CHAPTER 3

THE PHONOLOGY OF GEBA 1

3.1 Introduction

Geba is a Western Central Karenic language which is spoken in Taungoo township. There are two dialects in Geba which are called Geba 1 and Geba 2 in this study. There are 36 Geba villages together which include both dialects. The villagers are mostly farmers. This language does not yet have an orthography. So the phonological description of Geba 1 will help the Geba people to understand their language system.

In this chapter, the phonological description will be presented including consonants, vowels, tones, and syllable structure.

3.2 Phonemes

3.2.1 Geba 1 Consonant Phonemes

Saw Lar Baa produced a phonological description of Geba (which he spells 'Gebah'). There are 32 consonant phonemes in his data including those which occur rarely. These phonemes are enclosed in parenthesis. This inventory of consonants for Geba is shown in the following table.

		Labial	Dental	Alveolar	Postalv	Velar	Glottal
Plosive	fortis vl asp	p^h		t^h		k^h	
	fortis vl	p	t̪	t		k	ʔ
	lenis vd	b		d		(g)	
Implosive	lenis vd	ɓ		ɗ			
Affricate	fortis vl				tʃ		
	lenis vl				(d̥ʒ)		
Fricative	fortis vl asp			s^h			
	lenis vl			s	ʃ	(x)	h
	lenis vd					ɣ	(ɦ)
Nasal	voiced	m		n		(ŋ)	
	voiceless	(m̥)		(n̥)			
Trill				(r)			
Approximant		w		l	j		
Lateral Fricative				ɬ			

Table 45: Geba consonant inventory (Saw Lar Baa 2001: 50)

In this study of Bennett's data on Geba 1, there are three series of stops: voiceless aspirated, voiceless unaspirated, and voiced unaspirated. Geba 1 has two nasals, two types of fricatives (voiceless aspirated and voiceless unaspirated), three liquids, two glides, and one affricate. The inventory of Geba 1 consonants is shown in the following table.

		Bilabial	Labial-Velar	Dental	Alveolar	Postalv	Alveolo Palatal	Palatal	Uvular	Velar	Glottal
Plosive	Asp.	p^h(30)			t^h(48)					k^h(59)	
	Vl.	p(66)			t(76)					k(71)	ʔ(32)
	Vd.	b(42)			d(45)			ɟ(3)	ɢ(1)		
Fricative	Asp.				s^h(48)	$ʃ^h$(7)					
	Vl.		ʍ(8)	θ(51)	s(31)					x(1)	h(44)
Affricate							tɕ(1)				
Nasal	Vd.	m(65)			n(32)		$tɕ^h$(1)				
Liquid Lateral fricative					ɬ(10)						
Lateral approximant					l(92)						
Trill					r(2)						
Glide			w(52)				j(25)				

Table 46: Raw consonant phone chart in Geba 1 and frequency counts

The table above shows the raw data phones which are occur in the Geba 1 word list. As listed in table 46, there are 27 consonant phones. The raw data in this study differs in several points from Saw Lar Baa's consonant inventory. Saw Lar Baa has /t̪, g, ɓ, ɗ, tʃ, d̪ʒ, ʃ, s, ɣ, ŋ, m̪, n̪, ɲ / which Bennett's word list doesn't have; While Bennett's word list has /ɟ, ɢ, tɕ, $tɕ^h$, $ʃ^h$, ʍ, θ/ which Sar Lar Baa's consonant inventory doesn't have.

From the word list, the initial and medial elements of Geba 1 can be summarized as follows:

1. There are 21 consonant phones /p^h, t^h, k^h, p, t, k, ʔ, b, d, s^h, $ʃ^h$, s, ʍ, θ, h, m , n, ɬ, l, w, j/ and 11 consonant clusters /pl, pw, tɕ, kl, hm, hn, p^hl, lw, t^hw, k^hl, k^hw/, which may occur initially or medially in a word.
2. There is one consonant phone /ɟ/ and 7 consonant clusters /pj, kw, mj, θw, hl, jw, sw/ , which occur only initially in a word.

3. There are 3 consonant phones /ɢ, x, r/ and 2 consonant clusters /tɕh, p^hj/, which occur only medially in a word.
4. There is only 1 consonant phone /j/ which may occur in the final position in a word. Elsewhere the phoneme /j/ occurs as part of a consonant cluster. We have only one example of a word final consonant.

The following table shows the initial elements and the medial elements of words which occur in the Geba 1 word list, including consonant clusters. The numbers in the table show the frequency of the consonant phones which occur in the word list.

