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When internal reconstruction goes further: proposing the vowel system of Pre-Khroskyabs through examining bound state apophony

Abstract: This paper proposes an internal reconstruction of the vowel system of Pre-Khroskyabs by analysing bound state apophony in modern Siyuewu Khroskyabs. While most modern Khroskyabs dialects do not exhibit sufficient variations of bound state apophony, Siyuewu Khroskyabs is conservative in this regard. The internal reconstruction deals with the different reflexes between final and non-final vowels in modern Khroskyabs dialects, and postulates a unified origin for them, by hypothesising two series of vowels, velarised and plain. Velarisation in Pre-Khroskyabs is then compared with uvularisation in Tangut, showing regular correspondences between the two. This work demonstrates that velarisation is an important feature that can be reconstructed back to Proto-Gyalrongic, and that it helps us in understanding Trans-Himalayan historical linguistics. Additionally, it can be seen through this paper that internal reconstruction is an indispensable procedure in reconstructing the history of a language, as a significant portion of vocalic contrasts cannot be reconstructed by cross-linguistic comparisons alone.

Keywords: apophony; bound state; Gyalrongic; internal reconstruction; Khroskyabs; Siyuewu

1 Introduction

This paper aims to propose an internal reconstruction of the vowel system of Pre-Khroskyabs (Gyalrongic, Sino-Tibetan), based on the bound state apophony exhibited by one of its most conservative descendants, Siyuewu Khroskyabs.

The structure of the paper is outlined as follows. Sections 1.1 through 1.3 provide background information, including a profile of the Khroskyabs language and previous accounts, a brief description of Khroskyabs' phonology, as well as the problem that is dealt with in this paper. Section 2 briefly presents bound states in different Gyalrongic languages, including East Gyalrongic languages such as Japhug, Zbu and Bragbar Situ, and Wobzi Khroskyabs, a close relative to Siyuewu. Section 3 describes the formation of bound state in Siyuewu Khroskyabs in detail. Section 4 provides an internal reconstruction of relevant vowels in Pre-Khroskyabs, hypothesising several sound changes concerning the opposition between plain and velarised vowels in open syllables. In Section 5, I compare velarisation in reconstructed Pre-Khroskyabs forms with uvularisation in Tangut. Section 6 offers concluding remarks.

1.1 The language and previous accounts

Gyalrongic languages are a subgroup of the Trans-Himalayan (or Sino-Tibetan) family mainly spoken in Western Sichuan, China (Sun 2000a, 2000b). This subgroup has two

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main sub-branches, the East Gyalrongic branch and the West Gyalrongic branch (see Sagart et al. 2019 for the phylogeny of Trans-Himalayan). The East Gyalrongic branch includes Japhug, Zbu, Situ and Tshobdun, and the West Gyalrongic branch includes Horpa-Stau varieties, Khroskyabs, and Tangut (Lai et al. 2020), see Figure 1.

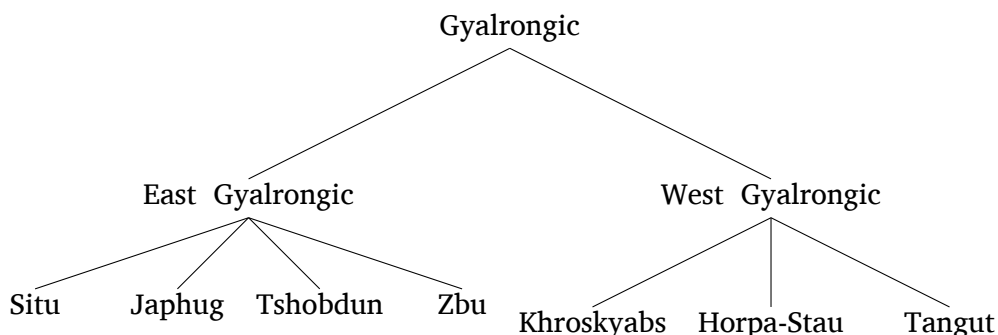


Figure 1: Gyalrongic languages.

Khroskyabs, the language treated in this paper, is spoken in Rngaba Prefecture, Sichuan, China (Figure 2). Like almost all Gyalrongic languages, it exhibits complex phonology and morphology. The main Khroskyabs dialect analysed in this paper is the Siyewu dialect, spoken by around 500 people in the Siyewu village in Dзамthang County. Other dialects cited include Wobzi (Lai 2017), Guanyinqiao (Huang 2007), Njorogs ((Yin 2007) and Xiaoyili Huang 2007; Sun 2005, 2008).

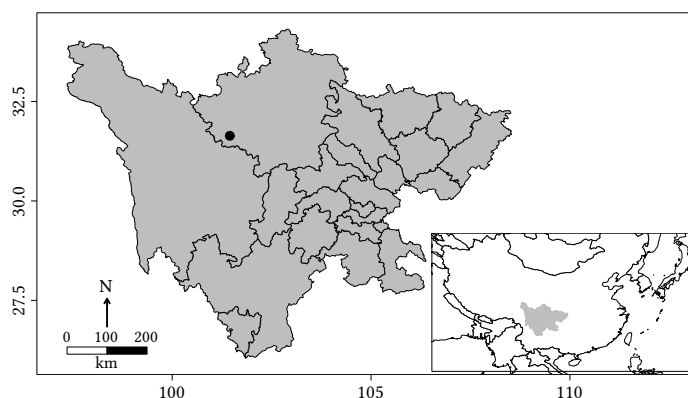


Figure 2: Location of Khroskyabs in Sichuan, China.

Except for two grammatical sketches (Huang 2007; Yin 2007) and one reference grammar (Lai 2017), previous research papers on Khroskyabs have mainly focused on synchronic morphosyntactic and morphophonological analyses (Lai 2013b, Lai 2015, Lai 2016, Lai 2018), with limited discussion of diachronic developments.

Diachronic morphology in Khroskyabs was first discussed in Sun (2000b) from a Gyalrongic perspective. Recently, three papers deal with specific problems in Khroskyabs' diachronic morphology. Lai (2021a) deals with the emergence and establishment of the

chain of inflectional prefixes in Siyuewu Khroskyabs. Lai (2020), comparing two better described varieties, Wobzi and Siyuewu, discusses the evolution of inverse marking from Pre-Khroskyabs to modern varieties. Finally, Lai (2021b) offers a reconstruction for the ablauting system of verbs in Khroskyabs through internal reconstruction, proposing several sound changes concerning closed syllables; relevant points from which will be presented in Section 4.2.

1.2 Synchronic phonological inventory of Siyuewu Khroskyabs

The consonant inventory of Siyuewu Khroskyabs is illustrated in Table 1. There are 41 consonant phonemes in total.

Table 1: Consonant inventory of Siyuewu Khroskyabs.

Bilabial		<i>p</i>	<i>p^h</i>	<i>b</i>	<i>m</i>
Labio-dental		<i>f</i>	<i>v</i>		
Dental		<i>s</i>	<i>z</i>	<i>ts</i>	<i>ts^h</i> <i>dz</i>
Alveolar		<i>t</i>	<i>t^h</i>	<i>d</i>	<i>ɬ</i> <i>l</i> <i>n</i>
Alveolo-palatal		<i>ç</i>	<i>ʒ</i>	<i>tç</i>	<i>tç^h</i> <i>dʒ</i>
Retroflex		<i>ʂ</i>	<i>tʂ</i>	<i>tʂ^h</i>	<i>dʐ</i> <i>r</i>
Palatal		<i>c</i>	<i>c^h</i>	<i>ɟ</i>	<i>ç</i> <i>j</i>
Velar		<i>k</i>	<i>k^h</i>	<i>g</i>	<i>ɣ</i> <i>ŋ</i>
Uvular		<i>q</i>	<i>q^h</i>	<i>χ</i>	<i>ʁ</i>

The vowel chart of Siyuewu Khroskyabs is shown in Figure 3. Siyuewu Khroskyabs exhibits a seven-vowel system, with three front vowels, three back vowels and a central vowel.

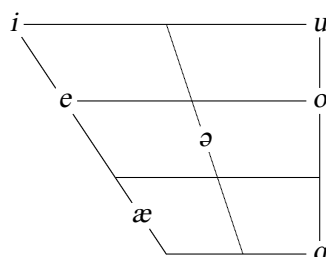


Figure 3: Siyuewu Khroskyabs vowel inventory.

Two tones are attested in Siyuewu Khroskyabs, a high tone, $\acute{\text{a}}$, and a falling tone, $\hat{\text{a}}$. Minimal pairs showing tonal contrast are shown in Table 2. In this paper, tones are not taken into consideration for reconstructed forms, as too little is known about the tonogen-

esis of Khroskyabs.

Table 2: Tonal contrast in Siyuewu Khroskyabs.

High tone	Gloss	Falling tone	Gloss
<i>ɣlé</i>	hare	<i>ɣlê</i>	flute
<i>ví</i>	bottom	<i>vî</i>	do
<i>rɣá</i>	face	<i>rɣâ</i>	hunt
<i>jú</i>	rob	<i>jû</i>	utter

1.3 Overview of the problem

Ablaut, or apophony, is not only present in verbs in Khroskyabs, but can also be found in non-verbal constructions. Through internal reconstruction of nominal apophony, a series of reconstructions for open syllables can be proposed. As is apparent from the following two examples, these open syllables are not easily reconstructible by comparing Khroskyabs dialects alone.

First, in modern Khroskyabs varieties, there are two vowels widely found in open syllables. Khroskyabs *-i* and *-a* (or *-a* in some dialects) both correspond to East Gyalrongic **-a*, as illustrated in Table 3. Though these vowels are clearly related, examination of the different Khroskyabs dialects provides no stable evidence to propose a systematic reconstruction for *-i* and *-a*, such that **-a₁* > *-i* and **-a₂* > *-a* (assuming that **-a₁* and **-a₂* were once related through a certain phonological operation). One would have to reconstruct **-i* for modern *-i* and **-a* for modern *-a* in these cases. Following this logic, the distinction must have been made before the branching off of Khroskyabs from Proto-Gyalrongic.

Table 3: Khroskyabs *-i* and *-a* corresponding to East Gyalrongic **-a*.

Gloss	Siyuewu	Wobzi (<i>ɤagû</i>)	Wobzi (<i>ɕâzə</i>)	Njorogs	Japhug
axe	<i>rvî</i>	<i>rvî</i>	<i>rvî</i>	<i>rví</i>	<i>tu-rpa</i>
tooth	<i>ɕəvî</i>	<i>ɕqî</i>	<i>ɕqî</i>	<i>ɕɣí</i>	<i>tu-ɕya</i>
shoe	<i>ɣzî</i>	<i>jzî</i>	<i>ɣzî</i>	<i>ɣzî</i>	<i>tu-xtsa</i>
this year	<i>pêvi</i>	<i>pêvi</i>	<i>pêvi</i>	<i>pívi</i>	<i>ɣɯjpa</i>
face	<i>rɣá</i>	<i>rɣá</i>	<i>rɣá</i>	<i>rɣá</i>	<i>tu-rɣa</i>
corruption	<i>mgâ</i>				<i>tu-mga</i>
fly (insect)	<i>ɣvazá</i>	<i>jvazá</i>	<i>ɣvazá</i>		<i>βɣɣza</i>
mule	<i>tærkâ</i>	<i>tærká</i>		<i>tarkâ</i>	<i>tɣrka</i>
climb	<i>nrɕêrɕa</i>	<i>rɕêrɕa</i>	<i>rɕêrɕa</i>		<i>nɯrɕɯrɕa</i>

Second, the vowel *-o* in East Gyalrongic languages corresponds to *-e* and *-o* in Khroskyabs varieties, demonstrated in Table 4. These vowels correspond to **-aŋ* in Proto-East-Gyalrongic (Jacques 2004: 228–232), which gives *-o* in modern Japhug. The conditioning factors that have caused the *-o/-e* division are still unclear, but will be made clear in this paper.

Table 4: Khroskyabs *-e* and *-o* corresponding to East Gyalrongic **-o < *-aŋ*.

Gloss	Siyuewu	Wobzi (<i>kaɣû</i>)	Wobzi (<i>ca̠zə</i>)	Njorogs	Japhug
see	<i>vdê</i>	<i>vdê</i>	<i>vdô</i>	<i>vrô</i>	<i>mtô</i>
be hard	<i>ryê</i>	<i>ryê</i>	<i>ryô</i>		<i>rko</i>
be high	<i>brê</i>	<i>æ-brê</i>	<i>v-brô</i>	<i>bró</i>	<i>mbro</i>
dream	<i>rmô</i>	<i>rmô</i>	<i>rmô</i>	<i>rmó</i>	<i>tu-jmŋo</i>
show	<i>stô</i>	<i>stô</i>	<i>stô</i>	<i>stót</i>	<i>sumto</i>
be deaf	<i>nbô</i>	<i>mbô</i>	<i>mbô</i>	<i>mbó?</i>	<i>ɣmbyo</i>

Comparisons with Japhug may suggest that Khroskyabs dialects making this distinction have *-o* after bilabials corresponding to Japhug *-ɣo* or *-ŋo*. Yet, Japhug preserves the medial *-ɣ-* after consonants of other places of articulation such as *tyV*; thus, this line of investigation proves insufficient to explain the correspondence between Khroskyabs *stô* ‘show’ and Japhug *sumto* ‘show’ (one would expect †*sumtyo* in Japhug).¹

To account for the development of these vowels, Lai (2017) originally suggested the sound changes **-o^v > -o* and **-o > -e*, based on the existence of velarised vowels in the Xiaoyili variety of Khroskyabs.

While in most cases, Xiaoyili velarisation corresponds to the velarisation proposed in Lai (2017), indicating that the Xiaoyili case is probably inherited from the ancestral language (see also the supplementary material²), Xiaoyili might have undergone secondary sound changes that have led to a number of innovative velarised or plain vowels. It will be shown in this paper that Lai’s (2017) original assumption was aimed in the right direction, however, dialectal comparison alone is not enough to reconstruct velarisation in this case. One has to settle for **-o₁ > -o* and **-o₂ > -e*.

As external evidence is insufficient for a systematic reconstruction of such seemingly related vowel pairs, one must turn to internal evidence. Irregular vocalic alternations provide clues to the sound changes that may have led the same proto-vowel to develop into different modern vowels. Conducting internal reconstructions based on these alternations is therefore necessary along with cross-linguistic comparisons (Campbell 2013: 211). Towards this end, this paper focuses on nominal apophony found in the bound state in a conservative variety of Khroskyabs, Siyuewu, and proposes an internal reconstruction of the affected vowels.

2 Bound state apophony in Gyalrongic languages

I follow Jacques (2021) in using the term “bound state”, which was previously termed “construct state” in Jacques (2012b) to address a similar phenomenon apparent in incorporation-like constructions (ILCs) in Japhug.

¹The dagger symbol indicates an expected but unattested form.

²The supplementary material can be downloaded from the following link: <https://doi.org/10.5281/zenodo.4748664>

In Japhug, there are two differences between an absolute noun and a noun in the bound state, which Jacques uses to refer to nominal stems in ILC verbs and the first element of a compound noun. First, bound state nouns do not require possessive prefixes that are obligatory for some nouns. Second, open syllable nouns undergo vowel changes in bound state forms. For example, the bound state of the noun *tu-ku* ‘head’ is *kɣ-*, as found in the compound noun *tu-kɣ-rme* ‘hair (on the head)’; the noun *tɕu* ‘road’ combines with *tɣ-mt^hum* ‘meat’ to form *tɕɣ-mt^hum* ‘provision of meat for the road’, with the vowel changed from *-u* to *-ɣ* (Jacques 2012b: 1215). Vowel changes in bound state nouns in Japhug are shown in Table 5.

Table 5: Bound state apophony in Japhug.

Base	Bound state
<i>-a</i>	<i>-ɣ/-a-</i>
<i>-o</i>	<i>-ɣ/-a-</i>
<i>-e</i>	<i>-ɣ/-a-</i>
<i>-u</i>	<i>-ɣ/-a-</i>
<i>-i</i>	<i>-u-</i>

In Bragbar Situ, the resulting vowel in a bound state noun is the corresponding central vowel of the non-bound state form’s vowel or diphthong: *-i* and *-u* become *-ə*, *-e* and *-o* become *-ɐ*, and *-iɛ* becomes *-a* (Zhang 2020). See Table 6 for examples.

Table 6: Bound state apophony in Bragbar Situ.

Base rhyme	Base noun	Bound state
<i>-i</i>	<i>tə-ʃí</i> ‘water’	<i>ʃə-</i>
<i>-u</i>	<i>pəʃû</i> ‘mouse’	<i>pəʃə-</i>
<i>-e</i>	<i>çê</i> ‘wood’	<i>çɐ-</i>
<i>-o</i>	<i>kə-ʃók</i> ‘sheep’	<i>kə-ʃɐk-</i>
<i>-iɛ</i>	<i>baliê</i> ‘bull’	<i>bala-</i>

In Zbu, bound state nouns involve an invariable shift towards the central vowel *-ɐ* (Gong 2018: 117–118). See Table 7.

