非 玉 ZY **[ŋ]ü* < LMC **ŋyok^{w}*
丑$_{138}$	‹ewg^{w}›	通 *-*ewk^{w}*	㐅丑 叔 ZY **šü* < LMC **śyewk^{w}*

3. Analysis of Rhyming Words

In Khitan rhymes, each rhyming line usually consists of four words; the last words in the even lines (and sometimes also in the first line) rhyme with each other.[8]

Table 6 shows extracts of rhyming monosyllabic open-syllable words from Khitan rhymes. They are divided into five groups and are presumed to share the same, or nearly the same, vowel in each group.

Table 6

Group	Rhyming words	Source
Caa	力 *naa*, 仔 *taa*, 九为 *gaa*, 六 *daa*. 亚 *xaa*, 丑 *baa*.	*Daozong* 28–29 *Xingzong* 31–32
Cää	又 *mää*, 令斗 *tää*, 斗 *ää*, 㐅斗 *šää*. 又 *mää*, 㐅斗 *šää*.	*Daozong* 14–15 *Xuanyi* 19
Cëë	公文 *nëë*, 丹文 *bëë*, 百文 *yëë*.	*Renyi* 23–24
Coo	叉及 *moo*, 北 *poo*, 尚 *soo*, 女及 *ǰoo*, 义 ?, 叉及 *moo*. 公及 *noo*, 北 *poo*, 叉及 *moo*, 尚 *soo*.	*Daozong* 21–22 *Tadii* 23–24
Cuu /Cʊʊ	百交 *yuu*, 当 *tuu*, 业交 *puu*, 仉 *kuu*, 弓 *ǰuu*, 支 *luu*, 个 *puu*, 个 *puu*, 伞 *ʊʊ*, 几 *kuu*, 业交 *puu*, 交 *uu*, 九交 *guu*. 百交 *yuu*, 丹交 *buu*, 几 *kuu*, 九交 *guu*, 个 *puu*, 弓 *ǰuu*, 当 *tuu*, 几 *kuu*, 伞 *ʊʊ*, 仉 *kuu*, 交 *uu*.	*Min* 23–26 *Mt. Haitang* 11–13

[8] Shen (2009) is the first systematic study on Khitan rhymes. He mistakenly assumed that only the last grapheme in a word is involved in rhyming. In fact, the *whole* word is involved. For instance, 币平亚丰 *čawlağar*, 邪平亚丰 *ǰawlağar*, 百夹平亚丰 *yawlağar* and 穴平亚丰 *dawlağar* rhyme in *Čawǰ* 26–27; 艻化公㕛 *čewdeğeer*, 百土化公㕛 *yewdeğeer*, 伏土化公㕛 *ňewdeğeer* and 土化公㕛 *ewdeğeer* rhyme in *Daozong* 13; 北九 *bideg*, 丸勺 *idig*, 穴丸勺 *kidig* and 令丸勺 *tidig* rhyme in *Hongben* 17–18.

To summarise the observations made in Sections 2 and 3, the presumed V graphemes and CV graphemes are shown in Table 7.

Table 7

	V graphemes	CV graphemes
a	为 ‹aa›	丞 ‹baa›, 彳 ‹taa›, 穴 ‹daa›, 力 ‹naa›, 吊 ‹čaa›, 升 ‹ǰaa›, 巫 ‹xaa›, 歹 ‹xʷaa›
ä	丬 ‹ää›	又 ‹mää›, 不 ‹xää›
e	劣 ‹ee›	叔 ‹kee›
ë	支 ‹ëë›	
o	及 ‹oo›	非 ‹poo›, 生 ‹too›, 甬 ‹doo›, 尚 ‹soo›, 奏 ‹xoo›
ö	圶 ‹öö›	
ө	仲 ‹өө›	
u/*ʊ*	攴 ‹uu›, 爭 ‹ʊʊ›	分 ‹puu›, 半 ‹muu›, 劣 ‹tuu›, 们 ‹duu›, 发 ‹luu›, 习 ‹ǰuu›, 几 ‹kuu›, 仉 ‹kuu›, 玘 ‹xuu›
ü	宀 ‹üü›	
i	关 ‹ii›	付 ‹bii›, 王 ‹tii›, 友 ‹ǰii›
ɪ	谷 ‹ɪɪ›	廿 ‹sɪɪ›, 与 ‹ǰɪɪ›, 夙 ‹šɪɪ›

4. Analysis of the Khitan Spelling Rule for Vowels

In the transcriptions of Chinese words, a vowel-overlapping phenomenon is observed:

凡丬丞	‹(e)g-ää-ăm›	監 (ZY **gyam*)	‹(V)C-V-VC›	CVC
吊刍	‹čaa-aŋ›	長 (ZY **čaŋ*)	‹CV-VC›	CVC
劣火	‹tuu-uŋʷ›	同 (ZY **tuŋʷ*)	‹CV-VC›	CVC

Many researchers refer to this phenomenon, but none of them has successfully generalised it. In this section, I conduct an exhaustive survey of bigrams from a corpus in order to elucidate this vowel-overlapping rule.