	Initial	Medial	Final	Total
p^h	9	16		25
t^h	22	23		45
k^h	21	26		47
p	18	17		35
t	37	37		76
k	30	29		59
ɢ		1		1
ʔ	16	16		32
b	17	25		42
d	25	20		45
ɟ	3			3
s^h	26	22		48
$ʃ^h$	6	1		7
s	16	13		29
ʍ	7	1		8
θ	29	21		50
x		1		1
h	14	7		21

Table 47: The frequency of consonants in Geba 1 words

	Initial	Medial	Final	Total
m	23	24		47
n	7	20		27
ɬ	7	3		10
l	29	29		58
r		2		2
w	6	9		15
j	8	11	1	20
pj	2			2
pl	6	2		8
pw	6	15		21
tɕ	1			1
$tɕ^h$		1		1
kw	1			1
kl	2	9		11
mj	1			1
θw	1			1
hm	10	7		17
hn	4	1		5
hl	1			1
jw	1			1
p^hj		1		1
k^hw	1	4		5
lw	2	1		3
p^hl	2	2		4
sw	2			2
k^hl	6	1		7
t^hw	1	2		3

Table 47: The frequency of consonants in Geba 1 words

3.2.1.1 Consonant Phoneme Contrasts

Selected contrasts between phonetically similar segments are illustrated in analogous environments or minimal pairs in the following section.

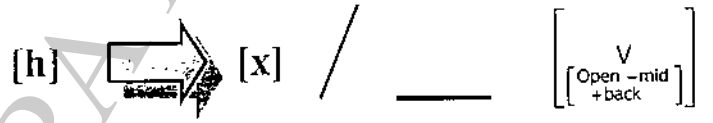
a)	[pʰ] – [p]	pʰuɬ˥ *'belly'*	puɬ˥ *'to be thin'*
	[tʰ] – [t]	tʰiɬ˥ *'to kick'*	tiɬ˥.paɬ.piɬ *'black'*
	[kʰ] – [k]	kʰlɔɬ *'pillow'*	klɔɬ *'green'*
b)	[p] – [b]	pɔɬ *'to vomit'*	bɔɬ *'to be fat'*
	[t] – [d]	taɬ.pe̱ɻ *'to sing'*	daɬ *'to be short(height)'*
c)	[pʰ] – [b]	pʰɔɬ *'flower'*	bɔɬ *'to be fat'*
	[tʰ] – [d]	tʰiɬ˥ *'water'*	diɬ˥ *'to be thick'*
d)	[ʔ] – [h]	ʔoɬ *'bite'*	hoɬ *'firewood'*
		ʔaɬ *'to eat'*	a.pwe̱ɬ.sʰiɬ *'ten (persons)'*
e)	[k] – [h]	kiɬ.doɬ˥ *'clothing'*	hiɬ *'house'*
f)	[m] – [n]	mi̱ɬ *'grass'*	ni̱ɬ *'day'*
g)	[m] – [w]	mi̱ɬ *'name'*	wi̱ɬ *'cane/rattan'*
h)	[s] – [sʰ]	soɬ *'cool'*	sʰoɬ.hmiɬ *'to burn'*
i)	[s] – [ʃʰ]	sɔɬ *'to be wet'*	ʃʰɔɬ *'feather'*
j)	[sʰ] – [ʃʰ]	sʰɛɬ *'to hurt'*	ʃʰɛɬ *'star'*
k)	[j] – [ɟ]	a.pwe̱ɬ.tə.kə.je̱ɬ *'hundred (persons)'*	ɟe̱ɬ *'to laugh'*
l)	[θ] – [t]	θiɬ *'comb'*	tiɬ.hɛɬ˥ *'to know'*
	[θ] - [d]	θiɬ˥ *'to die'*	diɬ˥ *'to be thick'*
m)	[l] – [n]	le̱ɬ *'warm'*	ne̱ɬ *'thou 2s'*
n)	[w] – [j]	we̱ɻ *'to be skinny'*	je̱ɻ.pwe̱ɬ *'five (persons)'*
o)	[w] – [k]	we̱ɬ *'to be good'*	ke̱ɬ.baɬ *'to return'*