Table 7: Bound state apophony in Zbu.

Base rhyme	Base noun	Bound state
<i>-éʔ</i>	<i>kwəzɛʔ</i> ‘dog’	<i>kwəzɐ-</i>
<i>-ê</i>	<i>ɸdortê</i> ‘balcony’	<i>ɸdortɐ-</i>
<i>-íʔ</i>	<i>tɐwí</i> ‘Tawi (place name)’	<i>tɐwɐ-</i>
<i>-î</i>	<i>k^hwî</i> ‘house’	<i>k^hwɐ-</i>

Wobzi Khroskyabs, a Khroskyabs variety closely related to Siyuewu, exhibits a simple bound state apophony pattern similar to that of Zbu. The bound state apophony is apparent on open syllables only, with the resulting vowel invariably presented as *-æ*, or *-a* after uvulars (Lai 2017: 163–164). See Table 8.

Table 8: Bound state apophony in Wobzi Khroskyabs.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>jvî</i>	mill	<i>jâm</i>	house	<i>jvæjóm</i>	mill house
<i>sê</i>	wood	<i>-p^ho</i>	CLF	<i>sæp^hô</i>	tree
<i>k^hâ</i>	mouth	<i>mp^hjær</i>	be beautiful	<i>k^hæmp^hjær</i>	courtesy
<i>jdê</i>	water	<i>†mər</i>	mouth	<i>jdæmər</i>	well
<i>ɛbrô</i>	yak	<i>p^ho</i>	M	<i>ɛbræp^hó</i>	(name of a mountain spirit)
<i>vjú</i>	human	<i>ɾjî</i>	be wild	<i>vjæɾjî</i>	yeti
<i>ɛû</i>	head	<i>k^hê</i>	back	<i>ɛâk^hê</i>	back of the head

There is apparent regularity in apophony within bound state noun forms across Gyalrongic languages, indicating a significant effect of analogy. Analogy blurs information about language history by eliminating irregular alternations. As in the case of Wobzi Khroskyabs, the invariable change towards *-æ* in all bound state nouns leaves few clues about the development of the morphological operations. The Siyuewu dialect, on the other hand, shows more conservative patterns with a greater variety of vocalic alternations in bound state nouns.

3 The bound state in Siyuewu Khroskyabs

This section describes the formation of the bound state in Siyuewu Khroskyabs. In Siyuewu Khroskyabs, the bound state is usually found within compounds which usually involve a non-verbal component (in most cases a noun). Verb-verb compounds with bound state exist in a few instances. Most of the forms exhibiting bound state are open syllables, although a small portion of them are closed syllables.

There is no measurable mode of predicting whether or not a given compound will exhibit bound state. Two theories can be proposed to account for this unpredictability. First, for some vowels, a bound state did not develop due to the fact that these particular vowels do not change under the condition where bound state emerged, that is, the bound state of these vowels remains the same as what they originally are. Second, bound state has ceased to be productive, with recent compounds no longer exhibiting it. Distinguishing the first case from the second will require both internal and external comparisons, though some cases will not be easy to verify.

In Section 3.1, I present information on bound state apophony for non-verbal compounds. In Section 3.2, verbal compounds, including incorporation-like constructions and verb-verb compounds, are presented.

3.1 Non-verbal compounds with bound state

This section presents non-verbal compounds with bound states, sorted according to the vowel of the base. Most of the compounds are semantic nouns, but occasional semantic adverbs are also attested. Examples are exhaustively listed for every case.

3.1.1 Constructional types of non-verbal compounds

Lai (2017: 163–169) finds two types of nominal compounding in Wobzi Khroskyabs which are most adequately described using the Sanskrit terms *Tatpuruṣa* and *Dvandva*. *Tatpuruṣa* are determinative nominal compounds where the first component serves as the modifier of the second. *Dvandva* is the juxtaposition of two components without dependency of one upon the other.

Tatpuruṣa is the dominant type of compounding involving bound state. Lai & Zhang (2019) summarise six subtypes of *Tatpuruṣa* in Siyuewu Khroskyabs, according to the semantic role of the first component. Three of the six types attest bound states: genitive, dative and descriptive. The other three compounding types, locative, resultative, and thematic, are not attested.

1. Genitive

- Component 1 is the possessor of component 2: $p^h\hat{a}y$ ‘pig’ + $g\acute{a}v$ ‘foot’ → $p^h\hat{a}gav$ ‘pig’s foot’

2. Dative

- Component 1 is the recipient of component 2: $p^h\hat{a}y$ ‘pig’ + $z\hat{b}j\acute{u}$ ‘*Urtica*’ → $p^h\hat{a}z\hat{b}j\acute{u}$ ‘*Urtica dioica*’ (literally ‘urtica for pigs’, as this species of urtica is used to feed pigs)

3. Descriptive (Karmadhāraya)

- Component 1 describes certain characteristics of component 2: $br\acute{o}$ ‘horse’ + $vdz\acute{u}$ ‘thorn’ → $br\acute{a}vdz\acute{u}$ ‘*Cirsium shansiense*’ (the leaves of this plant look like the neck of a horse with mane hair)

Dvandva is mainly found in social collective nouns, such as $z\hat{a}vi$ ‘father and son’, composed of $z\hat{i}$ ‘son’ and $v\hat{i}$ ‘father’, and $v\hat{a}me$ ‘father and mother, parents’, from $v\hat{i}$ ‘father’ and $m\hat{e}$ ‘mother’.

Among compounds serving semantic roles as nouns, there are instances of noun-adjective compounds that exhibit bound state. Examples include $y\hat{z}\hat{a}ba$ ‘old shoe’, composed of $y\hat{z}\hat{i}$ ‘shoe’ and $b\hat{a}$ ‘old’, $v\hat{j}\hat{a}r\hat{r}\hat{i}$ ‘yeti, wild human’, composed of $v\hat{j}\hat{u}$ ‘human’ and $r\hat{r}\hat{i}$ ‘wild’, etc.

Noun-verb compounds as action nouns exist with a few examples, such as $y\hat{v}\hat{a}nm\hat{a}k$ ‘eating tsampa for medical purposes’, where $y\hat{v}\hat{a}$ - is the bound state of $y\hat{v}\hat{a}$ ‘tsampa’, and $nm\hat{a}k$ is a verb meaning ‘eat powder-like food’. These constructions are most often found within incorporation-like constructions. ILC’s are usually semantic verbs, instead of action nouns, as we will see in Section 3.2.1.

Compounded numerals also exhibit a bound state. In Gyalrongic languages, numerals usually have two types of forms, a full form that can be used independently, and one or several dependent compound forms that attach to elements like classifiers or other numerals. For example, the independent numeral *mŋád* ‘five’, appears as *mŋê-* in *mŋêtsə* ‘fifty’, and *mŋâ-* in *mŋâ-lo* (five-CLF).

Remnants of old diminutive derivations exhibit bound state. For example, *pjezə* ‘sparrow’ is the diminutive form of the unattested †*pji* ‘bird’, cognate with the Japhug *pɣa* ‘bird’.³ The diminutive marker *-zə* is related to *zî* ‘son’.

Finally, in addition to apophony, bound state forms might have other types of segmental changes. For instance, the bound state of *sqí* ‘sister’ has an additional aspiration, as in *sq^heçə* ‘sisters’, *sɣəvzî* ‘uncle and nephew’, from *əɣo* ‘uncle’ and *zî* ‘son’, attests a circumfix *s-...v-* indicating kinship relation. These segmental changes are out of the scope of this paper, and will not be discussed in detail.

The fact that certain components either have no attested known source, or are totally etymologically obscure suggests that these bound state forms are old and contain information about earlier stages of Khroskyabs.

3.1.2 *i* as non-bound state vowel

Base forms with *i* as the non-bound state vowel exhibit three types of apophony in the bound state, alternating with *-e-*, *-æ-* and *-a-*.⁴ See Table 9. Most examples show an *-i* ~ *-æ-* alternation, while the other two are less frequently attested.⁵

³The form with a dagger, †*pji* ‘bird’, is unattested. Given Japhug *pɣa* ‘bird’, as Japhug *-a* regularly corresponds to *-i* in Khroskyabs, the expected corresponding form in Khroskyabs would be †*pji*. The other forms with a dagger in Table 9 are unclear; they are therefore represented with the same forms as in the compounds.

⁴Bound state vowels and closed syllable vowels are surrounded by two hyphens: *-V-*, final vowels are only preceded by a hyphen and followed by nothing: *-V*.

⁵Tibetan loanwords are marked with “[tib]” behind the gloss. The dagger symbol indicates an expected but unattested form.

Table 9: *i* as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
† <i>pji</i>	bird	- <i>zə</i>	DIM	<i>pjezə</i>	sparrow
<i>dji</i>	musk deer	<i>çi</i>	flesh [tib]	<i>djêçi</i>	musk deer meat
<i>tɕ^hi</i>	road	<i>k^hə</i>	back	<i>tɕ^hek^hə</i>	side of the road
<i>sqi</i>	sister	† <i>çə</i>	?	<i>sq^hçə</i>	sister
<i>vî</i>	father	<i>mê</i>	mother	<i>vâmê</i>	father and mother
<i>γvî</i>	mill	<i>jâm</i>	house	<i>γvâjâm</i>	mill house
<i>zî</i>	son	<i>vî</i>	father	<i>zâvi</i>	son and father
<i>zî</i>	son	<i>stây</i>	be alone	<i>zâstay</i>	only son
<i>γzî</i>	shoe	<i>bâ</i>	old	<i>γzâba</i>	old shoe
<i>tɕ^hî</i>	road	† <i>də</i>	?	<i>tɕ^hædə</i>	side of the road
<i>tɕ^hî</i>	road	† <i>go</i>	LOC?	<i>tɕ^hægo-(χjame)</i>	<i>Plantago asiatica</i>
<i>çi</i>	flesh [tib]	<i>rquí</i>	be dry and hard	<i>çærqu</i>	beef jerky
<i>χçi</i>	grass	† <i>spo</i>	?	<i>χçæspó</i>	simple warehouse
<i>rk^hî</i>	wool reel	<i>dəvô</i>	spindle	<i>rk^hædvo</i>	wool reel on the spindle
<i>mî</i>	surely	= <i>sta</i>	PART	<i>mâsta</i>	surely
<i>mjí</i>	farmland	= <i>la</i>	LOC	<i>mjalá</i>	farmland

3.1.3 æ as non-bound state vowel

Base forms with *æ* as the non-bound state vowel are almost all closed syllables, as evidenced by the first four examples in Table 10. Their codas are *-r*, *-z*, *-d* and *-γ*. In fact, the vowel *æ*, in theory, occurs exclusively in closed syllables. The last two examples in the table, involving the concept ‘fly (insect)’, do not have an attested independent base form attested. The Bragbar Situ cognate *kəvê*s indicates a closed syllable as well. Therefore, the Khroskyabs independent form should have an *a*-like vowel, probably †*γv[æ]z*. As we have no direct evidence for the coda, I stick to the form †*γvæ/γva* in Table 10.

There are two apophonic patterns for *-æ* forms, alternating with *e* and *a*.

Table 10: *æ* as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>γmæ̂r</i>	last night	† <i>dzə̂mêr</i>	the night before	<i>γmedzə̂mêr</i>	the night before last night
<i>rtsæ̂z</i>	deer	<i>rə̂</i>	horn	<i>rtsêrə̂</i>	deer horn
<i>ts^hæ̂d</i>	goat	<i>dzə̂</i>	skin	<i>ts^hêdzə̂</i>	goat skin
<i>γnæ̂γ</i>	two	<i>snə̂</i>	day	<i>γnêsnə̂</i>	two days
† <i>γvæ̂/γva</i>	fly (insect)	† <i>rju</i>	?	<i>γvæ̂rju</i>	bee
† <i>γvæ̂/γva</i>	fly (insect)	† <i>-za</i>	DIM	<i>γvazá</i>	fly (insect)

3.1.4 *a* as non-bound state vowel

As for base forms with *a* as the non-bound state vowel, there are two apophonic patterns: *-a* → *-e-*, and *-a* → *-æ-*. See Table 11.

Table 11: *a* as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>vjad</i>	eight	<i>-tsə</i>	ten	<i>vjətsə</i>	eighty
<i>ɕəvár</i>	night	<i>jə</i>	PL	<i>ɕvət̚jə</i>	night time
<i>mɲád</i>	five	<i>-tsə</i>	ten	<i>mɲət̚sə</i>	fifty
<i>p^háy</i>	pig	<i>gáv</i>	foot	<i>p^hægav</i>	pig's foot
<i>p^háy</i>	pig	<i>rɲí</i>	be wild	<i>p^hærɲí</i>	boar
<i>p^háy</i>	pig	<i>zɲjú</i>	<i>Urtica</i>	<i>p^hæzɲjú</i>	<i>Urtica dioica</i>
<i>p^háy</i>	pig	<i>†-tsi</i>	DIM	<i>pætsí</i>	piglet
<i>p^hráy</i>	rock	<i>fté</i>	slope	<i>p^hræfte</i>	cliff
<i>p^hráy</i>	rock	<i>qé</i>	root	<i>p^hræqé</i>	cave
<i>ɣvâ</i>	Tsampa	<i>nmæɕ</i>	eat (powder-like food)	<i>ɣvænæɕ</i>	eating tsampa for medical purposes
<i>rjâ</i>	Chinese [tib]	<i>lmóɣ</i>	mushroom	<i>rjælmoy</i>	(a kind of mushroom)
<i>rɣâ</i>	calf	<i>lé</i>	excrement	<i>rɣælé</i>	excrement of calf
<i>rɲá</i>	face	<i>mdôɕ</i>	colour [tib]	<i>rɲæmdos</i>	facial expression

3.1.5 *e* as non-bound state vowel

The non-bound state vowel *e* alternates with *-æ-*, as shown in Table 12.⁶

Table 12: *e* as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>zɲjê</i>	Mani stone	<i>†pi</i>	?	<i>zɲjæpí</i>	flat stone
<i>fté</i>	slope	<i>†pæɕ</i>	?	<i>ftæpæɕ</i>	forehead
<i>sê</i>	wood	<i>†vo</i>	?	<i>sævo</i>	well arranged firewood
<i>sê</i>	wood	<i>†p^hæɕ</i>	leaf	<i>sæ†p^hæɕ</i>	tree leaf
<i>sê</i>	wood	<i>qé</i>	?	<i>sæqé</i>	tree root
<i>†fse</i>	early morning	<i>†dí</i>	day	<i>fsædí</i>	the day after tomorrow

3.1.6 *ə* as non-bound state vowel

The non-bound state vowel *ə* has three apophonic patterns. It alternates with *-e-*, *-æ-*, and in two examples with *-o-*, *ɲojəqə* ‘everywhere’ and *xsôvrji* ‘three hundred’ (as well as other numerals or classifiers with *xsô-* ‘three’). The *-jəqə* part of *ɲojəqə* ‘everywhere’ could be composed of *=jə* ‘genitive’ and *qé* ‘source’. See Table 13.

⁶The form *†fse* ‘early morning’ is not attested independently, however, it is attested as a reduplicated form in *snâ-fsə~se* ‘recently (literally today’s morning)’. See Section 4.3.1 for further discussions on this category.

Table 13: ə as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>sjêd</i>	ten	<i>ftçêγ</i>	six	<i>sjeftçéγ</i>	sixteen
<i>sjêd</i>	ten	<i>vdê</i>	four	<i>sjevďê</i>	fourteen
<i>γďê</i>	water	† <i>mər</i>	mouth	<i>γďæmár</i>	well (noun)
<i>γďê</i>	water	† <i>ɸju</i>	fish?	<i>γďæɸjú</i>	fish
<i>sjêd</i>	ten	<i>rêγ</i>	one	<i>sjævréγ</i>	eleven
<i>xsê̄m</i>	three	<i>vrjî</i>	hundred	<i>xsô̄vrji</i>	three hundred
<i>ŋê̄</i>	no matter what	† <i>jəqe</i>	?	<i>ŋojê̄qe</i>	everywhere

3.1.7 o as non-bound state vowel

The non-bound state vowel *o* exhibits three apophonic patterns in the bound state, alternating with *-e-* in one example, *merbó* ‘tear (noun)’, from *môγ* ‘eye’; with *-ə-* in another example, *sγəvzî* ‘uncle and nephew’, from *əγô* ‘uncle’; and with *-æ-* in other cases. See Table 14.