4.1. Method and Results of the Survey

The question now is that in a sequence of two adjacent graphemes G_1-G_2 within a word, if G_1 is a vowel-final grapheme, then what grapheme would the G_2 be. To address this question, I counted in my corpus the number of tokens of G_1-G_2 bigrams where G_1 is any of the V and CV graphemes listed in Table 7.[9] The corpus consisted

[9] I exclude 仲 ‹өө› and the four graphemes representing ‹(C)ɪɪ› from the survey because of the former's limited quantity and the latter's characteristic of exclusive use for Chinese loanwords.

of 30 inscriptions that are equivalent to approximately three quarters of the existing KSS inscriptions.[10]

Table 8 shows the results of the survey.[11]

4.2. Abductive Inference of a Rule

From these data, the following generalisation can be made:

(i) In principle, a G_2 that can follow a (C)V grapheme whose vowel is V_i does not follow the other (C)V graphemes whose vowels are not V_i.

[10] The following list contains the inscriptions included in my corpus:
[1] *Epitaph of Čawň Lüü-peň* (*Yelü Zongjiao* 耶律宗教). Dated 1053, 36 lines.
[2] *Broken Epitaph of Gawň Puu-lëw* (*Xiao Shenhui* 蕭慎徽). Dated 1057, 32 lines.
[3] *Epitaph of Puunuuň Toxoser*. Dated 1068, 26 lines.
[4] *Epitaph of Uǰeeň* (*Yelü Jue* 耶律玦). Dated 1071, 46 lines.
[5] *Epitaph of Oŋuň Gaw-šib*. Dated from 1076 onward, 26 lines.
[6] *Epitaph of Kuyreğeeň Xaadii*. Dated 1080, 32-line text and 14-word title.
[7] *Epitaph of Bedelbeň Čawǰ*. Dated 1082, 28-line text and 15-word title.
[8] *Broken Epitaph of Yuŋuň*. Dated 1088, 43 lines.
[9] *Epitaph of Teleğeeň Xodɵxoň*. Dated 1091, 39 lines.
[10] *Epitaph of Lëëneň Xaar*. Dated 1091, 48 lines.
[11] *Epitaph of Sarağaň Dileed*. Dated 1092, 41 lines.
[12] *Epitaph of Orelbeň Yëëruu* (*Yelü Zhixian* 耶律智先). Dated 1094, 27 lines.
[13] *Epitaph of Guyneň Nuu*. Dated 1099, 48 lines.
[14] *Epitaph of Awloğooň Uyeer* (*Yelü Hongyong* 耶律弘用). Dated 1100, 32 lines.
[15] *Epitaph of Saraaň Šiluu*. Dated 1100, 13-line text and 7-word title.
[16] *Epitaph of Kuuŋuň Dilee* (*Yelü Chengkui* 耶律承窺). Dated 1101, 34 lines.
[17] *Eulogy for Emperor Daozong* 道宗. Dated 1101, 37-line text and 14-word title.
[18] *Eulogy for Empress Xuanyi* 宣懿. Dated 1101, 30-line text and 7-word title.
[19] *Epitaph of Ɵʊrdoğooň Umur*. Dated 1102, 51 lines.
[20] *Epitaph of Šiluuň J̌uurǰee* (*Xiao Zhiwei* 蕭知微). Dated 1107, 29 lines.
[21] *Broken Epitaph from Nangou* 南溝, *Sanshan township* 三山鄉. Dated 1108, 26 lines.
[22] *Eulogy for Imperial Grand Uncle Yihe renshou* 義和仁壽皇太叔祖 (*Yelü Hongben* 耶律弘本). Dated 1110, 25-line text and 6-word title.
[23] *Epitaph of Uuruğʷeeň, Wife of Yelü Hongben*. Dated 1110, 24-line text and 8-word title.
[24] *Epitaph of Baysbeň Čalaa* (*Xiao Min* 蕭旼). Dated 1113, 27 lines.
[25] *Epitaph of Ärloğooň Dilugʷ*. Dated 1114, 51 lines.
[26] *Epitaph of Tadii, Wife of Xiao Xiaosi* 蕭孝思. Dated 1115, 25 lines.
[27] *Record of the Journey of the Imperial Brother of the Great Jin Dynasty* 大金皇弟都統經略郎君行記. Dated 1134, 5 lines.
[28] *Epitaph of Oryeeň J̌uurǰee* (*Xiao Zhonggong* 蕭仲恭). Dated 1150, 50-line text and 9-word title.
[29] *Broken Epitaph from Yemaotai* 葉茂臺. Undated, 6 lines.
[30] *Broken Epitaph from Mount Haitang* 海棠山. Undated, 13 lines.

[11] I did not count bigrams that included (an) illegible or fully lost grapheme(s). Due to space limitations, I omitted the individual number of each CV grapheme and showed only the total number of CV graphemes that had a common vowel.