(a-o) illustrate major phonological contrasts of manner: (a) between aspirated voiceless plosives and voiceless plosives, (b) between voiceless plosives and voiced plosives, (c) between aspirated voiceless plosives and voiced plosives, (d) between a voiceless glottal plosive and a voiceless glottal fricative, (e) between a voiceless velar fricative and a plosive and voiceless glottal fricative, (f) between a voiced bilabial nasal and a voiced alveolar nasal, (g) between a bilabial nasal and a labial-velar approximant, (h) between a voiceless alveolar fricative and an aspirated voiceless alveolar fricative, (i) between a voiceless alveolar fricative and an aspirated voiceless post-alveolar fricative, (j) between an aspirated voiceless alveolar fricative and an aspirated voiceless post-alveolar fricative, (k) between an alveo-palatal approximant and a palatal plosive, (l) between voiceless dental fricatives and alveolar plosives, (m) between a lateral approximant and an alveolar nasal, (n) between a labial-velar approximant and an alveo-palatal approximant, (o) between a labial-velar approximant and a voiceless velar plosive.

Note that /tɕ/ is analyzed as an affricate rather than two obstruents because of the syllable structure and because it is the only case of 2 obstruents in a cluster.

3.2.1.2 Allophones

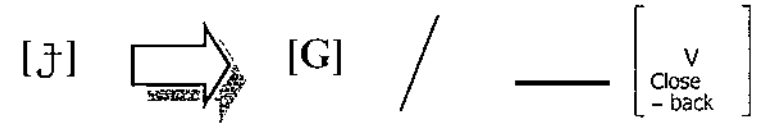
There are two consonants that have allophonic variants. The glottal fricative [h] becomes a voiceless velar fricative [x] when it occurs before an open-mid back vowel. There is only one example of [x] in the (b). This phenomenon can be expressed though the following rule.



For example,

a)	ʔaɭ.huɭ	*'to-steal'*	b) tɕɬ.xɔɬ	*'to-be-cold'*
	kʰaɬ.sɔɬ.hiɬ	*'spider-web'*		
	muɭ.hɛɬ.tɕɬ.nɨɬ	*'yesterday'*		
	sʰoɭ.kuɭ.hɛɬ	*'to-crawl'*		

The voiced palatal plosive [ɟ] becomes a voiced uvular plosive [G] when it occurs before a close front vowel. There is one example which contain [G] in this (b). This phenomenon can be expressed though the following rule.



For examples,

a) ɟɛ̱˦ *'to laugh'*
ɟɛ̱˦ *'I 1s)'*
ɟo̱˦ *'to suck'*

b) lõ˦.gi˩ *'sarong'*

In this section, we found that [x] is allophone of the phoneme /h/ and [ɢ] is an allophone of the phoneme /ɟ/. From table 47, there is only one example in /tɕ/, /tɕʰ/. For there is one example of each, but in this study will retain them because they are parts of the symmetry of similarity related to other languages. Table 48 shows the inventory of the consonant phonemes which occur in Geba 1.

		Bilabial	Labial-Velar	Dental	Alveolar	Postalv	Alveolo Palatal	Palatal	Uvular	Velar	Glottal
Plosive	Asp.	pʰ(30)			tʰ(48)					kʰ(47)	
	Vl.	p(66)			t(76)					k(59)	ʔ(32)
	Vd.	b(42)			d(45)			ɟ(3)			
Fricative	Asp.				sʰ(48)	ʃʰ(7)					
	Vl.		ʍ(8)	θ(51)	s(31)						h(21)
Affricate							tɕ(1)				
	Asp.						tɕʰ(1)				
Nasal	Vd.	m(65)			n(32)						
Liquid											
Lateral fricative					ɬ(10)						
Lateral approximant					l(92)						
Trill					r(2)						
Glide			w(52)				j(20)				

Table 48: Consonant phoneme chart in Geba 1 and frequency counts

From table 48, there are 24 consonant phonemes in Geba 1. The following examples show the occurrence of consonants in Geba 1.

/p/, voiceless bilabial stop, occurs in syllable initial position.

Examples:

	p	o̱˧	*'cow'*
ta˧.	p	o˩	*'to sing'*

/p^{h}/, aspirated voiceless bilabial stop, occurs in syllable initial position.

Examples:

	p^{h}	ɪ˧	*'to take'*
	p^{h}	ɔ˧	*'flower'*
	p^{h}	u˥˥	*'belly'*

/t/, voiceless alveolar stop, occurs in syllable initial position.

Examples:

	t	ɛ˥.mɛ˧	*'crocodile'*
	t	ɛ̱˧.s^{h}u˧	*'thorn'*
bo˧.	t	a˥˥	*'white'*

/t^{h}/, aspirated voiceless alveolar stop, occurs in syllable initial position.