Table 14: o as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>môγ</i>	eye	† <i>rbə</i>	?	<i>merbó</i>	tear (noun)
<i>əγô</i>	uncle	<i>zî</i>	son	<i>sγəvzî</i>	uncle and nephew
<i>bró</i>	horse	<i>vdzú</i>	thorn	<i>brævdzú</i>	<i>Cirsium shansiense</i>
<i>bró</i>	horse	<i>γê̄m</i>	door	<i>bræγê̄m</i>	(place name)
<i>rbô</i>	top of a house	† <i>ɸle</i>	?	<i>rbæɸlé</i>	top of the fifth floor

3.1.8 u as non-bound state vowel

The non-bound state vowel *u* alternates with *-ə-*, *-æ-* and *-o-* in the bound state, as illustrated by Table 15. One of the cases given in which *u* alternates with *-ə-* is found in a Wobzi word, *q^həzə* ‘bowl’ (originally the diminutive form), which coexists with *q^hû* ‘bowl’ in Wobzi. In Siyuewu, *q^hû* is the only word for ‘bowl’. We include this example for two reasons. First, although we mainly base ourselves on the Siyuewu dialect, it is reasonable to turn to other varieties when Siyuewu examples prove insufficient. Second, the vocalic systems in Wobzi and in Siyuewu are more or less the same, without major phonological differences.

It is noteworthy that *vjú* ‘human’ has two bound states, *vjæ-* on the one hand, as in *vjæŋí* ‘yeti’, and *vjo-* on the other, as in *vjôsta* ‘a single person’. This alternation is important for the reconstruction of the final vowel *-u*, as will be shown in Section 4.3.2.

Table 15: *u* as non-bound state vowel.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>vdzû</i>	thorn	<i>p^hrê^m</i>	white	<i>vdzæp^hrê^m</i>	(a kind of plant)
<i>vdzû</i>	thorn	† <i>qæ^κ</i>	?	<i>vdzæqæ^κ</i>	(a kind of fruit)
<i>vjû</i>	human	<i>rŋí</i>	be wild	<i>vjærŋí</i>	yeti
<i>vjû</i>	human	= <i>sta</i>	alone	<i>vjôsta</i>	a single person
<i>skû</i>	scallion	† <i>læ^γ</i>	stick?	<i>skôlæ^γ</i>	garlic
<i>lû</i>	milk	<i>κém</i>	oil on milk	<i>lokém</i>	oil on milk
<i>κû</i>	head	<i>rmê</i>	hair	<i>κormê</i>	hair of the head
<i>κû</i>	head	† <i>fsə</i>	?	<i>κôfsə</i>	exchange labour
<i>κû</i>	head	† <i>zə^γ</i>	?	<i>κozə^γ</i>	comb
<i>q^hû</i>	bowl	† <i>zə</i>	DIM	<i>q^həzə</i>	bowl (Wobzi)
<i>rŋû</i>	fry	† <i>pæ^κ</i>	?	<i>rŋəpæ^κ</i>	popcorn
<i>ŋû</i>	ear	<i>κjô</i>	hole	<i>ŋəκjô</i>	ear piercing

3.1.9 Bisyllabic bound states

A handful of bound states involve bisyllabic words. In these examples, apophony affects the second syllable, whose vowel is invariably changed to *-ə-*. See the examples in Table 16. This process seems to be completely affected by analogy, and its origin is not detectable for the time being. It will therefore not be discussed in Section 4, where we account for the historical development of bound state apophony.

Table 16: Bisyllabic bound states.

First component	Gloss	Second component	Gloss	Compound	Gloss
<i>sjæmŋád</i>	fifteen	<i>ɕər</i>	time (CLF)	<i>sjæmŋə-ɕər</i>	fifteen times
<i>fsædí</i>	the day after tomorrow	<i>mêr</i>	night	<i>fsædəmêr</i>	the night in two days
<i>t^hæmé</i>	finger	<i>c^hæd</i>	be big	<i>t^hæməc^hæd</i>	thumb

3.1.10 Summary of bound state apophony in Siyewu Khroskyabs

Table 17 summarises all the types of apophony attested in Siyewu Khroskyabs' bound states (except for bisyllabic bound states, which are not relevant to this paper).

Table 17: Summary of apophony in the bound state.

Non-bound state vowel	Bound state
<i>-i</i>	<i>-e-</i> , <i>-æ-</i> , <i>-a-</i>
<i>(-æ-)</i>	<i>-e-</i> , <i>-a-</i>
<i>-a</i>	<i>-e-</i> , <i>-æ-</i>
<i>-e</i>	<i>-æ-</i>
<i>-ə</i>	<i>-æ-</i> , <i>-o-</i>
<i>-o</i>	<i>-æ-</i> , <i>-ə-</i>
<i>-u</i>	<i>-æ-</i> , <i>-o-</i> , <i>-ə-</i>

3.2 Verbal compounds with bound state

There are two types of compounds which are semantic verbs in Siyuewu Khroskyabs that exhibit bound state, incorporation-like constructions, presented in Section 3.2.1, and fossilised reduplications, presented in Section 3.2.2.

3.2.1 Incorporation-like construction

Incorporation-like constructions (ILC) in Gyalrongic languages were first studied systematically by Jacques (2012b) in Japhug. These constructions are verbs that consist of a nominal component and a verbal component. They cannot be classified as incorporations by definition (Gerdtz 1998; Mattissen 2003; Mithun 1984; Sapir 1911), as they require a denominal prefix to acquire the verbal status. Jacques (2012b) proposes that ILCs in Japhug underwent four evolutionary stages, as shown in (1).

- (1) Noun-verb compound → Action noun → Denominalisation → ILC

For instance, the Japhug ILC *nɣ-q^ha-ru* ‘look back’ consists of the bound state of *(u-)q^hu* ‘back’, the verb *ru* ‘look’, as well as the denominal prefix *nɣ-*. The form without the denominal prefix, *q^haru* ‘a look back’ is an attested action noun, which leaves no doubt that *nɣ-q^ha-ru* ‘look back’ is a denominal derivation.

Because most ILCs in Japhug are denominal verbs, they cannot be counted as real incorporations. The case of Khroskyabs is slightly different. Lai (2017: 405–409) finds ILCs with denominal prefixes as well as real incorporations in Wobzi Khroskyabs, and hypothesises that ILCs in Wobzi Khroskyabs underwent similar evolutionary steps as those of Japhug, and then made a step further to create real incorporations by reanalysing the denominal prefixes as homophonous verbal derivational prefixes.

In Siyuewu Khroskyabs, as in Wobzi, there are both ILCs and real incorporating verbs, which probably followed the same pathway, as shown in Table 18. The form *tɕ^hərdə* ‘be far’, consisting of *tɕ^hɨ* ‘road’ and the unattested †*rdə* ‘be long’,⁷ is a case of real incorporation. The form *nɔp^həm* ‘cover the head’, from *ɛu* ‘head’ and *p^həm* ‘cover’, is an ILC with

⁷The cognates in Stau dialects are attested in words such as Mazur Stau *dzi* ‘be long’ and Geshiza *dzi* ‘be long’.

the denominal prefix *n-*. As a detailed analysis of incorporation in Siyuewu Khroskyabs is beyond the scope of this paper, in this section, we only focus on the bound state of these constructions.

In Table 18, ILCs or incorporations exhibiting bound state are shown. There are three non-bound state vowels attested, *-i*, *-æ* and *-u*. They do not exhibit new patterns that are non-existent in non-verb compounds: *-i* alternates with *-e-* and *-æ-*, *-a* with *-e-* and *-æ-*, while *-u* with *-o-*.

Table 18: Incorporation-like constructions in Siyuewu Khroskyabs demonstrating bound state.

Nominal	Gloss	Verbal	Gloss	ILC	Gloss
<i>rvî</i>	axe	† <i>jæd</i>	?	<i>rvæjæd</i>	chop
<i>ɕəvî</i>	tooth	† <i>rəm</i>	?	<i>ɱɕəvæɾóm</i>	be of the same age
<i>tɕ^hî</i>	road	† <i>rdə</i>	long	<i>tɕ^hêrdə</i>	be far
<i>rtâ</i>	horse [tib]	† <i>rjəy</i> [tib]	to run	<i>χterjəy</i>	run
<i>rtâ</i>	horse [tib]	† <i>rjəy</i> [tib]	to run	<i>χtærjəy</i>	run
<i>sâ</i>	land [tib]	<i>jô</i>	defend	<i>sêjo</i>	defend one's land
<i>sâ</i>	land [tib]	<i>læd</i>	release	<i>sælæd</i>	see off
<i>k^hâ</i>	mouth [tib]	<i>mp^hjær</i>	be beautiful	<i>k^hêmp^hjær</i>	be courteous
<i>zgâ</i>	saddle [tib]	† <i>hta</i>	?	<i>zgêhta</i>	put on a saddle
<i>κû</i>	head	† <i>ləle</i>	(light verb)	<i>nκôləle</i>	spin
<i>κû</i>	head	<i>nκê</i>	return	<i>nκônκe</i>	be dizzy
<i>κû</i>	head	<i>p^hóm</i>	cover	<i>nκop^hóm</i>	cover one's head
<i>κû</i>	head	<i>p^hjê</i>	change	<i>nκôp^hjê</i>	swap labour

3.2.2 Fossilised Reduplication

A few verbs with fossilised reduplication exhibit bound state, but none of these show a previously unattested pattern. Examples include the verb *rc^hærc^hê* ‘tie together’, from the verb *rc^hê* ‘tie’, and *nvævi* ‘adjust, to correct’, from *vî* ‘do’.

4 Internal reconstruction

This section proposes an internal reconstruction of open syllables involving bound state. I will begin by presenting the importance of investigating alternations in Section 4.1. Special note is made of the fact that a given sound may undergo different changes in different positions, and may exhibit varying degrees of archaism or innovation.

The present internal reconstruction is closely related to the sound changes proposed in Lai (2021b). As such, Section 4.2 presents a brief introduction of the article's main findings on the sound change processes associated with velarisation.

The following sections present a two-step procedure for conducting internal reconstruction. Section 4.3 represents the first step of analysing apophonic patterns in the bound

state, and proposes a preliminary reconstruction. Next, in Section 4.4, the reconstruction is refined with evidence from other Gyalrongic varieties.

4.1 Archaic forms across syllable structure types

Sound changes may be conditioned by different phonological environments. A single proto-phoneme may formally split according to the positions in which it occurred. Some modern reflexes are closer to their ancestor clearly demonstrating a common origin across different positions. These different sound change pathways lead to phonological irregularities across related dialects or languages.

Observing irregularities, more often than not, helps us to better understand the history of the language (Meillet 1925: 25). Proto-Algonquian was thought not to have initial **o*, as all **o*'s appeared after a consonant. Hockett (1981: 53, 57) proposes the sound change **we* > **o* after a consonant to explain this gap. Thus, both the first syllable in *wecopahkik* 'root' and the *o* in *'qotanku* 'eleven' in Malecite–Passamaquoddy (Eastern Algonquian) are to be reconstructed as **we*, with the modern initial reflex being more conservative (Francis et al. 2008).

From Old Chinese to Middle Chinese, vowels are better preserved in closed syllables than in open syllables. Baxter & Sagart (2014: 220) note an alternation caused by the suffix **-s*, as shown in (2); They also report an alternation between the zero coda and **-ŋ*, as shown in (3) and (4) (Baxter & Sagart 2014: 227). The Old Chinese vowel **-a* is well preserved in the closed syllable **-aŋ*, while becoming *-u* in open syllables.

- (2) a. 度 **[d]ʰak-s* > **[d]ʰa-s* > Middle Chinese *dù* 'measure (noun)'
 b. 度 **dʰak* > Middle Chinese *dak* 'measure (verb)'
- (3) a. 無 **ma* > Middle Chinese *mju* 'not have'
 b. 亡 **maŋ* > Middle Chinese *mjaŋ* 'disappear'
- (4) a. 于 **G^w(r)a* > Middle Chinese *hju* 'go; be at'
 b. 往 **G^waŋ* > Middle Chinese *hjawán* 'go to'

In the examples above, the same proto-phoneme underwent different sound changes under different conditions. The historical linguist should be able to account for these alternations and reconstruct them with the same phoneme.

Sound alternations within a given language can be internally reconstructed together with external comparative work, as alternations may contain information about the language's history. Since Siyuewu Khroskyabs exhibits such alternations, it is important to explore them and find out their history, which is the main problem I will be dealing with

in the rest of this section.⁸

4.2 Sound changes proposed by Lai (2021b) concerning closed syllables

Lai (2021b) examines verbal ablaut in Siyuewu Khroskyabs, and proposes several sound changes in closed syllables from Pre-Khroskyabs to modern Siyuewu Khroskyabs. Verbal ablaut only occurs in closed syllable in Siyuewu Khroskyabs. Sound changes in closed syllables are closely related to those in bound states. As will be shown in the rest of the paper, bound state vowels and vowels in closed syllables are to be treated in the same way.

Lai (2021b) hypothesises two series of vowels, a plain series and a velarised series. The velarisation reconstructed in Lai (2021b) is reflected as posterior or rounded features within closed syllable vowels in the modern language.⁹

The sound changes of closed syllable vowels paired by velarisation are listed in (5).

- (5)
- a. $*-\text{æ}C > -\text{æ}C$
 - b. $*-\text{æ}^{\text{v}}C > -\text{a}C$ ¹⁰
 - c. $*-\text{ə}C > -\text{æ}C$
 - d. $*-\text{ə}^{\text{v}}C > -\text{o}C$ ¹¹
 - e. $*-\text{o}C > -\text{æ}C$
 - f. $*-\text{o}^{\text{v}}C > -\text{o}C$
 - g. $*-i^{(\text{v})}C > -iC$
 - h. $*-u^{(\text{v})}C > -uC$
 - i. $*-u^{(\text{v})}C > -\text{ə}C$

From these proposed sound changes, it is easy to see that the modern vowel æ is characteristic of closed syllables, as plain $*-\text{ə}C$, $*-\text{o}C$ and $*-\text{æ}C$ merged into modern $-\text{æ}C$.¹² Only

⁸Despite the importance of internal reconstruction, its use in Trans-Himalayan historical linguistics is surprisingly rare, with so many languages presenting complex alternation patterns. Furthermore, it has seen nearly zero application in the study of Gyalrongic languages. Most internal reconstructions concern verbal inflection, such as Li (1933), Coblin (1976) and Jacques (2012a) on Tibetan verbal morphology, Jacques (2009) on Tangut verb stem alternation, Michailovsky (2012) on Dumi verbs, as well as Jacques et al. (2012) on the structure of Khaling verbs. Lai (2021b) on verb ablaut in Siyuewu Khroskyabs is the only publication which proposes internal reconstruction focusing on a modern Gyalrongic language. Internal reconstruction of non-verbal constructions is so far still an untouched domain. The following reconstruction therefore emphasises the role of internal reconstruction of non-verbs in Gyalrongic, as well as Trans-Himalayan, historical linguistics.

⁹Bifurcate vocalic systems opposing plain versus phonetically marked vowels is widely found in Burmo-Gyalrongic languages. The phenomenon was first reported in Sun (2000a) (on Northern Horpa) and Sun (2004) (on Zbu), followed by a series of phonetic and phonological studies devoted to vocalic uvularization in Northwestern Qiang (Evans et al. 2016; Sun & Evans 2013), as well as pharyngealised vowels in Northern Horpa (Chiu & Sun 2020; Lin et al. 2012). Modern velarisation in velarity-conservative Khroskyabs dialects (such as Xiaoyili) should be studied experimentally in the future.

¹⁰Except $*-\text{æ}^{(\text{v})}C > -\text{æ}C$.

¹¹When followed by $-m$, $-om > -\text{ə}m$, the same applies to $*-\text{o}^{\text{v}}m$ which became $-\text{ə}m$ via $-om$.

¹²Open syllables in $-\text{æ}$ are very rare, nearly all of them are simplified from closed syllables.

velarised vowels preserved their original contrasts. The relations between proto-rhymes and modern rhymes can be summarised in Table 19.¹³

Table 19: Summary of proto-rhymes and modern rhymes in closed syllables.

Proto-rhymes	Modern rhymes
$-\text{x}^{(y)}C$	$-\text{x}C, -aC$
$-\text{ə}^{(y)}C$	$-\text{x}C -oC$
$-o^{(y)}C$	$-\text{x}C, -oC$
$-u^{(y)}C$	$-\text{ə}C$

4.3 Internal reconstruction of Pre-Khroskyabs vowel system

In Section 4.3.1, I will first make the claim that the bound state vowel $-e-$ is in reality a conditioned variant of $-\text{x}-$ resulting from vowel harmony. Section 4.3.2 will focus on the reconstructions of bound states with $-\text{x}-$ and $-o-$, and Section 4.3.3 on those with $-\text{ə}-$.

4.3.1 $-e-$: a conditioned variant of $-\text{x}-$

Table 20 reproduces all the apophony patterns attested in the bound state from Table 17.

Table 20: Summary of apophony in the bound state (reproduced).