Table 8

G_2 \ G_1			*aa*		*ää*		*ëë*	*öö*	*oo*		*uu/ʊʊ*			*üü*	*ii*		*ee*	
			为	Caa	礻	Cää	交	夬	及	Coo	攵	Cuu	爫	宀	关	Cii	爻	Cee
	夭$_{011}$	**‹an›**	127	39	5	0	0	0	0	0	0	0	0	0	0	0	0	0
	丵$_{051}$	‹ağ›	17	210	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	共$_{069}$	‹aľ›	188	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	方$_{098}$	‹al›	165	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	尗$_{099}$	‹ad›	78	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	丰$_{122}$	**‹ay›**	153	52	1	0	0	0	0	0	0	0	0	0	0	0	0	6
	丰$_{123}$	‹ar›	354	42	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	刘$_{151}$	‹ax›	4	4	1	0	0	0	0	0	0	0	0	0	3	1	2	0
	夬$_{161}$	**‹aw›**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	冬$_{174}$	‹as›	15	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a	乃$_{184}$	**‹am›**	42	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	肉$_{189}$	**‹aa›**	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	年$_{196}$	**‹ab›**	22	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	气$_{199}$	**‹aŋ›**	2	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	先$_{203}$	‹ard›	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	爻$_{269}$	?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	出$_{290}$	‹ań›	332	14	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	尒$_{312}$	‹ald›	16	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	攴__	‹ağ›	59	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	史__	‹and›	70	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	攵__	?	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	丙$_{023}$	‹äd›	0	0	10	0	2	0	0	0	0	0	0	0	0	0	0	0
	並$_{062}$	**‹ëŋ›**	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
	去$_{073}$	**‹än›**	0	0	4	0	107	16	0	0	0	0	0	0	0	0	0	0
	左$_{084}$	‹är›	0	0	42	0	44	4	0	0	0	0	0	0	0	0	0	0
	劣$_{093}$	‹ärd›	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
	力$_{168}$	‹äx›	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	尔$_{197}$	**‹äy›**	0	0	14	1	0	0	0	0	0	0	0	0	0	0	0	0
ä	仝$_{270}$	**‹äm›**	0	0	22	2	27	0	0	0	0	0	0	0	0	0	0	0
	幺$_{274}$	‹äğ›	0	0	9	6	0	0	0	0	0	0	0	0	0	0	0	0
	止$_{280}$	‹äl›	0	0	6	0	4	2	0	0	0	0	0	0	0	0	0	0
	肖$_{299}$	?	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	升$_{315}$	‹äš›	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0
	文$_{327}$	**‹ëë›**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	礻$_{335}$	**‹ää›**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
	坐$_{359}$	?	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
ö	屶$_{115}$	‹öl›	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
	咄$_{324}$	**‹ön›**	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0

(Continued on the next page)

G_2 \ G_1			*aa*		*ää*		*ëë*	*öö*	*oo*		*uu/ʊʊ*			*üü*	*ii*		*ee*	
			为	Caa	扌	Cää	文	坎	及	Coo	攵	Cuu	夂	宀	关	Cii	劵	Cee
o	币$_{016}$	‹od›	0	0	0	0	0	0	7	15	0	0	0	0	0	0	0	0
	圮$_{076}$	‹or›	0	0	0	0	0	0	119	51	0	0	0	0	0	0	0	0
	衣$_{107}$	**‹oy›**	0	0	0	0	0	0	89	3	0	0	0	0	0	0	0	0
	子$_{149}$	‹ol›	0	0	0	0	0	0	208	45	0	0	0	0	0	0	0	0
	尒$_{154}$	**‹on›**	0	0	0	0	0	0	11	17	0	0	0	0	0	0	0	0
	尹$_{157}$	‹ols›	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	0
	欠$_{169}$	‹ox^{w}›	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
	及$_{186}$	**‹oo›**	0	0	0	0	0	0	17	0	0	0	1	0	0	0	0	0
	州$_{188}$	‹oǰ›	0	0	0	0	0	0	8	1	0	0	0	0	0	0	0	0
	朱$_{217}$	‹ond›	0	0	0	0	0	0	1	90	0	0	0	0	0	0	0	0
	行$_{220}$	‹om›	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0
	公$_{252}$	‹oğ^{w}›	0	0	0	0	0	0	6	13	0	0	0	0	0	0	0	0
	企$_{255}$	‹olʾ›	0	0	0	0	0	0	89	59	0	0	0	0	0	0	0	0
	闲$_{304}$	‹old›	0	0	0	0	0	0	47	11	0	0	0	0	0	0	0	0
	肉$_{322}$	‹oň›	0	0	0	0	0	0	122	0	0	0	0	0	0	0	0	0
	乡$_{354}$	‹os›	0	0	0	0	0	0	29	5	0	0	0	0	0	0	0	0
	米$_{355}$	‹ord›	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
u	卡$_{041}$	‹us›	0	0	0	0	0	0	0	0	9	134	0	0	0	0	0	0
	杏$_{059}$	‹uň›	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0
	廾$_{090}$	‹ʊğ^{w}›	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
	安$_{097}$	‹ur›	0	0	0	0	0	0	0	0	81	35	0	0	0	0	0	0
	攵$_{131}$	**‹uu›**	0	0	0	0	0	0	0	0	4	26	0	0	0	0	0	0
	冯$_{148}$	?	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
	羽$_{152}$	‹uǰ›	0	0	0	0	0	0	0	0	328	10	1	0	0	0	0	0
	夂$_{172}$	**‹ug^{w}›**	0	0	0	0	0	0	0	0	14	6	0	0	0	0	0	0
	刈$_{177}$	‹urǰ›	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0
	尻$_{179}$	‹und›	0	0	0	0	0	0	0	0	18	2	6	6	0	0	0	0
	免$_{206}$	‹ulʾ›	0	0	0	0	0	0	0	0	6	2	0	0	0	0	0	0
	化$_{236}$	‹ud›	0	0	0	0	0	0	1	0	149	4	9	2	0	0	0	0
	余$_{246}$	‹ʊx^{w}›	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0
	分$_{249}$	‹urd›	0	0	0	0	0	0	0	0	0	0	46	0	0	0	0	0
	灾$_{262}$	**‹uy›**	0	0	0	0	0	0	0	0	14	1	1	2	0	0	0	0
	尐$_{273}$	**‹un›**	0	0	0	0	0	0	0	0	93	36	18	36	0	0	0	0
	火$_{345}$	**‹uŋ^{w}›**	0	0	0	0	0	0	0	0	1	96	0	9	0	0	0	0
	早$_{366}$	‹ul›	0	0	0	0	0	0	0	0	76	17	0	0	0	0	0	0
	尺$_{372}$	‹uğ^{w}›	0	0	0	0	0	0	0	0	0	155	0	0	0	0	0	0
	丵__	?	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
ü	吏$_{050}$	‹üd›	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
	圣$_{128}$	?	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0