Examples:

	t^{h}	ɛ˥	*'gold'*
	t^{h}	ɛ˥˥	*'bear'*
ʔɔ˧.	t^{h}	i˥	*'to drink'*

/k/, voiceless velar stop, occurs in syllable initial position.

Examples:

	k	ɛ̱˧.t^{h}i˧	*'to see'*
s^{h}o˥.	k	lo˧	*'to tie'*

/k^h/, aspirated voiceless velar stop, occurs in syllable initial position.

Examples:

	k^h	ɛɬ	*'to shoot'*
	k^h	i˥	*'tiger'*
θɛɬ.	k^h	wɛɬ	*'corn'*

/ʔ/, voiceless glottal stop, occurs in syllable initial position.

Examples:

	ʔ	a˥.hu˥	*'to steal'*
	ʔ	cɬ	*'bark'*
ʔoɬ.	ʔ	ɛɬ	*'to be many'*

/b/, voiced bilabial stop, occurs in syllable initial position.

Examples:

	b	ɛɬ	*'fat'*
	b	e˥.p^haɬ	*'to split'*
p^huɬ.	b	a˥˥	*'insect'*

/d/, voiced alveolar stop, occurs in syllable initial position.

Examples:

	d	ɛ˥˥.lɪɬ	*'house lizard'*
	d	ɪ˥˥	*'cooked rice'*
θu˥.	d	u˥˥	*'land leech'*

/s^h/, aspirated voiceless alveolar fricative, occurs in syllable initial position.

Examples:

	s^h	ɪɬ.poˌ	*'to launder'*
k^hɛɬ.	s^h	ɔɬ	*'beard'*

/ʃʰ/, aspirated voiceless post-alveolar fricative, occurs in syllable initial position.

Examples:

	ʃʰ	o˥.ka˥.kị˦	*'easy'*
	ʃʰ	ɔ˦	*'feather'*
pʰla˦.	ʃʰ	ɛ˦.kə.du˥	*'to wink'*

/ʍ/, voiceless labial-velar fricative, occurs in syllable initial position.

Examples:

	ʍ	ɛ˦	*'bee'*
	ʍ	ɛ˦.kʰɛ˦	*'to whistle'*
tə.	ʍ	i˦.tə.sʰɛ˦	*'medicine'*

/θ/, voiceless dental fricative, occurs in syllable initial position.

Examples:

	θ	ɛ˥˥	*'to be new'*
	θ	e˦.hmu˦	*'to be drunk'*
θo˦.	θ	ɛ˦	*'fruit'*

/s/, voiceless alveolar fricative, occurs in syllable initial position.

Examples:

	s	o˦	*'cool'*
	s	u˦.kʰɔ˦	*'palm'*
dɔ˦.	s	a˦	*'to count'*

/h/, voiceless glottal fricative, occurs in syllable initial position.

Examples:

	h	ɛ˦.tʰa˦	'to exit'
	h	a˥	'to weep'
ʔa˥.	h	u˥	'to steal'

/m/, voiced bilabial nasal, occurs in first and second position of the syllable.

Examples:

	m	ɛ̱˧.θi˥	*'to kill'*
	m	i̱˧	*'grass'*
θo˥.	m	ɛ̱˧	*'tooth'*
h	m	ɛ˥	*'wife'*

/n/, voiced alveolar nasal, occurs in first and second position of the syllable.

Examples:

	n	ɛ̱˧.t^{h}ɛ˧	*'nose'*
h	n	ɛ˧	*'ghost'*
h	n	a˥.dɛ˧	*'needle'*

/ɬ/, alveolar lateral fricative, occurs in syllable initial position.

Examples:

	ɬ	ɛ˥.meɻ	*'to disappear'*
	ɬ	ɪ˥˥	*'to be bright'*
θo˧.	ɬ	ɛ˧	*'leaf'*

/l/, alveolar lateral approximant, occurs in first and second position of the syllable.

Examples:

	l	ɛ̱˧	*'warm'*
	l	a̱˧.pa˧	*'plate'*
bɛ˧.	l	ɔɻ	*'to love'*

/r/, alveolar trill occurs in syllable initial position. It was noted that it occurs in two words in the word list in the medial element of Geba 1 words.

Examples:

ba˧.tɔ.	r	e˧	*'to grind'*
su˧.θi˥.	r	e˧	*'ring (finger)'*

/w/, labial-velar glide, occurs in first and second position of the syllable.

Examples:

	w	ɛɻ.tʰoɬ	*'to stand'*
	w	a̤ɬ	*'to scratch'*
taɬ.	w	iɬ	*'to be hungry'*

/j/, alveo-palatal glide, occurs in first and second position of the syllable.