Non-bound state vowel	Bound state
$-i$	$-e-, -\text{x}-, -a-$
$(-\text{x}-)$	$-e-, -a-$
$-a$	$-e-, -\text{x}-$
$-e$	$-\text{x}-$
$-\text{ə}$	$-\text{x}-, -o-$
$-o$	$-\text{x}-, -\text{ə}-$
$-u$	$-\text{x}-, -o-, -\text{ə}-$

Three vowels in the bound state also regularly occur in closed syllables: $-\text{x}-$, $-o-$ and $-a-$. Both $-a-$ and $-o-$ occur in the same rows with $-\text{x}-$, but there is no contact between $-a-$ and $-o-$ in the same row. This mapping is exactly the same as that of the modern rhymes presented in Table 19.

Given this similarity, one must ask what happened to the bound states $-e-$ and $-\text{ə}-$, which are shaded in Table 20. The bound state $-\text{ə}-$ will be treated later, but for now I will focus on $-e-$. A closer look at the syllable structures where $-e-$ appears suggests that $-e-$ is conditioned by specific phonological environments. Table 21 lists examples with $-e-$ as the bound state vowel.

¹³The rhymes $*-i^{(y)}C$ and $*-u^{(y)}C$ are not included because they do not exhibit apophony.

Table 21: Bound states with -e-.

Example	Gloss
<i>djêçi</i>	musk deer meat
<i>sjeftçéy</i>	sixteen
<i>ymedzəmêr</i>	the night before last night
<i>pjezǎ</i>	sparrow
<i>tç^hek^hǎ</i>	side of the road
<i>sq^heçǎ</i>	sister
<i>rtsêrǎ</i>	deer horn
<i>ts^hêdzǎ</i>	goat skin
<i>ynêsnǎ</i>	two days
<i>vjêtsǎ</i>	eighty
<i>çvêrjǎ</i>	night time
<i>tç^hêrdǎ</i>	be far
<i>mjêtsǎ</i>	fifty
<i>sjevdǎ</i>	fourteen
<i>merbǎ</i>	tear (noun)

We can see from the table that most of the forms with -e- as the bound state vowel exhibit a *CeCǎ* structure, while the remainder are *CeCi* or *CeCeC* structures. All the vowels in the second syllables are middle to high vowels, -*çi*, -*ftçéy* and -*mer* in particular are high vowels. Thus, some of the final -ǎ's in the table may have high vowel origins. This conclusion is supported by cognates found in Wobzi Khroskyabs and the Geshiza and Mazur Stau dialects: *pjezǎ* 'sparrow' is cognate with Wobzi Khroskyabs *pjizí*, *tç^hêrdǎ* 'be far' is cognate with Geshiza *tçædzǎ* 'be far', *snǎ* 'day' in *ynêsnǎ* 'two days' is cognate with Geshiza *sni* 'day', and *merbǎ* 'tear (noun)' cognate with Mazur Stau *mubli* 'tear'. As such, the schwa -ǎ here could be postulated as originating from a higher vowel, *-*u*.

In light of the regular syllable structure of the bound states with -e- attested in Siyewu, we can reasonably hypothesise that -e- is actually -æ- heightened by the high vowel in the following syllable, as shown by the representative examples in (6). This vowel harmony process is a Siyewu innovation, as it is unattested in other known Khroskyabs dialects. It may also represent an early historical layer of the bound state of Siyewu, as there are a few other cases that do not exhibit vowel harmony.

- (6) a. **djâçi* > *djêçi*
 b. **sjæftçéy* > *sjeftçéy*
 c. **pjæzǎ* > *pjezǎ*

As a result, some compounds which exhibit *e* in both the absolute and bound states could very well have exhibited a different vowel earlier on, which was later obscured by vowel harmony, as shown in Table 22. All these examples show structures that trigger

vowel harmony, and it is reasonable to assume that they were originally **fsæmêr*, **fsâsk^hə* and **sêšə*.

Table 22: Possible alternations due to vowel harmony.

First component	Gloss	Second component	Gloss	Compound	Gloss
† <i>fse</i>	early morning	<i>mêr</i>	night	<i>fsemêr</i>	tomorrow night
† <i>fse</i>	early morning	† <i>sk^hə</i>	?	<i>fsêsk^hə</i>	previous period
<i>sê</i>	wood	† <i>sə</i>	fruit?	<i>sêšə</i>	wild berry

4.3.2 Bound states with -æ- and -o-

Knowing that -e- in the bound state was historically a conditioned variant of -æ-, the mappings of bound state vowels to the closed syllables reconstructed in Lai (2021b) can be summarised as shown in Table 23.

Table 23: Comparison of apophonic pairs for bound state vowels and closed syllables.

Bound state	Closed syllable
-æ-, -a-	-æC, -aC
-æ-, -o-	-æC -oC

As the mappings between bound state vowels and closed syllables are exactly the same, it is natural for one to suspect that bound states developed in the same way as closed syllables in Siyewu Khroskyabs. Bound state vowels and the vowels of closed syllables can both be considered “non-final vowels”, and should be reconstructed in a similar fashion. In short, one needs to hypothesise that final vowels and non-final vowels underwent different sound changes in Siyewu Khroskyabs.

We can now simplify Table 20 into Table 24, with only -æ-, -a- and -o- as bound state vowels.

Table 24: Summary of bound state apophony related to final vowels.

Non-bound state vowel	Bound state
-i	-æ-, -a-
-a	-æ-
-e	-æ-
-ə	-æ-, -o-
-o	-æ
-u	-æ-, -o-

If non-final vowels (in the bound state and in closed syllables) are of the same nature, they must share the same reconstructions with the closed syllables proposed in Lai (2021b).

Following the same logic, the proto-bound-states are reconstructed as follows:

- (7) a. $-\text{æ}$ - and $-a$ -, both related to the non-bound state vowel $-i$, are reconstructed as $*-\text{æ}$ - and $*-\text{æ}^{\text{V}}$ -:
 $*-\text{æ}$ - > $-\text{æ}$ - ($*v\text{æ}-me > v\hat{\text{æ}}me$ ‘father and mother’)
 $*-\text{æ}^{\text{V}}$ - > $*-a$ - ($*m\eta\text{æ}^{\text{V}}-l\text{æ}^{\text{V}} > m\eta\text{al}\acute{a}$ ‘farmland’)
- b. $-\text{æ}$ -, related to the non-bound state vowel $-a$, is also reconstructed as $*-\text{æ}$ -:
 $*-\text{æ}$ - > $-\text{æ}$ - ($*\gamma v\text{æ}-nm\text{æ}\text{K} > \gamma v\hat{\text{æ}}nm\text{æ}\text{K}$ ‘eating tsampa for medical purposes’)
- c. $-\text{æ}$ -, related to the non-bound state vowel $-e$, is reconstructed as $*-e$ -:¹⁴
 $*-e$ - > $-\text{æ}$ - ($*s\text{e}-\text{t}p^h\text{æ}\text{K} > s\hat{\text{e}}\text{t}p^h\text{æ}\text{K}$ ‘tree leaf’)
- d. $-\text{æ}$ - and $-o$ -, both related to the non-bound state vowel $-\text{ə}$, are reconstructed as $*-\text{ə}$ - and $*-\text{ə}^{\text{V}}$ -:
 $*-\text{ə}$ - > $-\text{æ}$ - ($*\gamma d\text{ə}-m\text{ər} > \gamma d\text{æ}m\acute{a}r$ ‘well’)
 $*-\text{ə}^{\text{V}}$ - > $-o$ - ($*x s\text{ə}^{\text{V}}-vrji > x s\hat{o}vrji$ ‘three hundred’)
- e. $-\text{æ}$ - related to the non-bound state vowel $-o$ is reconstructed as $*-o$ -:
 $*-o$ - > $-\text{æ}$ - ($*bro-vdzu > br\text{æ}vdz\acute{u}$ ‘*Cirsium shansiense*’)
- f. $-\text{æ}$ - and $-o$ -, both related to the non-bound state vowel $-u$, is provisionally reconstructed as $*-o$ - and $*-o^{\text{V}}$ -, and will be discussed further below:
 $*-o$ - > $-\text{æ}$ - ($*vjo-r\eta\text{æ} > vj\text{æ}r\eta\acute{i}$ ‘yeti’)
 $*-o^{\text{V}}$ - > $-o$ - ($*sko^{\text{V}}-l\text{æ}\gamma > sk\hat{o}l\text{æ}\gamma$ ‘garlic’)

The proto-bound-states can be summarised in Table 25.

Table 25: Proto-bound states.

Non-bound state vowel	Bound state	Proto-Bound-state
$-i$	$-\text{æ}$ -, $-a$ -	$*-\text{æ}$ -, $*-\text{æ}^{\text{V}}$ -
$-a$	$-\text{æ}$ -	$*-\text{æ}$ -
$-e$	$-\text{æ}$ -	$*-\text{æ}$ -
$-\text{ə}$	$-\text{æ}$ -, $-o$ -	$*-\text{ə}$ -, $*-\text{ə}^{\text{V}}$ -
$-o$	$-\text{æ}$ -	$*-o$ -
$-u$	$-\text{æ}$ -, $-o$ -	$*-o$ -, $*-o^{\text{V}}$ -

It may be hypothesised that the non-bound state vowels and the proto-bound-states were originally the same vowels, with their present variation conditioned by their positions.

¹⁴This reconstruction implies $*-eC > -\text{æ}C$, which further predicts that $-eC$ does not exist in modern Siyuewu Khroskyabs. Rhymes in $-eC$ do, however, exist in modern Siyuewu Khroskyabs. With less than 20 instances, most of them are non-native or non-etymological. The rhyme $-em$ is borrowed from Tibetan, for example, $s\acute{e}m$ ‘heart’ from Tibetan $sems$ ‘heart’. Some of the codas after $-e$ - are of unknown origin, for example, $fs\acute{e}r$ ‘lead’ corresponds to Wobzi Khroskyabs $fs\acute{e}$ ‘lead’, as well as to Japhug $mts^h i$ ‘conduct’, both cognates without a coda. $-eC$ as a rhyme in Khroskyabs represents a minority of the entire vocabulary. The problem of $-eC$ ’s development is yet to be resolved.

From Table 25, it is obvious that *-i* and *-a* are related: first, *-i* and *-a* are both in contact with *-æ*, and second, *-i* has *-a*- as one of its bound state vowels. Therefore, I reconstruct **-æ* for *-i* and **-æ^v* for *-a*.

The reconstructions of *-e* and of *-ə* are more straightforward. **-e* may be reconstructed for *-e*, but there is no evidence for a velarised **-e^v* from the perspectives of bound state. Similarly, **-ə* may be reconstructed for *-ə*. The likely velarised counterpart **-ə^v*, will be treated later.

The vowels *-o* and *-u* should be analysed together. The reconstruction of *-u* is problematic if we postulate simply **-u*. Of the sound changes proposed in Lai (2021b), **-uC > -uC* does not support the reconstruction of **-u* for *-u*, because one would expect modern †*-u*- in the bound state on the basis of such a reconstruction. As such, the modern *-u* and its bound state vowels could not have been **-u* in the proto-language. We must therefore conduct separate reconstructions for this *-u* that became **-o*- and **-o^v*- in bound state.

Observing attested cases of *-o* and *-u*, we can see that the two merged in bound state. Although *-o* only exhibits *-æ*- (**-o*-) as the bound state, it is because the velarised version, **-o^v*-, producing *-o*- in modern Siyuewu, did not evolve into a modern bound state, which by definition is different from the final. For instance, *ntsoré* ‘vegetable soup’ from *ntsó* ‘vegetable’ with *ré* ‘soup’, *mosnám* ‘brother and sister’ from *mô* ‘brother (female-speaking)’ with *snám* ‘younger sister (male-speaking)’, and *xtçôp^hə* ‘leper’ from *xtçô* ‘leprosy’ with †*-p^hə* ‘NMLZ’. It is conceivable, in light of the unchanged *o* in both final and non-final positions, to reconstruct final *-o* in the same way as non-final *-o*-, that is, **-o^v > -o*.¹⁵ The reflex of final **-o* will be discussed in Section 4.4.

As for *-u* exhibiting *-æ*- and *-o*- as bound state vowels, I propose **-u^(v) > -u*. The effect of velarity on this final vowel is unreconstructable. The fact that *vʃú* ‘human’ has both *vʃæ*- and *vʃo*- as bound states supports this reconstruction (see Section 3.1.8). *vʃú* ‘human’ must be reconstructed as **vʃu^(v)* in order to account for its modern bound state vowels, *-æ*- (< **-u*-) and *-o*- (< **-u^v*-).

The syllable with a bilabial nasal final, **-o^vm*, should have produced †*-om* in the modern language, however, this syllable is prohibited by the phonotactics of Siyuewu. Rather, as will be explained in Section 4.4, it became *-ə^vm*.

See (8) for the sound changes reconstructed so far for final vowels.

(8) Sound changes for final vowels

- a. **-æ > -i*
- b. **-æ^v > -a*
- c. **-e > -e*
- d. **-ə > -ə*
- e. **-u^(v) > -u*
- f. **-o^v > -o*

¹⁵We will also see that there is a possibility to reconstruct **ə^v* for these cases in Section 4.3.3, if we only consider the bound state behaviour of these *o*'s. However, the reconstruction of **ə^v* must be accompanied by other evidences, such as verbal ablaut, vowel harmony, as well as external comparisons, otherwise, **o^v* should be considered in the first place.

See (9) for the sound changes reconstructed so far for non-final vowels.

(9) Sound changes for non-final vowels

- a. $*-æ- > -æ-$
- b. $*-æ^Y- > -a-$
- c. $*-e- > *-æ- > -æ-$
- d. $*-ə- > -æ-$
- e. $*-ə^Y- > -o-$
- f. $*-u- > *-o- > -æ-$
- g. $*-u^Y- > *-o^Y- > -o-$
- h. $*-o- > -æ-$
- i. $*-o^Y- > -o-$

4.3.3 Bound states with $-ə-$

In this section, I deal with the bound state vowel $-ə-$ that was left unreconstructed in Section 4.3.2. Examples are reproduced in Table 26.

Table 26: Examples of bound state $-ə-$.

First component	Gloss	Second component	Gloss	Compound	Gloss
$ɪŋû$	fry (barley)	$†pæɕ$?	$ɪŋəpæɕ$	popcorn
$q^hû$	bowl	$†zə$	DIM	$q^həzə$	bowl (Wobzi)
$nû$	ear	$ɕʃə$	hole	$nəʃə$	ear piercing
$əɣô$	uncle	$zî$	son	$sɣəvzî$	uncle and nephew

According to Lai (2021b), modern non-final $-ə-$ should be reconstructed as $*-u^{(Y)}$ -, therefore these non-bound state vowels $-u$ must be related to $*-u^{(Y)}$ -. As a result, I reconstruct $*-u^Y$ for these $-u$'s.

The case of $sɣəvzî$ 'uncle and nephew' (related to $əɣô$ 'uncle') is problematic. Following the logic of our reconstruction, the form $sɣəvzî$ should be reconstructed as $*s-ɣu^{(Y)}-v-zæ$, with the non-final vowel $*-u^{(Y)}$ -. However, such a reconstruction faces problems from comparative evidence. There exists an $-ə- :: -æ-$ correspondence between Siyuewu and other varieties of Khroskyabs, especially Wobzi ($ɕagû$) and Guanyinqiao, which generalise the bound state vowel $-æ-$ ($-a-$ in Guanyinqiao) from the final vowels $*-æ$, $*-o$ and $*-ə$, as shown in Table 27. However, Siyuewu $-ə-$, so far, can only reflect Pre-Khroskyabs $*-u-$. Therefore, the correspondence between Siyuewu $-ə-$ and Wobzi $-æ-$ in Table 27 is irregular and must be explained specifically. I am going to explain this from two aspects.

Table 27: $-\text{ə}- :: -\text{æ}-$ correspondence between Siyuewu and other Khroskyabs varieties.

Siyuewu	Wobzi (<i>κâgu</i>)	Guanyinqiao	Gloss
<i>ts^həgí</i>	<i>ts^hægí</i>	<i>ts^hagí</i>	clothes
<i>dγərc^hé</i>	<i>gærc^hé</i>		pig skin
<i>κjêle</i>		<i>jalé</i>	Tibetan bread

First, The vowels in the second syllables in the Siyuewu examples in Table 27 are all high vowels, $-i$ and $-e$, as shown in Section 4.3, these vowels were able to trigger vowel harmony in a certain stage in Siyuewu Khroskyabs' history. It is reasonable that the irregularity is caused by vowel harmony, which heightened those Siyuewu bound state vowels to $*-u-$, hence $-\text{ə}-$ in modern Siyuewu.

As $*-\text{æ}-$ and $*-o^{(y)}$ - would be heightened to $-e-$ by vowel harmony, the most reasonable choice is to postulate $*-\text{ə}-$ for the forms in Table 27 in that its heightening to $*-u-$ is both intuitively and logically plausible. Coming back to the Siyuewu form *sγəvzí* 'uncle and son', although no Wobzi and Guanyinqiao cognates are attested, the syllable structure suggests a possible effect of vowel harmony: $*s-\gamma\text{ə}-v-z\text{æ} > *s-\gamma\text{ə}-v-zi > *s-\gamma u-v-zi > s\gamma\text{ə}vz\acute{i}$.