(Continued on the next page)

G_2 \ G_1			*aa*		*ää*		*ëë*	*öö*	*oo*		*uu/ʊʊ*			*üü*	*ii*		*ee*	
			为	Caa	扌	Cää	文	圡	及	Coo	攵	Cuu	夂	宀	关	Cii	爻	Cee
ü	刃$_{137}$	**‹ür›**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	仕$_{224}$	‹ül›	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
	非$_{282}$	**‹ügʷ›**	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
	宀$_{289}$	**‹üü›**	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
	冂__	?	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
i	丙$_{018}$	**‹in›**	0	0	0	0	0	0	0	0	0	0	0	0	37	31	0	0
	丞$_{033}$	‹iš›	0	0	0	10	0	0	0	0	0	124	0	0	171	14	0	0
	尤$_{089}$	‹id›	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
	又$_{133}$	**‹im›**	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0
	勺$_{165}$	**‹ig›**	0	0	0	0	0	0	0	0	0	0	0	0	29	1	0	0
	仉$_{235}$	‹ir›	0	0	0	0	1	0	0	0	0	0	0	0	254	1	0	0
	用$_{302}$	‹il›	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	同$_{303}$	**‹iŋ›**	0	0	0	0	0	0	0	0	0	0	0	1	15	11	0	0
	关$_{339}$	**‹ii›**	0	0	0	0	0	0	0	0	0	0	0	0	13	1	0	0
	爷$_{352}$	‹iğ›	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
e	丐$_{020}$	**‹ey›**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6
	求$_{162}$	‹eǰ›	1	0	0	0	0	0	0	0	0	0	0	0	1	0	73	1
	矢$_{205}$	‹end›	0	0	0	0	0	0	0	0	1	1	0	2	10	5	10	0
	伞$_{244}$	‹es›	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
	丹$_{311}$	**‹eb›**	0	0	0	0	1	0	0	0	0	0	0	0	0	0	8	0
	火$_{344}$	‹eld›	0	0	0	0	0	0	4	0	37	1	0	0	1	0	14	0
	岔$_{349}$	‹eğ›	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1
	尘$_{356}$	‹eľ›	0	0	0	0	0	0	0	0	0	0	1	3	1	0	20	5
	北$_{080}$	‹eel›	0	0	0	0	0	0	0	0	1	1	0	0	1	0	2	116
	令$_{247}$	‹eed›	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
	公$_{251}$	**‹een›**	0	0	0	0	0	2	0	0	0	0	0	0	0	0	5	0
	金$_{257}$	**‹em›**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	64
	爻$_{341}$	‹eer›	1	0	0	0	12	0	1	0	5	1	1	0	0	0	7	4
	当$_{361}$	‹eeň›	0	0	0	0	0	0	0	0	6	0	0	0	1	0	0	6
	交$_{108}$	?	0	0	0	0	4	0	0	0	10	0	0	0	0	0	0	0
	朴$_{140}$	**‹en›**	0	0	0	0	0	0	0	0	0	1	0	1	21	16	4	0
	及$_{144}$	‹er›	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	伏$_{222}$	‹eň›	0	0	1	0	0	0	0	0	11	0	0	1	3	0	0	0
	岔$_{254}$	‹ed›	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0
	伞$_{258}$	‹ez›	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
	仆$_{261}$	‹el›	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
	安$_{264}$	**‹eŋ›**	0	0	0	0	0	0	0	0	0	2	0	1	2	1	0	0
	尖$_{293}$	‹ens›	0	0	0	0	5	0	0	0	13	0	0	0	3	0	0	0
	爻$_{348}$	**‹ee›**	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0
–	由$_{320}$	‹bel›	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

For instance, the grapheme 夫$_{069}$ can follow the graphemes ‹(C)aa›, but does not follow the other (C)V graphemes. Similarly, all G_2s that can follow ‹(C)aa›s do not follow the other (C)V graphemes, though some exceptions were observed. This is true of the other vowels, too.[12]

Consequently, it appears that a (C)V grapheme can only be followed by specific G_2s. In order to interpret the data coherently, it is the most plausible explanation to presume that such G_2s are vowel-initial graphemes whose vowels are identical with the preceding one. Therefore, the following rule is inferred:

(ii) **Vowel-overlapping rule**: A vowel-final grapheme has to be followed by a vowel-initial grapheme whose vowel is identical with the preceding one.

This rule reveals that essentially all of the above-mentioned G_2s are VC graphemes, because the rule does not function between these graphemes and the following ones, and they are thus presumed as consonant-final graphemes.[13] As such, the vowel-overlapping rule is effectual in confirming the types and vocalic values of the graphemes.[14]

This rule is applied in principle whenever a grapheme is spelled after a vowel-final grapheme (e.g. 戈为夫 ‹eš-aa-aľ› *šaaľ*)[15], but if the most suitable VC grapheme does not exist in the KSS syllabary, then the second most suitable one is spelled, such as 个禾伏 ‹puu-iš-eň› *puušeň* (because there is no ‹uš›), 丙右及火 ‹ey-är-uu-eld› *yäruuld* (no ‹uld›), 仐及奘 ‹es-uu-ens› *suuns* (no ‹uns›). In addition, there were relatively many spellings that slightly deviated from the rule. However, they mostly had another spelling according to the rule and are fewer than the regular ones, hence they were assumed to be "non-orthographic".[16]

[12] There is no space to discuss the individual exceptions here. As for the main factor of exceptions, see the description below in this section.

[13] This consequence is supported by an analysis of Khitan transcriptions of Chinese words discussed in Section 2.3. Exceptional sequences ‹(C)VV-VV› are occasionally observed, most of which are optional and peculiar spellings exclusive to Chinese *qusheng* 去聲 syllables (Shen 2012).

[14] Some researchers have reconstructed VCV graphemes such as 杏 ‹uni›, 夫 ‹ali›, 生 ‹abu› from the inadequate evidence as stated in Section 1. The vowel-overlapping rule proves that such reconstructions are incorrect and they are VC graphemes. Furthermore, many researchers have reconstructed 礻 (335)'s value as a diphthong ‹ia›. However, viewed from the vowel-overlapping phenomenon, the characteristic of the grapheme is similar to that of 文 ‹ëë› rather than 为 ‹aa›. We thus have to reconstruct the value of 礻 as a vowel whose quality is similar to that of *ë* rather than *a*.

[15] A similar rule is applied after semivowel-final graphemes, such as 六夾仇- ‹ek-uy-ir› *kuyr-*, 夾用 ‹uy-il› *uyl*, 土耳 ‹ew-ul› *ewl*, 介交 ‹xaw-ur› *xawr*. The grapheme 用 (302) ‹il› is not attested in the position after ‹(C)ii› graphemes in my corpus, but it is often followed by ‹(C)Vy› graphemes, thus the value is presumed to be ‹iC›.

[16] For example, 九礻乃 ‹eg-ää-am› *gääm* (3 examples) vs. 九礻仝 ‹eg-ää-äm› *gääm* (22 examples), and 不夭 ‹xää-iš› *xääš* (7 examples) vs. 不卉 ‹xää-äš› *xääš* (19 examples).

5. Reconstructing the Khitan Vowel System

Based on the reconstructed phonetic values, I will use this section to establish the regular vowel correspondences between Khitan and Mongolian in addition to describing the phonological changes that explain these correspondences.

Firstly, I added another V grapheme to the twelve graphemes shown in Table 2. See the following example of rhyming words in an epitaphic rhyme:

叔父 *keer*, 仲父 *öör*, 季父 *čeer*,
罗父 *CVVr*, 丙文父 *yëër*, 仐考父 *sVVr* (*Nuu* 43–45)

The grapheme 考$_{125}$, which is not used for Chinese words, rhyms with the vowels *e*, *ë*, and *ö* in closed-syllable words. Thus, it must represent a vowel whose quality is similar to those of *e*, *ë*, and *ö*. I reconstructed its value as **ɵ* based on a correspondence to be discussed in Section 5.2.