Second, the cognate of Siyuewu *əγô* 'uncle' in Guanyinqiao Khroskyabs is *ayê* 'maternal uncle', suggesting that Siyuewu $-o$ is somehow related to $-\text{ə}$. In light of these two pieces of evidence, the final vowel of Siyuewu *əγô* 'uncle' must be related to $*-\text{ə}^{(y)}$. I therefore reconstruct $*-\text{ə}^y$ to account for its change into modern $-o$.

The sound changes hypothesised in this section are listed in (10).

(10) Final vowels

- a. $*-u > -\text{ə}$ ($*\eta u > \eta\hat{\text{ə}}$ 'ear (a free variant of $\eta\hat{u}$ 'ear)')
- b. $*-u^y > -u$ ($*r\eta u^y > r\eta\hat{u}$ 'fry (barley)')
- c. $*-\text{ə}^y > -o$ ($*u\gamma\text{ə}^y > \text{ə}\gamma\hat{o}$ 'uncle')

In non-final positions, as Lai (2021b) suggests, the contrast of $*-u-$ and $*-u^y-$ disappeared, with both resulting in $-\text{ə}-$ in modern Siyuewu.

4.3.4 Supporting evidence from other constructions or Khroskyabs dialects

Some isolated evidence inside Khroskyabs supports a few of our reconstructions.

1. The diminutive Siyuewu form, *pætsí* 'piglet', is related to *p^hây* 'pig' and a variant of the diminutive suffix $\dagger-tsi$. According to our logic, it should be reconstructed as $*pæts\text{æ}$. The identical vowel found in both syllables would be a sign of vowel harmony. There is some evidence that vowel harmony may have once been regular for diminutives, examples include *γvazá* 'fly (noun)' and *q^həzə* 'bowl (Wobzi)', etc. There is, however, no explanation for the unaspirated consonant $p-$ for 'pig', the non-lenited consonant $ts-$ for the diminutive suffix, as well as the fact that the form is not affected by vowel harmony.

2. The open syllable word *rqú* ‘be dry and hard’ has a closed syllable free variant, which is a closed syllable: *rqód*. The final *-d* is of unknown origin. The addition of the coda *-d* changes the vowel from *-u* to *-ə*. According to our reconstruction, *rqú* needs to be reconstructed as **rqu^v*, and *rqód* as **rqu^vd*. Final **-u^v* would produce *-u*, hence *rqú*, and non-final *-u^v-* would produce *-ə-* (Lai 2021b: 112), hence *rqód*.
3. The open syllable word *rvî* ‘axe’ is related to *ə-rvæd*, a classifier for the action of chopping with an axe. The form *rvæd* is clearly derived from *rvî* followed by a nominalising suffix *-d*. I reconstruct *rvî* as **rvæ*, and *rvæd* as **rvæd*, explaining the vowel difference in these two forms.
4. The word for ‘fish’ has different structures in Siyuewu and in Wobzi Khroskyabs, see Table 28.

Table 28: ‘Fish’ in different Khroskyabs dialects.

Siyuewu	Wobzi	Japhug
<i>ɣdæɰjú</i>	<i>ɰdojú</i>	<i>qaʃy</i>

The uvular *ɰ-* in Khroskyabs is related to *qa-* in Japhug which is probably the remnant of a classifier for animals (Jacques 2014b: 158–159; Matisoff 2003: 134–135). *ɣdæ-* and *do-* in the Khroskyabs dialects are clearly from *ɣdê* ‘water’, and *jú* is cognate of *-ʃy* in Japhug, which probably meant ‘fish’. The “animal prefix” *ɰ-* is differently placed in the two Khroskyabs dialects: after ‘water’ in Siyuewu, and before ‘water’ in Wobzi. According to our reconstruction, the word ‘water’ should be reconstructed as **ɣdə*. In Siyuewu, **ɣdə* underwent the normal bound state vowel change, becoming *ɣdæ-*. While in Wobzi, the vowel became *-o-* and the pre-initial *ɣ-* was dropped. We need to assume that the proto-form in Wobzi was **ɰ-ɣdə-ju*, and that the sequence **ɰɣd-* was phonotactically illegal, forcing the pre-initial *ɣ-* to be compressed into a velarised feature of the vowel *-ə-*: **ɰ-ɣdə-ju* > **ɰ-də^v-ju* > *ɰdojú*. This example supports the sound change **-ə^v-* > *-o-* as well as the hypothesis of velarised vowels presented in Lai (2021b).

4.3.5 Summary of the internal reconstruction

Table 29 summarises the internally reconstructed system for Pre-Khroskyabs, achieved through examining bound state apophony in modern Siyuewu Khroskyabs. The system explains every single instance of bound state attested in Siyuewu. All bound state vowels have a velarised counterpart, with the exception of **-e*, for which there is no evidence of such a pair. One explanation could be that **-e^v* has the same reflex as **-e*, similar to the case of **-u^v*. Although **-u* and **-u^v* might have the same reflex in modern Siyuewu, their distinction is preserved in non-final positions. The modern reflex of plain **-o* will be discussed in Section 4.4.

Table 29: Summary of the proposed internal reconstruction.

Final		Non-final	
Reconstruction	Modern Siyuewu	Reconstruction	Modern Siyuewu
*-æ	-i	*-æ-	-æ-
*-æ ^y	-a	*-æ ^y -	-a-
*-e	-e	*-e-	-æ-
*-ə	-ə	*-ə-	-æ-
*-ə ^y	-o	*-ə ^y -	-ə- (before -m), -o-
*-u	-u	*-u-	*-o- > -æ-
*-u ^y	-u	*-u ^y -	*-o ^y - > -o-
*-uu	-ə	*-uu-	-ə-
*-uu ^y	-u	*-uu ^y -	-ə-
*-o	?	*-o-	-æ-
*-o ^y	-o	*-o ^y -	-o-

We do not, however, have sufficient evidence to predict when velarisation will occur in bound state. In some cases, the independent form and the bound state do not agree in velarity. For instance, *mpî* < (**mpæ*) ‘farmland’ is without velarisation in its independent form, however, it is velarised in its bound state, *mpalá* (< **mpæ^y-læ^y*) ‘farmland’; *vjád* (< **vjæ^yd*) ‘eight’, having a velarised vowel in the independent form, loses the velarity in bound state: *vjêtsə* (< **vjæ-ts[u]*) ‘eighty’. Velarisation may also have already been heavily flattened by analogy. The bound state of *ku* ‘head’ is invariably *ko-*, the other theoretical possibility, *kæ-*, is unattested. These secondary changes must be studied in a separate paper with more field data.

4.4 External comparisons

In this section, I compare attested forms exhibiting bound states with cognates from Wobzi Khroskyabs (the *çâzə* sub-variety), Japhug, Bragbar Situ and Zbu with Siyuewu Khroskyabs forms and the reconstructed forms.¹⁶ The *çâzə* sub-variety of Wobzi is selected for its conservative *o*-vocalism. For every Siyuewu example, the Pre-Khroskyabs reconstruction and the forms in other modern Gyalrongic varieties are given. I follow the conventions proposed by Baxter & Sagart (2014) in the reconstructions, using square brackets to indicate proto-phonemes/features that could have alternative reconstructions, and round brackets to indicate the possible existence of a proto-phoneme/feature.

4.4.1 Cognates of words with *i*

Table 30 lists cognates of words that exhibit bound state with *i* in other Gyalrongic languages. Earlier, we reconstructed this vowel as *-æ in final positions. In most cases,

¹⁶The Japhug data are from Jacques (2015), the Bragbar Situ data from Zhang (2020) and the fieldnotes of the same author, the Zbu data from Gong (2018).

*-æ corresponds to Japhug -a, Bragbar Situ -iɛ or -a, and Zbu -e or -i, which should be considered regular, especially with Japhug and Bragbar Situ.

The cognate for ‘grass’ is problematic. The rhyme -ɲj in Japhug comes from Proto-East-Gyalrongic *-ɲj (Jacques 2004: 217), which probably does not correspond to *-æ in Pre-Khroskyabs. In this case, the bound state in Siyuewu Khroskyabs χcæ- could be the result of analogy.

Table 30: Cognates of words with *i*.

Pre-Khroskyabs	Siyuewu	Wobzi (çâzə)	Japhug	Bragbar Situ	Zbu	Gloss
*pjæ	pjezɔ̌ (†pjî) ‘sparrow’	pjizî ‘sparrow’	pɣa	patçû ‘chicken’	pɣé?	bird
*væ	vî	vî	pa	viê		to do
*væ	væme (†vi) ‘parents’	vî ‘father’	tx-wa ‘father’			father
*ɣvæ	ɣvî	ɣvî	βɣa		ɣvî	mill
*zæ	zî	zî	tx-flsa	tə-zîê	tse, ze ‘DIM’	son, man
*djæ	djî	djî	ca	ciê		musk deer
*tç ^h æ	tç ^h î	tç ^h î	tʂu	tʂalié	tçé ^h be	road
*mɲæ	mɲî	mɲalá		tə-mɲié		farmland
*χc[æ]	χcî	χcî	xcaj			grass

4.4.2 Cognates of words with æ

The vowel æ only exists in non-final syllables. The three examples that exhibit bound state are listed in Table 31, and are reconstructed with three different rhymes.

The word for ‘deer’ is unproblematic, as all the other varieties show æ-like vowels.

The word for ‘last night’ could be reconstructed as *ɣmer, ɣmər, *ɣmər or *ɣmor. I opt for the rounded version to explain the correspondence with Bragbar Situ rə-môr ‘one night’.

The word for ‘two’ could be reconstructed as *ɣne[z], *ɣnə[z] or *ɣnæ[z], based on internal and external evidence. *ɣn[e][z] is chosen as most of its cognates have high vowels. The coda could be either *-ɣ or *-z, but *-z is far more plausible because in Njorogs Khroskyabs, the form is ɣnéʔs (the -s/-z coda is also attested in East Gyalrongic varieties). The Siyuewu coda -ɣ should be due to the analogy with ræɣ ‘one’.

Table 31: Cognates of words with æ.

Pre-Khroskyabs	Siyuewu	Wobzi (çâzə)	Japhug	Bragbar Situ	Zbu	Gloss
*rtsæz	rtsêz	rtsê	qarts ^h az	k ^h arts ^h âs	qértse	deer
*ɣm[o]r	ɣmêr	ɣmêr	juɣmur ‘tonight’	rə-môr ‘one night’	vuu-mûz ‘that night’	last night
*ɣn[e][z]	ɣnêɣ	ɣnê	ɛnuuz	kənêz	ɛnîz	two

4.4.3 Cognates of words with a

Table 32 lists Gyalrongic cognates with Siyuewu -a words. Almost all cases correspond to a-like vowels in other Gyalrongic languages.

The proto-form $\epsilon v\text{æ}^{(Y)}r$ underwent epenthesis in Siyuewu with a schwa inserted between $^*\epsilon$ - and *v -. However, the issue of velarity is problematic. The Siyuewu $-a$ - points to a velarised $^*\text{-æ}^y$ -, while the Wobzi $-æ$ - to a plain $^*\text{-æ}$ -. This variance is not yet explainable.

The coda $-d$ in Siyuewu $m\eta\acute{a}d$ ‘five’ is probably analogical, given that we have $vj\acute{a}d$ ‘eight’, $\eta g\acute{o}d$ ‘nine’ and $sj\hat{o}d$ ‘ten’.

The word for ‘fly (insect)’ is less clear, as there is no independent form attested in Siyuewu or Wobzi. The form in Njorogs Khroskyabs is $\gamma v\acute{o}s$, which may be an indication of a proto *s or *z final. The bound state in Siyuewu does not support the Njorogs vocalism $-\text{ə}$ -, but the Njorogs form could be borrowed from Bragbar Situ $k\text{ə}v\acute{e}s$, due to the geographical proximity between the two varieties. The Japhug cognate $\beta\gamma\chi za$ is clearly directly related to Siyuewu $\gamma v\acute{a}z\acute{a}$, even demonstrating the same diminutive morphology. Japhug’s relation to Siyuewu within the Gyalrongic branch is, however, relatively distant, which means $\gamma v\acute{a}z\acute{a}$ can likely be reconstructed as far back as Proto-Gyalrongic. Except Njorogs, all known West-Gyalrongic varieties preserved the diminutive form, with the non-diminutive form more common in Situ (Lai 2013a). Therefore, it is highly likely that the Njorogs form is due to language contact with Situ. We provisionally reconstruct $^*\gamma v[\text{æ}](z)$ with an uncertain rhyme to account for the Njorogs form, in case it is indeed inherited from the proto-language.

Table 32: Cognates of words with a .

Pre-Khroskyabs	Siyuewu	Wobzi ($\epsilon\hat{a}z\text{ə}$)	Japhug	Bragbar Situ	Zbu	Gloss
$^*p^h\text{æ}^y\gamma$	$p^h\acute{a}\gamma$	$p^h\acute{a}\gamma$	$p\text{æ}k$	$pi\acute{a}k$	$p\acute{e}k$	pig
$^*p^hr\text{æ}^y\gamma$	$p^hr\acute{a}\gamma$	$p^hr\acute{a}\gamma$	$\beta\text{ra}k$	$pr\acute{a}k$		rock
$^*vj\text{æ}^y d$	$vj\acute{a}d$	$vj\acute{a}$	$ku\text{r}cat$	$k\text{ə}rc\acute{e}t$	$v\text{ə}rj\acute{e}t$	eight
$^*\epsilon v\text{æ}^{(Y)}r$	$\epsilon\text{ə}v\acute{a}r$	$\epsilon\eta\acute{e}r$	$\epsilon\chi r$	$swi\acute{e}r$	$\epsilon w\text{er}^n\text{G}\acute{o}?$ ‘midnight’	night
$^*m\eta\text{æ}^{(d)}$	$m\eta\acute{a}d$	$m\eta\acute{a}$	$ku\text{m}\eta\eta u$	$k\text{ə}m\eta\acute{e}j$	$k\text{ə}m\eta\acute{e}$	five
$^*r\gamma\text{æ}^y$	$r\gamma\acute{a}$	$r\gamma\acute{e}l\acute{i}$	$rgali$			calf
$^*r\eta\text{æ}^y$	$r\eta\acute{a}$	$r\eta\acute{a}$	$tu-r\eta a$		$v\text{ə}-r\eta\acute{e}?$ ‘her/his face’	face
$^*\gamma v[\text{æ}](z)$	$\gamma v\text{æ}-/\gamma v\text{a}-$	$\gamma v\acute{a}z\acute{a}$	$\beta\gamma\chi za$	$k\text{ə}v\acute{e}s$		fly (insect)

4.4.4 Cognates of words with e

In this section, the plain *o , which was left untreated in Section 4, is reconstructed.

The Siyuewu $-e$ has two correspondence patterns in other Gyalrongic languages. It either corresponds to unrounded front vowels in East Gyalrongic, such as $s\acute{e}$ ‘wood’ and $rc^h\acute{e}$ ‘tie’, or to the rounded vowel $-o$ in East Gyalrongic, as in $ft\acute{e}$ ‘slope’, † fse ‘early morning’ and $j\acute{e}$ ‘3SG.REFL’. See Table 33.

Table 33: Cognates of words with *e*.

Pre-Khroskyabs	Siyuewu	Wobzi (câzə)	Japhug	Bragbar Situ	Zbu	Gloss
* <i>se</i> * <i>rc^he</i>	<i>sê</i> <i>rc^hê</i>	<i>sî</i> <i>rc^hi</i>	<i>si</i>	<i>çé</i> <i>rc^hé</i>	<i>sótç^hɸk</i> ‘firewood’	wood to tie
* <i>fto</i> * <i>fso</i> * <i>jo</i>	<i>fié</i> ‘slope’ † <i>fse</i> <i>jê</i>	<i>fió</i> <i>fsô</i> <i>jô</i>	<i>fso</i> ‘tomorrow’ <i>zo</i>	<i>mtó</i> <i>soçní</i> ‘tomorrow’ <i>tə-jê</i>	<i>fsí-/fsó-</i> <i>tə-jê?</i>	forehead early morning 3SG.REFL

For the *-e* that corresponds to unrounded vowels, **-e* was reconstructed in Section 4.3.2. For the *-e* that corresponds to *-o*, **-o* is reconstructed, hence the Siyuewu sound change in (11).

(11) **-o > -e*

This particular sound change seems to have occurred relatively recently, and must postdate the split of Siyuewu from Pre-Khroskyabs, as the *câzə* variety of Wobzi (and a few other Khroskyabs dialects such as Xiaoyili) still preserves the *o*-vocalism. Siyuewu, Wobzi of *ɸagû* and Guanyinqiao all underwent this sound change individually. In Guanyinqiao Khroskyabs, the sound change even affected some recent borrowings, the personal name *mtsho.mo* is pronounced as *mts^hemû*, from earlier †*mts^homû*.