5.1. Vowel Length

Vowels represented by V or CV graphemes are long. This is because long vowels in the modern Mongolian languages such as Mongolian (Mong.),[17] Kalmyk (Kalm.), and Dagur (Dag.) or hiatuses in Middle Mongolian (MMo.) correspond to Khitan (Khit.) vowels represented by V or CV graphemes:[18]

	Khit.			Meaning	MMo.	Mong.
(a)	亟	‹xaa›	*xaa*	‘khaghan’	*xa’an*	*xaaŋ*
	仝为	‹äm-aa›	*ämaa*	‘sheep’	*ima’an*	*yamaa*
	扑-	‹ǰaa-›	*ǰaa-*	‘to tell’	*ǰi’a-*	*ǰaa-*
	令力为	‹et-äx-aa›	*täxaa*	‘chicken’	*takiya*	*däxaa*
	戈史为	‹eš-aw-aa›	*šawaa*	‘falcon’	*šiba’un*	*šoboo*
	丹车为买	‹eb-är-aa-an›	*bäraan*	‘right-hand’	*bara’un*	*baroon*
	公斗	‹ed-ää›	*dää*	‘enemy’	*dayin*	*dääŋ*
	戋免为	‹taw-uľ-aa›	*tawľaa*	‘hare, rabbit’	*taulai*	*toolää*
	叔	‹kee-›	*kee-*	‘to say’	*ke’e-*	—
	朱岁	‹eč-ee›	*ǰee*[19]	‘sister’s child’	*ǰi’e*	*ǰee*
	又岁	‹er-ee›	*eree*	‘now’	*edö’e*	Dag. *edee*
	甬子-	‹doo-ol-›	*dool-*	‘to hear’	*du’ul-*	*dool-*
	几	‹kuu›	*kuu*	‘person’	*kü’ün*	Kalm. *küün*

[17] Mongolian mentioned henceforward refers to the Chakhar dialect in Inner Mongolia.

[18] Mongolian long vowels derived from MMo. hiatuses *A’U* in initial syllables, however, correspond to Khitan diphthongs *aw* and *ew*, e.g. 邪 *ǰaw* ‘hundred’ || MMo. *ǰa’un*, Mong. *ǰoo* ‘id.’; 右 *dew* ‘man’s younger sibling of the same sex’ || MMo. *de’ü*, Mong. *duu* ‘younger brother’. See Ōtake (2016b, p. 24).

[19] This word means “one’s sister’s child” and “one’s daughter’s child” (Ōtake 2016c).

Some Khitan long vowels were derived from vowels in monosyllabic open-syllable words. It appears to be the traces of the minimal word condition which is a constraint that prohibits the occurrence of monomoraic words.

	Khit.			Meaning	MMo.	Mong.
(b)	为-	‹aa-›	*aa-*	‘to be’	*a*-	*a*- ~ *aa*-
	斧	‹ee›	*ee*	‘this’	*e*(*ne*)	*en*
	非	‹poo›	*poo*	‘time, season’	*ho*(*n*)	*oŋ*
	全	‹ʊʊ›	*ʊʊ*	‘water’	*u*(*sun*)	*ʊs*
	丹考-	‹eb-өө-›	*bөө-*	‘to be’	*bö*-	—

More interestingly, long vowels in early loanwords correspond to Turkic primary long vowels that are mainly reconstructed by data from modern languages like Yakut (Yak.) and Turkmen. It implies that Proto-Mongolic (PMo.)[20] distinguished between vowel lengths, which was preserved in Khitan. Such primary long vowels are also observed in Khitan native words as shown in Section 5.2.[21]

	Khit.			Meaning	MMo.	OTü.	Yak.
(c)	丹及子-	‹eb-oo-ol-›	*bool-*	‘to become’	*bol-*	*bol-*	*buol-* < **bōl-*
	几卡	‹kuu-us›	*kuus*[22]	‘strength’	*kučün*	*küč*	*küüs*
	米及	‹ord-uu›	*orduu*	‘ordo’	*ordo*	*ordu*	*orduu*

5.2. Regular Vowel Correspondences

In principle, the Mongolian unrounded short vowels *a*, *e*, *i*, or the MMo. *a*, *e*, *i*, respectively, correspond to the Khitan short vowels *a*, *e*, *i* (d) or the long vowels *aa*, *ee*, *ii* (e):

	Khit.			Meaning	MMo.	Mong.
(d)	丹冬	‹eb-as›	*bas*	‘again, also’	*basa*	*bas*
	丙史	‹ey-aw-›	*yaw-*	‘to conduct’	*yabu-*	*yab-*
	仝礽	‹es-en›	*esen*	‘healthy’	*esen*	*eseŋ*
	八屮	‹ek-el›	*kel*	‘word’	*kelen*	*xel*
	乔	‹iš›	*iš*	‘nine’ (fem.)	*yisün*	*yis*
	圣	‹ǰir›	*jir*[23]	‘two’ (fem.)	*jirin*	—
(e)	为-	‹aa-›	*aa-*	‘to be’	*a*-	*a*- ~ *aa*-
	斧	‹ee›	*ee*	‘this’	*e*(*ne*)	*en*
	朮关乔	‹eč-ii-iš›	*čiiš*	‘blood relative’	*čisun*	*ǰʊs*

[20] I employ the term “Proto-Mongolic” as the hypothetical common ancestor of all attested Mongolic languages including so-called “Para-Mongolic” (Janhunen 2003).