Some internal evidence within Siyuewu can also confirm this late change.

1. The word *jôtəɣ* ‘casually’ probably consists of *jê* ‘3SG.REFL’ and a definitive marker as in *ætəɣ* ‘DEM’. If the etymology is valid, we can reconstruct **jo^vtu^(y)ɣ* for this form. It shows *o*-vocalism, which implies that the isolated form must be **jo*.
2. The interrogative adverb *t^hjôɣ* ‘why’ is derived from *t^hjê* ‘what’ plus an instrumental marker = *ɣə*. *t^hjê* ‘what’ is related to *t^hjê* ‘what’ in Wobzi Khroskyabs (*ɸagû*) and *t^hi* ‘what’ in Guanyinqiao Khroskyabs. The Guanyinqiao form, *t^hi*, is the base, and the Wobzi form, *t^hjê*, is a contraction of *t^hi* ‘what’ + *jê* ‘3SG.REFL’. The Siyuewu form, *t^hjê*, is an isolation of the bound state of *t^hjê*. Therefore, the Siyuewu ‘what’ must have been †*t^hjê* at some point in time.

The word for ‘why’, on the other hand, should be reconstructed as **t^hjo^vɣ* (either the velarisation contrast is lost in **-o^(y)ɣ*, or **-o-* automatically velarises when followed by **-ɣ* in Siyuewu), and can be understood to have demonstrated *o*-vocalism. We need to reconstruct *t^hjê* as **t^hjo* to account for its relation with *t^hjôɣ* ‘why’.

4.4.5 Cognates of words with ə

Table 34 shows the examples with *ə* that exhibit bound state.

The proto-form **sjə* is reconstructed for ‘ten’, despite the fact that the Siyuewu form has a coda *-d*. This *-d* should be considered analogical in that it should hypothetically not exist in the proto-language, as none of the other modern Gyalrongic varieties exhibits this coda. If we had taken this *-d* into account, we would have to reconstruct **sjud*, which

would well derive *sjêd* in modern Siyuewu. However, instead of the attested *sjæ-*, one would then expect to find †*sjə-* as the bound state form.

The word for ‘three’ is reconstructed as **xsə^ym*, which would have produced **xsôm* at an earlier stage, before going on to become *xsê^m*. The *o*-vocalism is preserved in Njorogs, for which the word is *xsôm*.

Table 34: Cognates of words with ə.

Pre-Khroskyabs	Siyuewu	Wobzi (câzə)	Japhug	Bragbar Situ	Zbu	Gloss
<i>*sjə</i>	<i>sjêd</i>	<i>sjê</i>	<i>sqi</i>	<i>zjé</i>	<i>sɛkɛ</i>	ten
<i>*xsə^ym</i>	<i>xsê^m</i>	<i>xsê^m</i>	<i>χsum</i>	<i>kəsê^m</i>	<i>χsóm</i>	three

The proto-final-vowel **-u* is not expected to exhibit bound state, as its non-final counterpart, **-u-*, produces *-ə-* as in syllable final positions.

4.4.6 Cognates of words with o

Table 35 summarises the cognates of words with *o*.

Table 35: Cognates of words with o.

Pre-Khroskyabs	Siyuewu	Wobzi (câzə)	Japhug	Bragbar Situ	Zbu	Gloss
<i>*bro^(y)</i>	<i>bró</i>	<i>bró</i>	<i>mbro</i>	<i>mbró</i>	<i>"brá</i>	horse
<i>*rbo^y</i>	<i>rbô</i>	<i>rbô</i>	<i>ɾpyo</i> ‘top of a hill’	<i>rvó</i> ‘halfway up a hill’		top of a house
<i>*m[o]^(y)</i>	<i>môγ</i>	<i>mâγ</i>	<i>tu-mɲak</i>	<i>tə-mɲák</i>	<i>ɐ-mɲêk</i> ‘my eyes’	eye

The word for ‘horse’ is reconstructed as **bro^(y)* in Pre-Khroskyabs. Velarity is present in Siyuewu and Wobzi, but the Guanyinqiao form *bré* points to a plain **bro*. There are three explanations. First, **bro^y* and **bro* could be proto-variations,¹⁷ with the Guanyinqiao form inherited from the plain variant, and the Siyuewu and Wobzi forms inherited from the velarised variant. Second, ‘horse’ could be reconstructed as a plain **bro*, which regularly produces *bré*, with *bró* being a borrowing from other Gyalrongic languages, such as Situ. Third, it could be reconstructed as a velarised **bro^y*, and Guanyinqiao can be presumed to have undergone a second wave of unrounding: **-o^y > -o > -e*.

As for the **rbo^y* ‘top of a house’, it is likely that the velar medial in Japhug *ɾpyo* ‘top of a hill’ is a trace of velarisation.

The vowel of the word for ‘eye’ in Pre-Khroskyabs is reconstructed as **-o-*. This reconstruction is plausible within Khroskyabs varieties, as the Wobzi rhyme *-aγ* regularly corresponds to *-æγ*, *-aγ* and *-oγ* in Siyuewu. The presence of *a*-like vowels in all other Gyalrongic languages is unexplainable at present.

¹⁷However, “proto-variations”, as referred to in this example, must be addressed with rigorous historical comparative methodology (Fellner & Hill 2019). In this case, the velarity of **bro^y* could be a trace of some ancient affix.

4.4.7 Cognates of words with *u*

In Table 36, cognates of words with *u* that exhibit bound state are listed. Modern Siyuewu *-u* comes from **-u^(Y)* or **-u^Y*. It is clear from the table that most **-u^(Y)* correspond to *-u* in Japhug and Zbu, and *-o* in Bragbar Situ.

As for **-u^Y*, the word for ‘bowl’, **q^hu^Y*, is confirmed by the unrounded vocalisms in Japhug and especially by that of Bragbar Situ.

The word for ‘fry (barley)’, *rŋû*, corresponds to Japhug *rŋu* and Bragbar Situ *rŋô*, which points to the proto-form **rŋu^(Y)*. However, based on the behaviour of its bound state, *rŋə-*, one needs to reconstruct **rŋu^Y*. I stick to the internal reconstruction **rŋu^Y*, as the sound changes between East and West Gyalrongic are still poorly understood.

The word *ɲû* ‘ear’ is reconstructed as **ɲu^Y*. In East Gyalrongic languages, the word ‘ear’ is *tu-rna* in Japhug, *tə-rniê* in Bragbar Situ, and *tə-rnáʔ* in Zbu, which are potential loanwords from Tibetan *ma* ‘ear’. In Khang.gsar Stau, the cognate is *ɲə*.

Table 36: Cognates of words with *u*.

Pre-Khroskyabs	Siyuewu	Wobzi (çâzə)	Japhug	Bragbar Situ	Zbu	Gloss
<i>*vdz^u(^Y)</i>	<i>vdzû</i>	<i>vdzû</i>	<i>tɣ-mdzu</i>	<i>tə-mdzó</i>		thorn
<i>sku^(Y)</i>	<i>skû</i>	<i>skû</i>	<i>çku</i>	<i>çkó</i>	<i>skúʔ</i>	scallion
<i>*ɛ^u(^Y)</i>	<i>ɛû</i>	<i>ɛû</i>	<i>tu-ku</i>	<i>ta-wô</i>	<i>tə-kúʔ</i>	head
<i>*vɣ^u(^Y)</i>	<i>vɣû</i>	<i>vɣû</i>			<i>kə-r^mbjúʔ</i> ‘be human’	man, human
<i>*l^u(^Y)</i>	<i>lû</i>	<i>lû</i>	<i>tɣ-lu</i>	<i>tə-ló</i>	<i>tə-lt^hə</i>	milk
<i>*q^hu^Y</i>	<i>q^hû</i>	<i>q^hû</i>	<i>k^hutsa</i>	<i>k^hí</i>		bowl
<i>*rŋu^Y</i>	<i>rŋû</i>	<i>rŋû</i>	<i>rŋu</i>	<i>rŋô</i>	<i>rŋóʔ</i>	fry (barley)
<i>*ɲu^Y</i>	<i>ɲû</i>	<i>ɲû</i>				ear

4.4.8 Other proto-vowels

There are two pairs of proto-vowels proposed in Lai (2021b) that are not treated in this paper. They are **i/*i^Y* and **u/*u^Y*. As these vowels do not show the plain/velarised contrast in non-final positions, they cannot be reconstructed through bound state analyses. A number of examples with *-i* and *-u* without bound state might be reconstructed with **-i^(Y)* and **-u^(Y)*. For example, *xtsî* ‘gruel’ does not undergo apophony in *xtsîpətæɛ* ‘gruel with noodle slices’, and is cognate with Japhug *tuts^hi* ‘gruel’, perhaps pointing to an earlier **xtsi^(Y)*. Similarly, *sú* ‘cattle’, similarly, does not have a bound state, as in *suɲâ* ‘cattle excrement’, its proto-form is probably **su^(Y)*.

The reconstructions proposed here should be revised as long as new evidence from Khroskyabs dialects are revealed.

4.5 The Pre-Khroskyabs vowel system

Figure 4 shows a system of reconstructed vowels in Pre-Khroskyabs. Except for *e*, which shows no evidence of a velarised counterpart, all the other vowels have a plain-velarised contrast.

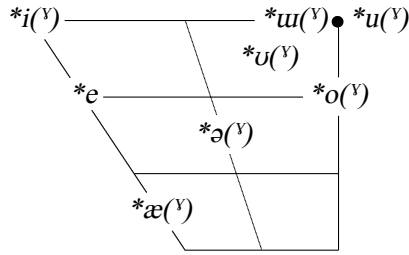


Figure 4: Pre-Khroskyabs vowel system.

Table 37 shows the sound changes which occurred to the proto-vowels in both final and non-final positions as they shifted towards modern Siyuewu Khroskyabs in the same positions. There is no internal evidence for the modern reflexes of final $*-i^{(Y)}$ and $*-u^{(Y)}$.

Table 37: Summary of Pre-Khroskyabs’s internal reconstruction.

Final		Non-final	
Reconstruction	Modern Siyuewu	Reconstruction	Modern Siyuewu
$*-i^{(Y)}$	$-i$ (?)	$*-i^{(Y)}-$	$-i-$
$*-æ$	$-i$	$*-æ-$	$-æ-$
$*-æ^Y$	$-a$	$*-æ^Y-$	$-a-$
$*-e$	$-e$	$*-e-$	$-æ-$
$*-ə$	$-ə$	$*-ə-$	$-æ-$
$*-ə^Y$	$-o$	$*-ə^Y-$	$-ə-$ (before $-m$), $-o-$
$*-u$	$-u$	$*-u-$	$*-o- > -æ-$
$*-u^Y$	$-u$	$*-u^Y-$	$*-o^Y- > -o-$
$*-uu$	$-ə$	$*-uu-$	$-ə-$
$*-uu^Y$	$-u$	$*-uu^Y-$	$-ə-$
$*-u^{(Y)}$	$-u$ (?)	$*-u^{(Y)}-$	$-u-$
$*-o$	e	$*-o-$	$-æ-$
$*-o^Y$	$-o$	$*-o^Y-$	$-ə-$ (before $-m$), $-o-$

The naturalness of this reconstructed vowel inventory might bear the problem of having too many contrasts in back and rounded vowels, which are asymmetrically distributed against the front vowels. However, such asymmetry is not entirely rare in languages of the world. Ostyak shows contrasts among high back/rounded vowels, $ʉ$, uu and u , while not exhibiting similar contrasts within the front vowels (i , $æ$ and a) (Stanford Phonology Archive 2019a). Vietnamese distinguishes $ɣ$ from o , $ʌ$ from $ə$, and presents u , while having only three front vowels i , e and $ɛ$ (Stanford Phonology Archive 2019b). Further comparative studies will hopefully allow for the postulation of a more refined vowel inventory for Khroskyabs. For now, the current system suffices to explain the phenomena we encountered so far.

5 Handling of Tangut cognates

The history of Tangut, an extinct Trans-Himalayan language once spoken in today’s Ningxia Province, China, is a hot topic among historical linguists working on related languages. Tangut has long been assumed to be a Qiangic language, though its affiliations with other Qiangic languages remain uncertain. Sagart et al. (2019) shows phylogenetic evidence which supports the classification of Tangut with Gyalrongic. Based on lexical innovations, Lai et al. (2020) further demonstrates that Tangut should be a West Gyalrongic language, meaning that Tangut and Khroskyabs are much more closely related than we previously believed.

Tangut rhymes have traditionally been reconstructed along three grades (Gong Hwang-Cherng 1994). Grade I rhymes are reconstructed with a plain vowel, Grade II with a *-i-* medial, and Grade III with a *-j-* medial. Two recent works, both by Gong Xun (2017; 2020), propose a revised version of Tangut rhyme reconstruction: Grade I rhymes are reconstructed with a uvularised vowel, Grade II with a pharyngeal *-ʕ-* medial together with a uvularised vowel, and Grade III with a plain vowel. Grade I and Grade II rhymes that are reconstructed with uvularised vowels are not compatible with velar consonants. Thus, Gong Hwang-Cherng’s velar initials followed by Grade I and II rhymes are revised to uvular consonants. Similarly, non-uvular Grade III rhymes are not compatible with uvular consonants, so relevant forms reconstructed by Gong Hwang-Cherng remain velar. Table 38 summarises Gong Xun’s revision.

Table 38: Gong Xun’s (2017; 2020) revision of Tangut rhymes.

Grade	Tangut	Gong Hwang-Cherng	Gong Xun	Gloss
Grade I	𐰇𐰏	<i>ya</i> ¹	<i>ka</i> ^{k1}	needle
Grade II	𐰇𐰏	<i>khia</i> ²	<i>qhʕa</i> ^{k2}	ploughshare
Grade III	𐰇𐰏	<i>khja</i> ²	<i>kha</i> ²	draw (water)

The uvularisation hypothesis, similar to our reconstruction of velarisation, is a guttural colouring of vowels. Given the proposed affiliation between Tangut and Khroskyabs, one should ask if Tangut uvularisation is, at least in part, related to Khroskyabs velarisation.

Tangut uvularisation has two main origins: inherited (‘primary’, to use Gong Xun’s 2017 term) and innovated (‘secondary’ in Gong Xun’s 2017 terminology). Inherited velarisation can be traced back to Proto-Gyalrongic. It corresponds to Zbu velarisation (Gong 2017), such as 𐰇𐰏⁵²⁷⁴ *pə*^{k1} ‘pus’, related to Zbu *tazvû* ‘pus’ (*u* is a velarised vowel in Zbu), and 𐰇𐰏²⁸⁷⁸ *bʕi*^{k1} ‘willow’, related to Zbu *zⁿbrúʔ* ‘willow’. Innovated uvularisation, on the other hand, could be derived from surrounding guttural segments. This type of uvularisation regularly corresponds to uvular codas, medials, preinitials or pre-syllables in East Gyalrongic. For example, 𐰇𐰏⁰⁶³⁰ *la*^{k1} ‘to weave’ corresponds to Japhug *taʕ* ‘weave’ and Zbu *têʕ* ‘weave’, and 𐰇𐰏¹⁴⁹⁰ *tsu*^{k1} ‘winter’ to Japhug *qartsu* ‘winter’ and Zbu *qərtsóʔ* ‘winter’ (Gong 2020).

Khroskyabs may have undergone similar innovated velarisation by compressing a guttural element into a vowel, but this process may well have happened separately from Tangut. Inherited velarisation in Khroskyabs is to be compared with inherited uvularisation in Tangut. In the remainder of this section, I compare Proto-Khroskyabs examples with their Tangut cognates.

Khroskyabs, like Japhug, share more than 300 cognates with Tangut (Jacques 2014a; Lai et al. 2020). In the following comparative study, only examples with confirmed velarisation status in Khroskyabs are taken into consideration, resulting in a total of 65 cognates analysed.¹⁸ I will first compare cognates where Khroskyabs velarisation corresponds to Tangut uvularisation (Section 5.1), then, those where Khroskyabs velarisation corresponds to Tangut non-uvularisation (Section 5.2), and finally, those where Khroskyabs non-velarisation corresponds to Tangut uvularisation (Section 5.3).

5.1 Khroskyabs velarisation = Tangut uvularisation

Table 39 shows the 32 examples in which Khroskyabs velarisation corresponds to Tangut uvularisation.¹⁹ Although in some examples Tangut may have innovated the uvularisation from Proto-Gyalrongic guttural codas (-ɣ, -ʁ), as reflected in Khroskyabs and in Japhug, most of the examples do not have these codas, and should be considered inherited from at least Proto-West-Gyalrongic. One should also notice that the West Gyalrongic innovations, from *ɣd[o]ʷ ‘be poor’ to *ku(ʷ)tæʷ ‘dog’, all of them without a velar coda, represent a considerable portion of velarisation/uvularisation correspondences.

Table 39: Khroskyabs velarisation = Tangut uvularisation.

Pre-Khroskyabs	Siyuewu	Tangut	Japhug	Gloss
*p ^h æʷɣ	p ^h âɣ	𐵓 ⁰²⁹⁴ wa ^{ʁ1}	paʁ	pig
*zbl[o]ʷv	zblóv	𐵓 ³²⁹⁹ lwi ^{ʁw1}	tx-jlɣβ	steam
*xsəʷm	xsôm	𐵓 ⁵⁸⁶⁵ so ^{ʁ1}	χsum	three
*q ^h uʷ	q ^h û	𐵓 ⁴¹⁸⁹ qhu ^{ʁ1}	k ^h uʷtsa	bowl
*lvæʷɣ	lváy	𐵓 ⁵¹⁷² wə ^{ʁ1}	tu-rpaʁ	shoulder
*ʁæʷv	ʁáv	𐵓 ⁴⁹³⁵ ʁa ^{ʁ1}	ta-qaβ	needle
*læʷlæʷ	lalâ	𐵓 ⁰⁰⁰⁴ la ^{ʁ2}	ʃaʁ	aunt
*sep ^h oʷ	sæpô	𐵓 ⁵⁸¹⁴ phu ^{ʁ2}	tu-p ^h u	tree
*ɣmæʷɣ	ɣmáy	𐵓 ⁴⁸²⁰ ma ^{ʁ1}	tu-nmaʁ	son-in-law
*rts[o]ʷ	rtsô	𐵓 ¹⁴⁹⁰ tsu ^{ʁ1}	qa-rtsu	winter
*rts ^h [ə]ʷz	rts ^h óʒ	𐵓 ⁵¹⁰⁵ tsə ^{ʁ1}	tu-rts ^h ɣz	lung
*rdzæʷv	rdzáv	𐵓 ⁰⁰⁴⁵ za ^{ʁ1}	mɣrtsaβ	be spicy
*dæʷɣ	dây	𐵓 ⁰⁶³⁰ la ^{ʁ1}	taʁ	weave
*jæʷɣ	jây	𐵓 ³¹⁹² laa ^{ʁ1}	jaʁ	be thick
*vloʷd	vlód	𐵓 ⁴⁵⁰⁶ lu ^{ʁ2}	βlu	kindle
*mb[o]ʷ	mbô	𐵓 ¹³⁹¹ ba ^{ʁ1}	tu-mbyo	be deaf

¹⁸Cognate judgment is based on Jacques (2014a) and Lai et al. (2020).

¹⁹West Gyalrongic innovations, identified according to Lai et al. (2020), are in light-grey backgrounds in the tables.

Table 39 – continued from previous page

Pre-Khroskyabs	Siyuewu	Tangut	Japhug	Gloss
*ŋo ^y z	ŋóz	𐞗 ⁰⁵⁰⁸ ŋwu ^{kr2}	ŋu	be
*qæ ^y r	qár	𐞗 ⁴⁴⁸⁰ qa ^{kr} r ²	qxt	separate
*b[o] ^y	bô	𐞗 ²¹⁰¹ bu ^{kr} r ¹	rmbuu	accumulate
*rŋæ ^y	rŋâ	𐞗 ²²⁰⁰ ba ^{kr}	γɣɣbaɣ	hunt
*p ^h r[ə] ^y m	p ^h rê ^m	𐞗 ¹⁵⁷² phɣo ^{kr} w ¹	wɣrum	white
*rp ^h [ə] ^y m	rp ^h óm	𐞗 ⁰⁹⁷⁵ pa ^{kr} r ¹ ‘congeal’	jpɣom	ice
*rts ^h æ ^y v	rts ^h áv	𐞗 ⁰⁵¹² tsa ^{kr}	mdzartsié (Bragbar)	Xanthoxyle
*mŋo ^y d	mŋód	𐞗 ²¹²⁸ məð ^{kr}	γɣmut	blow
*rd[w] ^y	rdû	𐞗 ⁰⁰⁹¹ the ^{kr} w ²	a-tuɣ	meet
*dæ ^y ɣ	dâɣ	𐞗 ⁰⁰⁰⁸ do ^{kr}	tɣ-ndɣɣ	poison
*p ^h [o] ^y	p ^h ó	𐞗 ²⁴⁵¹ pɔ ^{kr2}	p ^h ɣo	flee
*ɣd[o] ^y	ɣdó	𐞗 ⁰²¹⁴ lu ^{kr2}		poor
*ɛr[o] ^y	ɛrô	𐞗 ¹²⁷⁴ ru ^{kr} r ¹ ra ^{kr} r ²		narrow
*ɣ[o] ^y	ɣó	𐞗 ¹²⁷⁴ wo ^{kr2}		be able
*næ ^y r[æ]	nâri	𐞗 ¹²⁷⁴ na ^{kr} r ¹ ra ^{kr} r ²		tomorrow
*ku ^(y) tæ ^y	kəta	𐞗 ¹²⁷⁴ kə ^{kr} r ¹ ta ^{kr} r ¹ ‘puppy’		dog

5.2 Khroskyabs velarisation = Tangut non-uvularisation

Table 40 shows examples of velarisation in Khroskyabs corresponding to non-uvularisation in Tangut. The first three examples, 𐞗⁴⁶⁰² ʔar¹ ‘eight’, 𐞗⁰⁸¹¹ ʔaar² ‘day’, and 𐞗¹⁸⁹⁴ ʔar¹ ‘daughter-in-law’, are probably regular, as the uvular colouring is probably removed in these words (Gong 2017). The rest of the examples, including the West Gyalrongic innovation, *m[ə]^yri^(y)d ‘footprint’, are less straightforward to explain.

The Tangut word 𐞗⁵³⁸² 𐞗⁰⁵⁷⁵ mə²rar² ‘footprint’ is probably related to the combination of 𐞗⁵³⁸² mə² ‘leg’ and 𐞗¹⁷¹⁵ rar¹ ‘write’, originally meaning ‘leg/foot that is written’. In Siyuewu, the cognate is *moríd* (< *m[ə]^yri^d). The second syllable, *ri^d*, is related to the attested past stem (Stem 2) of *réd* ‘write’, which is *rîd*. The first part, the now obsolete *mo-* (< *m[ə]^y-), is logically related to 𐞗⁵³⁸² mə² ‘leg’ in Tangut. A possible explanation for its velarity is that the irregular velarisation in Khroskyabs is due to a verbal prefix on *rîd* (write.II), as this verb normally requires a velar *kə-* as its past prefix, as shown in (12).

- (12) *jêdoŋva* = ɣə ætê dzədó = tə rê ku-rîd
 inhabitant.of.jêdoŋ = ERG DEM book = DEF one PST.INV-write.II
 ‘Someone from *jêdoŋ* wrote that book.’
 (syw2675²⁰)

Alternatively, the velar prefix could be an old marker for the patient-like relativisation, *kV-*, widely found in East Gyalrongic languages (Jacques 2016; Sun 2006). Khroskyabs

²⁰“Syw2675” means the 2675th sentence in my database. The reader is invited to contact me for more examples.

may have also had this prefix, however it is no longer used. **kV-rid* could therefore have meant ‘thing that is written’.

The Siyuewu form may have undergone the change outlined in (13).

$$(13) \quad *m\emptyset \quad *kV-rid > *m\emptyset-k-rid > *m\emptyset^Yrid$$

The examples **cvæ^(Y)r* ‘evening’ and **bro^(Y)* ‘horse’ are probably irregular in Khroskyabs, as one would expect them to have been non-velarised on the basis of external comparison, as discussed in Sections 4.4.3 and 4.4.6.

Notice that except for **m[o]^Y* ‘brother’, all the other examples from ‘footprint’ to ‘need’ are verbs. It could be that it is Khroskyabs that underwent some secondary velarisation, compressing, for example, the Gyalrongic infinitive prefix **kV-*, into the vowel. If this explanation is valid, the only irregular form that should not have undergone velarisation is **m[o]^Y* ‘brother’.

Table 40: Khroskyabs velarisation = Tangut non-uvularisation.

Pre-Khroskyabs	Siyuewu	Tangut	Japhug	Gloss
<i>*vjæ^Yd</i>	<i>vjád</i>	𪛗 ⁴⁶⁰² <i>ʔar¹</i>	<i>kuurcat</i>	eight
<i>*rjæ^Yɣ</i>	<i>rjáy</i>	𪛗 ⁰⁸¹¹ <i>ʔaar²</i> ‘day’	<i>tx-rʒaʒ</i>	day and night
<i>*rjæ^Yv</i>	<i>rjáv</i>	𪛗 ¹⁸⁹⁴ <i>ʔar¹</i> ‘daughter-in-law’	<i>tx-rʒaβ</i>	wife
<i>*cvæ^(Y)r</i>	<i>cvár</i>	𪛗 ⁰²⁸⁴ <i>ɕwo¹</i>	<i>ɕɣr</i>	evening
<i>*bro^(Y)</i>	<i>bró</i>	𪛗 ⁰⁷⁶⁴ <i>rej¹</i>	<i>mbro</i>	horse
<i>*m[ə]^Yrid</i>	<i>moríd</i>	𪛗 ⁰³³⁰ <i>mɪ²rar²</i>		footprint
<i>*rm[o]^Y</i>	<i>rmô</i>	𪛗 ⁰³³⁰ <i>meej¹</i>	<i>rma</i> ‘spend a night somewhere’	dream
<i>*sæ^Yd</i>	<i>sâd</i>	𪛗 ⁴²²⁵ <i>sa¹</i>	<i>sat</i>	kill
<i>*c^h[o]^Y</i>	<i>c^hô</i>	𪛗 ⁰⁰⁷⁰ <i>thwə¹</i> ‘excavate’	<i>cw</i>	open
<i>*snæ^Yd</i>	<i>snád</i>	𪛗 ⁵¹⁹² <i>nwə²</i>	<i>nwt</i>	burn
<i>*ɣdzə^Yv</i>	<i>ɣdzóv</i>	𪛗 ⁴⁶⁶² <i>dzə¹</i>	<i>ndzɣβ</i>	burn
<i>*r[o]^Y(d)</i>	<i>ród</i>	𪛗 ⁵⁵²³ <i>rar¹</i>	<i>ra</i>	need
<i>*m[o]^Y</i>	<i>mô</i>	𪛗 ⁰³⁵⁵ <i>mu¹</i> ‘mother’s brother’	<i>tx-wɣmu</i>	brother

5.3 Khroskyabs non-velarisation = Tangut uvularisation

Table 41 shows non-velarised examples in Khroskyabs that correspond to uvularised cognates in Tangut.

Most of the uvularised cognates with Tangut shown in the table are innovations. For the first four examples, from ‘bird’ to ‘ten’, uvularisation could be caused by the velar or uvular medials preserved in Khroskyabs or Japhug. For the next five examples, from ‘sister’ to ‘half’, uvularisation is due to the uvular initial preserved in Khroskyabs and Japhug. The following example, ‘side’, gets its uvularisation from the guttural codas preserved in Khroskyabs and Japhug. The examples from ‘deer’ to ‘drum’ may have had uvular or velar preinitials originally, as their cognates show.

The last five examples lack satisfactory explanations. However, the pharyngeal medial *-ʕ-* in Tangut, as reconstructed by Gong (2017), is always accompanied by the uvularisation

of the following vowel. Therefore, the uvularisation on 𪛗²⁴⁷⁵ $ph\acute{\iota}a^{k1}$ ‘break’, 𪛗⁵³⁹⁰ $ph\acute{\iota}i^{k2}$ ‘loosen, detach’ and 𪛗⁴⁰³⁶ 𪛗³³³² $dz\acute{\iota}w\acute{\alpha}^{k1}dz\acute{\iota}(w)i^{k1}$ ‘pull’ could also be secondary.²¹ The remaining two examples will be unexplained.²²

Table 41: Khroskyabs non-velarisation = Tangut uvularisation.

Pre-Khroskyabs	Siyuewu	Tangut	Japhug	Gloss
* $pj\acute{\alpha}z[\acute{\alpha}]$	$pj\acute{\epsilon}z\acute{\alpha}$	𪛗 ⁵¹³⁴ wi^{k1}	pya	bird
* $sj[\acute{\alpha}](d)$	$sj\acute{\alpha}d$	𪛗 ¹⁰⁸⁴ ka^{k1}	sqi	ten
* $nzy\acute{\alpha}$	$nzy\acute{\iota}$	𪛗 ⁴⁹⁶⁶ wi^{k1}	sya	rust
* $nsy[\acute{\alpha}]$	$nts^h\acute{\gamma}\acute{\alpha}$	𪛗 ⁵⁹⁵⁷ tse^{k1}	$ntsye$	sell
* $sq\acute{\alpha}$	$sq\acute{\iota}$	𪛗 ³³⁶¹ $q\acute{\iota}\acute{\epsilon}^{k1}$	$tx-sq^h\acute{\chi}j$	sister
* $sk\acute{\alpha}$	$sk\acute{\iota}$	𪛗 ²¹⁴⁴ $k\acute{\iota}\acute{\epsilon}^{k1}$	sqa	cook
* $vk\acute{\alpha}$	$vk\acute{\iota}$	𪛗 ³⁵⁹⁶ $k\acute{\iota}we^{k1}$	βka	win
* $rq\acute{\alpha}$	$rq\acute{\epsilon}$	𪛗 ⁰⁴⁵⁸ $q\acute{\alpha}^{k1}$	$tu-rq\acute{\alpha}$	throat
* $c^h[w]$	$c^h\acute{\alpha}$	𪛗 ⁰⁰⁷⁴ $qhwa^{k1}$	$tu-qiu$	half
* $p^h\acute{\alpha}\acute{\gamma}$	$p^h\acute{\alpha}\acute{\gamma}$	𪛗 ³⁹³⁶ pha^{k1}	$u-p^h\acute{\alpha}k$	side
* $rts\acute{\alpha}z$	$rts\acute{\alpha}z$	𪛗 ⁵¹⁸¹ tsa^{k1} ‘wild animal’	$qarts^h\acute{\alpha}z$	deer
* $\chi sp\acute{\alpha}$	$\chi sp\acute{\iota}$	𪛗 ⁰⁴⁹⁹ $p\acute{\iota}i^{k1}$	$qa\acute{\epsilon}pa$	frog
* $km[w]$	$km\acute{\alpha}$	𪛗 ⁴⁴⁰⁸ $m\acute{\alpha}\acute{\alpha}^{k1}$	smi	fire
* $\gamma d[\acute{\alpha}]$	$\gamma d\acute{\alpha}$	𪛗 ⁵⁸⁴⁵ $(l)(w)\acute{\alpha}^{k2}$	χtu	buy
* γbo	$\gamma b\acute{\epsilon}$	𪛗 ⁵⁵²⁸ ba^{k1}	$tx-rmbyo$	drum
* $p^hr\acute{\alpha}d$	$p^hr\acute{\alpha}d$	𪛗 ²⁴⁷⁵ $ph\acute{\iota}a^{k1}$	$pr\acute{\chi}t$	break
* $p^hr[\acute{\alpha}]$	$p^hr\acute{\alpha}$	𪛗 ⁵³⁹⁰ $ph\acute{\iota}i^{k2}$		loosen, detach
* $dz[\acute{\alpha}]dz[\acute{\alpha}]$	$dz\acute{\alpha}dz\acute{\alpha}$	𪛗 ⁴⁰³⁶ 𪛗 ³³³² $dz\acute{\iota}w\acute{\alpha}^{k1}dz\acute{\iota}(w)i^{k1}$		pull
* $m[w]$	$m\acute{\alpha}$	𪛗 ³⁵¹³ $m\acute{\alpha}^{k1}$	$tu-mu$	sky
* $\gamma m[o]r$	$\gamma m\acute{\alpha}r$	𪛗 ³⁹²⁵ mu^{k1} ‘darkness’	$juymur$ ‘tonight’	last night

5.4 Summary

Table 42 summarises the counts of explainable and unexplainable cognates, a distinction between strictly and loosely (un)explainable is made according to the analyses of the pre-

²¹As a reviewer points out, There is no evidence of the initial, rhyme and tone of 𪛗⁴⁰³⁶ 𪛗³³³² $dz\acute{\iota}w\acute{\alpha}^{k1}dz\acute{\iota}(w)i^{k1}$ ‘pull’ in the Tangut manuscripts. The current reconstruction is based on the possible rhyme alternation discussed in Gong (1997), note 8.

²²The preinitial γ - in * $\gamma m\acute{\alpha}r$ ‘last night’ is not related to the uvularisation in the cognate with Tangut (which means ‘darkness’), it is a morpheme meaning ‘last’, also found in $xsn\acute{\alpha}$ (/ γ - $sn\acute{\alpha}$ / (last-day)) ‘yesterday’.

vious sections.

Table 42: Comparison counts.