[21] For a more detailed discussion on Khitan vowel length, see Ōtake (2015c).

[22] To decipher this word, see Ōtake (2015a).

[23] This word rhymes with the syllables *Cir*, such as 仜 *ir* and 令仜 *tir*.

The Mongolian rounded short vowel *o*, or the MMo. *o*, corresponds to the Khitan short *o* or long *o* (f); the Mongolian short *ʊ*, or the MMo. *u*, corresponds to the Khitan short *o* or long *ʊ* (g). This reveals that the merger of the Proto-Mongolic short **u* with the short **o* took place, but the long **u* was retained as the long *ʊ* in Khitan.

	Khit.			Meaning	MMo.	Mong.
(f)	米攴	‹ord-uu›	*orduu*	‘ordo’	*ordo*	*ord*
	丹及子-	‹eb-oo-ol-›	*boo̲l-*	‘to become’	*bo̲l-*	*bo̲l-*
	甬北	‹doo-or›	*doo̲r*	‘under’	*do̲ro*	*do̲r ~ doo̲r*
(g)	尒	‹on-›	*o̲n-*	‘to fall, drop’	*u̲na-*	*ʊ̲n-*
	甬子-	‹doo-ol-›	*doo̲l-*[24]	‘to hear’	*du̲’u̲l-*	*doʊ̲l-*
	伞	‹ʊʊ›	*ʊ̲ʊ̲*	‘water’	*u̲(sun)*	*ʊ̲s*
	弓必	‹ǰuu-un›	*ǰʊ̲ʊ̲n*[25]	‘summer’	*ǰu̲n*	*ǰʊ̲ŋ*

Similarly, the Mongolian rounded short vowel *u*, or the MMo. *ü*, corresponds to the Khitan short *u* or long *u* (h); the Mongolian short *ө*, or the MMo. *ö*, corresponds to the Khitan short *u* or long *ө* (i). This shows that the merger of the Proto-Mongolic short **ö* with the short **ü* occurred, but the long **ö* was preserved as the long *ө* in Khitan.

	Khitan			Meaning	MMo.	Mong.
(h)	业早-	‹ep-ul-›	*pu̲l-*	‘to exceed’	*hü̲le-*	*u̲l-*
	攴早	‹uu-ul›	*uu̲l*	‘winter’	*ü̲bü̲l*	*өbөl*[26]
	几卡	‹kuu-us›	*kuu̲s*	‘strength’	*kü̲čün*	*xu̲č*
(i)	伞杏	‹es-uň›	*su̲ň*	‘night’	*sö̲ni*	*šө̲n ~ sө̲n*
	尺-	‹uğ^{w}-›	*u̲ğ^{w}-*	‘to give’	*ö̲g-*	*ө̲g-*
	丹考-	‹eb-өө-›	*bө̲ө̲-*	‘to be’	*bö̲-*	—
	兄	‹dөөr›	*dө̲ө̲r*[27]	‘four’ (fem.)	*dö̲r*(*ben*)	*dө̲rөb*

The phonemic changes concerning vowels that occurred between Proto-Mongolic and Khitan are summarised in Table 9.[28]

[24] This example shows that the merger of **u* (*ʊ*) with **o* precedes the contraction of hiatuses *V’V > VV (i.e. PMo. **duğul-* > **do’ol-* > Khit, *dool-*).

[25] In order to coherently explain the relevant sound changes, I assumed that the graphemes with a phonetic value ‹Cuu› can represent both /Cuu/ and /CʊU/.

[26] The correspondence between the MMo. *übül* and the Mong. *өbөl* is irregular.

[27] This word rhymes with the syllables *Ceer*, *Cөөr*, and *Cëër*. The dative-locative form of the word is written as 令考令 ‹et-өө-eed› *dөөdd* (*dөөr* + *-d* with a full assimilation of stem-final *r*), which reveals that the nominative form, that is, the reading of 兄, is *dөөr*. The relationship between the Khit. *dөөr* and the Proto-Turkic **tȫrt* ‘four’ is unknown.

[28] For convenience, I treated vowels in monosyllabic open-syllable words equally to primary long vowels in this table, though the former are phonologically short in the PMo. stage.