	Total counts	Explainable	Unexplainable
Khros. velar = Tang. uvular	32		
Khros. velar = Tang. non-uvular	13	5 (strict), 12 (loose)	8 (strict), 1 (loose)
Khros. non-velar = Tang. uvular	20	15 (strict), 17 (loose)	5 (strict), 3 (loose)
Total	65	52 (strict), 61 (loose)	13 (strict), 4 (loose)

Among the 65 cognate sets, between 52 and 61 can be considered regular, and irregular sets could be reduced to as few as 4. This observation indicates that Khroskyabs velarisation is historically related to Tangut uvularisation. Moreover, all of the 7 West Gyalrongic innovations included in this analysis are at least loosely explainable, with 5 strictly corresponding to each other (as well as one marginally explained), implying that velarisation/uvularisation continued as a productive process in Proto-West-Gyalrongic.

6 Final remarks

This paper proposes a reconstruction of the Pre-Khroskyabs vowel system based on the analysis of bound state apophony in compound words. The actual problem that this paper solves is restricted to one of the Khroskyabs varieties; however, by proposing a technical analysis to the apophony problem, I have shown that the results can be directly compared to similar phenomena in other Gyalrongic languages, especially Tangut, which is the only attested mediaeval Gyalrongic language. The successful cross-linguistic comparison implies that velarisation is important to Trans-Himalayan historical linguistics.

In particular, I have shown that: 1) modern Siyewu Khroskyabs *-i* that corresponds to Gyalrong **-a* should be reconstructed with an open vowel as **-æ*, and that 2) modern Siyewu Khroskyabs *-e* corresponding to Gyalrong **-o* should be reconstructed as **-o*. That is to say, the raising of **-æ* and **-o* must have happened at least by the time of the West Gyalrongic split.

Vowel raising and fronting, or “brightening”, to use Matisoff’s (2004) term, is widely found in Burmo-Gyalrongic languages. In Gyalrongic languages, it happened in most West Gyalrongic varieties, especially Khroskyabs and Tangut, and affected some East Gyalrongic branches, such as Zbu (Gong 2018) and Bragbar Situ (Zhang 2019). This phenomenon could be considered an areal feature which developed independently in different languages.

“Brightening” is common not only in Burmo-Gyalrongic languages, but also in many languages in the world: Attic-Ionic Greek raised **-a:* into **-e:* (Samuels 2017: 92), modern Sarawak varieties are known to have fronted proto-**a* into *e* or *i* in different positions (Blust 2000), not to mention the famous Great Vowel Shift, involving both raising and lowering, in particular, with the Old English *a:* turning into *e:*, and further into *iə* in some English dialects.

To explain vowel raising and fronting in modern Siyuewu, as well as other phenomena observed in apophony, I postulated a series of velarised vowels. Some velarisations are inherited, others are innovated, but briefly speaking, velarisation blocked vowel raising and it is the inherited velarisation that is most important to compare from a Gyalrongic perspective.

As velarisation is also attested Zbu (Gong 2018; Sun 2004) and Shangzhai (Sun 2000a), and velar segments corresponding to some velarised vowels in Khroskyabs are attested in Japhug, there is no doubt that velarisation is an old phenomenon. I have demonstrated in the paper that Khroskyabs velarisation is consistent with Tangut uvularisation, which is even true for shared innovated items across the two languages. The productivity of velarisation or uvularisation continued in Proto-West-Gyalrongic, which also indicates that this phenomenon could have some segmental origin with certain grammatical functions. Future studies on Proto-Gyalrongic rhyme systems should not neglect the existence of velarisation, which now seems to be vital for the understanding of Gyalrongic historical morphophonology.

Apart from the significance for Trans-Himalayan historical linguistics, the present paper also underlines the importance of understanding the internal morphology of a language. Although scholars agree upon the importance of internal reconstruction in historical linguistics, its role in assisting comparative study may still be underestimated, especially when specialists are not entirely familiar with all the varieties they compare. Moreover, in many cases, the Comparative Method can, more often than not, explain things that can also be explained by internal reconstruction. If Hittite had been deciphered before Saussure, laryngeals would have been reconstructed through the Comparative Method. However, this study is an example showing that internal reconstruction can explain phenomena that the Comparative Method cannot explain. Internally reconstructed forms could stand to be more archaic than proto-forms reconstructed through external comparison. Some Pre-Khroskyabs vocalic contrasts, such as **æ/*æ^v* and **-ʊ/*-o-*, can hardly be reconstructed by comparing different dialects. Needless to say, without internal reconstruction, we will not be able to explain bound state apophony and other relevant phenomena.

Abbreviations

Glosses follow the Leipzig Glossing Rules. Additional abbreviations are listed as follows: DIM: diminutive, INV: inverse, PART: particle.

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References

- Baxter, William H. & Laurent Sagart. 2014. *Old Chinese: A new reconstruction*. Oxford: Oxford University Press.
- Blust, Robert. 2000. Low-vowel fronting in Northern Sarawak. *Oceanic Linguistics* 39(2). 285–319.
- Campbell, Lyle. 2013. *Historical linguistics*. Edinburgh: Edinburgh University Press.
- Chiu, Chenhao & Jackson T.-S. Sun. 2020. On pharyngealized vowels in Northern Horpa: An acoustic and ultrasound study. *The Journal of the Acoustical Society of America* 147(4). 2928–2946.
- Coblin, Weldon South. 1976. Notes on Tibetan Verbal Morphology. *T'oung Pao* 62. 45–70.
- Evans, Jonathan P., Jackson T.-S. Sun, Chenhao Chiu & Michelle Liou. 2016. Uvular approximation as an articulatory vowel feature. *Journal of the International Phonetic Association* 46(1). 1–31.
- Fellner, Hannes & Nathan Hill. 2019. Word families, allofams, and the comparative method. *Cahiers de Linguistique Asie Orientale* 48(2). 91–124.
- Francis, David A., Robert Leavitt & Margaret Apt. 2008. *A Passamaquoddy-Maliseet dictionary*. Orono: University of Maine Press.
- Gerdts, Donna B. 1998. Incorporation. In Andrew Spencer & Arnold Zwicky (eds.), *The handbook of morphology*. Oxford: Blackwell.
- Gong, Hwang-chenng. 1994. A hypothesis of three grades and vowel length distinction in Tangut. *Journal of Asian and African Studies* 46-47. 305–314.
- Gong, Hwang-chenng. 1997. 西夏語若干韻母轉換的起源-重疊複合詞 Xīxià yǔ ruògān yùnmǔ zhuǎnhuàn de qǐyuán - chóngdié fùhé cí [The origin of some Tangut rime alternations: reduplicated compound words]. *中國境內語言暨語言學 Zhōngguó Jìngnèi yǔyán jì yǔyánxué* [Language and linguistics in China] 4. 265–289.
- Gong, Xun. 2017. Grade II in Tangut and Hexi Late Middle Chinese. Paper presented at Recent Advances in Tangut Studies, School of Oriental and African Studies, University of London, 24 January.
- Gong, Xun. 2018. *Le rgyalrong zbu, une langue tibéto-birmane de Chine du Sud-ouest : Une étude descriptive, typologique et comparative*. Paris: Institut National des Langues et Civilisations Orientales dissertation.
- Gong, Xun. 2020. Uvulars and uvularization in tangut phonology. *Language and Linguistics* 21(2). 175–212.
- Hockett, Charles Francis. 1981. The phonological history of menominee. *Anthropological Linguistics* 23(2). 51–87.
- Huang, Bufan. 2007. 拉瑪戎語研究 *Lāmàróngyǔ yánjiū* [Study on the Lavrung language]. Beijing: Nationalities Press.
- Jacques, Guillaume. 2004. *Phonologie et morphologie du japhug (Rgyalrong)*. Paris: Université Paris Diderot (Paris 7) dissertation.

- Jacques, Guillaume. 2009. The origin of vowel alternations in the Tangut verb. *Language and Linguistics* 10(1). 17–28.
- Jacques, Guillaume. 2012a. An internal reconstruction of Tibetan stem alternations. *Transactions of the Philological Society* 110(2). 212–224.
- Jacques, Guillaume. 2012b. From denominal derivation to incorporation. *Lingua* 122(11). 1207–1231.
- Jacques, Guillaume. 2014a. *Esquisse de phonologie et de morphologie historique du tangoute*. Leiden: Brill.
- Jacques, Guillaume. 2014b. On Coblin’s law. In Richard VanNess Simmons & Newell Ann Van Auken (eds.), *Studies in Chinese and Sino-Tibetan linguistics: Dialect, phonology, transcription and text*, 1, 155–165. Taipei: Institute of Linguistics, Academia Sinica.
- Jacques, Guillaume (ed.). 2015. *Dictionnaire Japhug-Chinois-Français*. Paris: Projet HimalCo.
- Jacques, Guillaume. 2016. Subjects and objects in Japhug and relativization. *Journal of Chinese Linguistics* 44(1). 1–28.
- Jacques, Guillaume. 2021. *A grammar of Japhug*. Berlin: Language Science Press.
- Jacques, Guillaume, Aimée Lahaussais, Boyd Michailovsky & Dhan Bahadur Rai. 2012. An overview of Khaling verbal morphology. *Language and linguistics* 13(6). 1095–1170.
- Lai, Yunfan. 2013a. Wobzi Lavrung Database, in *rGyalrongic Languages Database*. http://pdesign.sakura.ne.jp/_rgyalrong/ (accessed 26 Jan 2022).
- Lai, Yunfan. 2013b. 俄热话的辅音重叠 *Èrèhuà de fǔyīn chóngdié* [The consonantal reduplication in Wobzi]. *民族语文 Mǐnzú yǔwén* [Minority Languages of China] (6). 12–18.
- Lai, Yunfan. 2015. The person agreement system of Wobzi Lavrung (rGyalrongic, Tibeto-Burman). *Transactions of the Philological Society* 113(3). 271–285.
- Lai, Yunfan. 2016. Causativisation in Wobzi and other Khroskyabs dialects. *Cahiers de Linguistique - Asie Orientale* 45(2). 148–175.
- Lai, Yunfan. 2017. *Grammaire du khroskyabs de Wobzi*. Paris: Université Sorbonne Nouvelle (Paris 3) dissertation.
- Lai, Yunfan. 2018. Relativisation in Wobzi Khroskyabs and the integration of genitivisation. *Linguistics of the Tibeto-Burman Area* 41(2). 219–262.
- Lai, Yunfan. 2020. The historical development of inverse marking in Khroskyabs: Evidence from two modern varieties: Siyuewu and Wobzi. *Bulletin of the School of Oriental and African Studies* 83(2). 259–281.
- Lai, Yunfan. 2021a. Betrayal through obedience: The history of the unusual inflection chain in Khroskyabs. *Linguistic Typology* 25(1). 79–122.
- Lai, Yunfan. 2021b. The complexity and history of verb stem ablauting patterns in Siyuewu Khroskyabs. *Folia Linguistica* 55(1). 75–126.
- Lai, Yunfan, Xun Gong, Jesse P. Gates & Guillaume Jacques. 2020. Tangut as a West Gyalrongic language. *Folia Linguistica Historica* 41(1). 171–203.
- Lai, Yunfan & Shuya Zhang. 2019. Plant terms as key to nominal morphology in Rgyalrongic languages: The cases of Brag-bar Situ and Khroskyabs. Paper presented at the Fifth Workshop on Sino-Tibetan Languages of Southwest China, Nankai University, 21–23 August.

- Li, Fang-Kuei. 1933. Certain Phonetic Influences of the Tibetan Prefixes upon the Root Initials. *Bulletin of the Institute of History and Philology* 6.2. 135–157.
- Lin, You-Jing, Jackson T.-S. Sun & Alvin C.-H. Chen. 2012. 蒲西霍爾語軟顎化的語音對立 Púxī Huò'ěryǔ ruǎn'èhuà de yǔyīn duìlì [Non-consonantal velarization in Puxi Horpa]. *语言学论丛 Yǔyánxué Lùncóng* [Essays in linguistics] 45. 187–195.
- Matisoff, James A. 2003. *Handbook of Proto-Tibeto-Burman: System and philosophy of Sino-Tibetan reconstruction*, vol. 135. Berkeley and Los Angeles: University of California press.
- Matisoff, James A. 2004. “Brightening” and the place of Xixia in the Qiangic branch of Tibeto-Burman. In Ying-chin Lin, Fang-min Hsu, Chun-chih Lee, Jackson T.-S. Sun, Hsiu-fang Yang, & Dah-an Ho (eds.), *Studies on Sino-Tibetan Languages: Papers in honor of Professor Hwang-Cherng Gong on his seventieth birthday* (Language and Linguistics Monograph Series W4), 327–352. Taipei: Institute of Linguistics, Academia Sinica.
- Mattissen, Johanna. 2003. *Dependent-head synthesis in Nivkh: A contribution to a typology of polysynthesis*. Amsterdam & Philadelphia: John Benjamins.
- Meillet, Antoine. 1925. *La méthode comparative en linguistique historique*. H. Aschegoug & co.
- Michailovsky, Boyd. 2012. Internal reconstruction of the Dumi verb: Lexical bases and stem formation. *Linguistics of the Tibeto-Burman Area* 35(2). 49–87.
- Mithun, Marianne. 1984. The evolution of noun incorporation. *Language* 60(4). 847–894.
- Sagart, Laurent, Guillaume Jacques, Yunfan Lai, Robin J. Ryder, Valentin Thouzeau, Simon J. Greenhill & Johann-Mattis List. 2019. Dated language phylogenies shed light on the ancestry of Sino-Tibetan. *Proceedings of the National Academy of Sciences* 116(21). 10317–10322, <https://www.pnas.org/content/116/21/10317.full.pdf> (accessed 11 May 2020).
- Samuels, Bridget D. 2017. Vocalic shifts in Attic-Ionic Greek. *Papers in Historical Phonology* 2. 88–115.
- Sapir, Edward. 1911. The problem of noun incorporation in American languages. *American Anthropologist* 13. 250–82.
- Stanford Phonology Archive. 2019a. *Kazym-berezover-suryskarer khanty sound inventory (spa)*, Jena: Max Planck Institute for the Science of Human History, <https://phoible.org/inventories/view/184>, accessed 22 Jan 2022.
- Stanford Phonology Archive. 2019b. *Vietnamese sound inventory (spa)*, Jena: Max Planck Institute for the Science of Human History, <https://phoible.org/inventories/view/15>, accessed 22 Jan 2022.
- Sun, Jackson T.-S. 2000a. Parallelisms in the verb morphology of Sidaba rGyalrong and Lavrung in rGyalrongic. *Language and Linguistics* 1(1). 161–190.
- Sun, Jackson T.-S. 2000b. Stem alternations in Puxi verb inflection: Toward validating the rGyalrongic subgroup in Qiangic. *Language and Linguistics* 1(2). 211–232.
- Sun, Jackson T.-S. 2004. Verb-stem variations in Showu rGyalrong. In Ying-chin Lin, Fang-min Hsu, Chun-chih Lee, Jackson T.-S. Sun, Hsiu-fang Yang, & Dah-an Ho (eds.), *Studies on Sino-Tibetan languages: Papers in honor of Professor Hwang-cherng Gong on his seventieth birthday* (Language and Linguistics Monograph Series W4), 269–296. Taipei:

- Institute of Linguistics, Academia Sinica.
- Sun, Jackson T.-S. 2005. Linguistic coding of generic human arguments in rGyalrongic languages. Paper presented at the 11th Himalayan Languages Symposium, Chulalongkorn University, 6–9 September.
- Sun, Jackson T.-S. 2006. 草登嘉戎語的關係句 Cǎodēng Jiāróngyǔ de guānxìjù [Relative clauses in Tshobdun Rgyalrong]. *Language & Linguistics* 7(4). 905–933.
- Sun, Jackson T.-S. 2008. Tonality in Caodeng rGyalrong. In Brigitte Huber, Marianne Volkart, & Paul Widmer (eds.), *Chomolangma, Demawend und Kasbek: Festschrift für Roland Bielmeier zu seinem 65 Geburtstag*, 257–280. Halle (Saale): International Institute for Tibetan and Buddhist Studies.
- Sun, Jackson T.-S. & Jonathan P Evans. 2013. 麻窩羌語元音音系再探 Mǎwō Qiāngyǔ yuányīn yīnxì zàitàn [The vocalic system of Mawo Qiang revisited]. In Gang Peng & Feng Shi (eds.), *Eastward flows the great river: Festschrift in honor of Professor William S.-Y. Wang on his 80th birthday*, 135–151. Hong Kong: City University of Hong Kong Press.
- Yin, Weibin. 2007. 业隆拉坞戎语研究 Yèlóng Lāwùróngyǔ Yánjiū [Study on the 'Jorogs Lavrung language]. Beijing: Nationalities Press.
- Zhang, Shuya. 2019. From proximate/obviative to number marking: Reanalysis of hierarchical indexation in Rgyalrong languages. *Journal of Chinese Linguistics* 47(1). 125–150.
- Zhang, Shuya. 2020. *Le rgyalrong situ de Brag-bar et sa contribution à la typologie de l'expression des relations spatiales: L'orientation et le mouvement associé*. Paris: Institut national des langues et des civilisations orientales doctoral dissertation.