Table 9

PMo.	Khit.	PMo.	Khit.
**a*	*a*	**ā*	*aa*
**e*	*e*	**ē*	*ee*
**i*	*i*	**ī*	*ii*
**o*	*o*	**ō*	*oo*
**u*		**ū*	*ʊʊ*
**ö*	*u*	**ȫ*	*ɵɵ*
**ü*		**ṻ*	*uu*

5.3. Palatalised Vowels

Khitan has a series of palatalised vowel phonemes (i.e. *ä*, *ë*, *ö*, *ɵ̈*, *ü*), which seem to be palatalised versions of plain vowels *a*, *e*, *o*, *ɵ*, *u*, respectively. Phonological alternations without a semantic change are found in the following examples:

丞月 *ämaa* ~ 丞斗 *ämää*	‘sheep’ (MMo. *ima’an*)
屰丞月买 *lämaan* ~ 屰丞斗方 *lämään*	‘*linya* 林牙 (title)’ (gen.)
丞丙月丰 *dädaar* ~ 令丙斗卉 *dädäär*	‘*Xi* 奚’ (adj. masc.)[29]
丙文卉及 *yëërüu* ~ 丙文卉爿 *yëërüü*	‘peaceful’
由及 *xäruu* ~ 由爿 *xärüü*	‘black’ (fem.)

These synchronic free variations show that the progressive assimilation of a vocalic feature *frontness* is in progress in Khitan. As such, frontness is neutralised in non-initial syllables, but still functions in initial syllables.

The short palatalised vowel *ä* is derived from **i* before **a* or **a* before **i* (j);[30] the long *ä* is derived from **ayi* (k). The origin of the other palatalised vowels is unclear.

	Khit.			Meaning	MMo.	OTü.
(j)	丞月	‹äm-aa›	*ämaa*	‘sheep’	*ima’an*	*ımγa*
	奚	‹mäŋ›	*mäŋ*[31]	‘thousand’	*miŋqan*	*biŋ, bıŋ*
	令力月	‹et-äx-aa›	*täxaa*	‘chicken’	*takiya*	*taqıγu*
(k)	丞斗	‹ed-ää›	*dää*	‘enemy’	*dayin*	*yaγı* < **δaγı*
	又斗	‹eš-ää›	*šää*	‘good’	*sayin*	*saγ*

[29] This ethnic group is transcribed as 迭達 (ZY **dyä.da*) in the *Liaoshi* (Ōtake 2016a, p. 10).

[30] However, if the onset is (alveo-)palatal *č*, *ǰ*, *š* or *y*, the vowel **i* resulted in *a*, not *ä*, such as in 又夬月 ‹eš-aw-aa› *šawaa* ‘falcon’ (transcribed as 稍瓦 ZY **šaw.wa* in the *Liaoshi*) || MMo. *šiba’un* ‘id.’; 坠月 ‹čal-aa› *čalaa* ‘stone’ (transcribed as 查剌 ZY **ča.la* in the *Liaoshi* as a person’s name) || MMo. *čila’un* ‘id.’.

[31] This word is also used to represent the Chinese 孟 (LMC **mäŋ*) (Ōtake 2015b, p. 8).

"Irregular" correspondences concerning palatalised vowels are frequently observed as shown in (l), which may shed a light on the origin of Khitan palatalised vowels.

	Khit.			Meaning	MMo.
(l)	丹夲为关	‹eb-är-aa-an›	*bä̲raan* < **bi̲ra'un*?	'right-hand'	*ba̲ra'un*
	丹力	‹eb-äx›	*bä̲x* < **bi̲ga*?	'child'	*ba̲γa*
	关	‹ňär›	*ňä̲r*[32] < **ni̲ra*(*n*)?	'sun, day'	*na̲ran*
	伏力	‹eň-äx›	*ňä̲x* < **ni̲ka*(*n*)?	'dog'	*no̲qai*
	达	‹öl›	*ö̲l* < **i̲lo*(*n*)?	'much, many'	*o̲lon*
	又化	‹em-ir›	*mi̲r* < **mi̲ri*(*n*)?	'horse'	*mo̲rin*

6. Conclusion

Through the above discussion, the twelve vowel phonemes listed in Table 10 have been reconstructed in Khitan.[33]

Table 10[34]

	Plain vowels							Palatalised vowels				
	a	*e*	*i*	*o*	*ʊ*	*ɵ*	*u*	*ä*	*ë*	*ö*	*ɵ̈*	*ü*
[Open]	+	+	–	+	–	+	–	+	+	+	+	–
[Front]	–	–	+	–	–	–	–	+	+	+	+	+
[Round]	–	–	–	+	+	+	+	–	–	+	+	+
[RTR]	+	–	–	+	+	–	–	+	–	+	–	–

Khitan vowel phonemes are distinguished by four vocalic features. These features [open], [front] and [round], respectively, explain the distinctions between non-high vowels vs. high ones, front vs. non-front (back), and rounded vs. unrounded. The feature [RTR] (retracted tongue root) is needed to explain the harmonic phenomena which were not mentioned in this paper. In addition, vowel length is also distinctive as stated earlier.

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[32] This word is transcribed as 捏離 (ZY **nyä.li*) in the *Qidan guozhi* 契丹國志. (It has been miscopied as 担離 ZY **dan.li* in the *Yanbei zaji* 燕北雜記 collected in the *Leishuo* 類說.) It rhymes with the syllables *Cär* or *Cör*, such as 公夲 *när* and 由 *xär*.

[33] This excludes the non-native phoneme *ɩ* that is used for Chinese loanwords.

[34] "+" means the presence of the feature; "–" indicates its absence.

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