Examples:

	j	eɻ.bɛɬ	*'to speak'*
	j	o̤ɬ	*'monkey'*
p	j	a̤ɬ	*'you (2p)'*

3.2.1.3 Consonant clusters

In Geba 1, the consonant clusters only occur in major syllables. The co-occurrence of C_1 and C_2 is restricted to six patterns which form consonant clusters as follows:

a) - w - cluster (C_1w)

When C_2 is /w/, the C_1 must be /s, θ, j, p, k, kʰ, l/.

C_1 and C_2 make seven -w- clusters /sw, θw, jw, pw, kw, kʰw, lw/.

Examples:

s	weɬ	*'spoon'*
θ	wiɬ	*'blood'*
p	we̤ɬ	*'to-buy'*
k	waɬ.θiɬɬ	*'betel-nut'*
kʰ	wiɬ	*'bone'*
l	wɪɻ.pwɛ̤ɬ	*'four(persons)'*

b) - m - cluster (C_1m)

When C_2 is /m/, the C_1 must be /h/.

C_1 and C_2 make one -m- cluster /hm/.

Examples:

h	mɛ˥	*'wife'*
h	mɛ˥.lɛ̱J.klɛ˧	*'forest'*

c) – n – cluster (C_1n)

When C_2 is /n/, the C_1 must be /h/.

C_1 and C_2 make one -n- cluster /hn/.

Examples:

h	nɛ˧	*'ghost'*
h	na˥.de˧	*'needle'*

d) – l – cluster (C_1l)

When C_2 is /l/, the C_1 must be /h, p, p^h, k, k^h/.

C_1 and C_2 make five -l- clusters /hl, pl, p^hl, kl, k^hl/.

Examples:

h	lɛ˥	*'moon'*
p	la˥	*'to be fast'*
p^h	lo˧	*'seed'*
k	lɔ˧	*'green'*
k^h	la˥	*'loose'*

e) – j – cluster (C_1j)

When C_2 is /j/, the C_1 must be /p, p^h, m/.

C_1 and C_2 make three -j- clusters /pj, p^hj, mj/.

Examples:

	p	ja̱˧	*'you2p'*
t^hɔ˧.	p^h	je˧˧	*'pounded rice'*
	m	je˧.bɛ˧˥	*'peanut'*

	/w/	/m/	/n/	/l/	/j/
/s/	2				
/θ/	1				
/h/		17	5	1	
/j/	1				
/p/	21			8	2
/p^h/				4	1
/m/					1
/k/	1			11	
/k^h/	2			7	
/l/	3				

Table 49: Co-occurrence of the first consonant (C_1), and second consonant (C_2) in consonant clusters in Geba 1

The co-occurrence of the first consonant (C_1) and the second consonant (C_2) in table 29 shows that:

1. There are six consonant phones /w, m, n, l, j, h/ that may occur as the second member of a consonant cluster.
2. In a – w – cluster, only a voiceless alveolar fricative, a voiceless dental fricative, a voiceless glottal fricative, an alveo-patatal glide, a voiceless bilabial plosive, a voiceless velar plosive, an aspirated voiceless velar plosive, and an alveolar lateral approximant may occur as the first member of this cluster.
3. In an – m – cluster, only a voiceless glottal fricative occurs as the first member of this cluster.
4. In an – n – cluster, only a voiceless glottal fricative occurs as the first member of this cluster.
5. In an – l – cluster, only plosives /p, p^h, k, k^h/ and a voiceless glottal fricative may occur as the first member of this cluster.
6. In a – j – cluster, only plosives /p, p^h/ and a voiced bilabial nasal may occur as the first member of this cluster.
7. In an – h – cluster, only a voiceless alveolo-palatal affricate occurs as the first member of the cluster.

3.2.2 Geba 1 Vowel Phonemes

Saw Lar Baa concluded that there are nine vowels in Geba. He noted that diphthongs are rare. The Geba vowel inventory in Saw Lar Baa's research is shown in table 50.

	Front	Central	Back
	Unrounded	Unrounded	Rounded
High	i	ɯ	u
Mid	e	ə	o
	ɛ		ɔ
Low		a	

Table 50: Geba vowel inventory (Saw Lar Baa 2001: 52)

In this study, Geba 1 vowel phones function as the syllable nucleus. There are 23 single vowel phones. All vowels can also be breathy. There are two clear vowels which occur with nasalization as follows /ẽ/, and /õ/. The vowel phones are shown in the table below.

	Front				Central		Back			
	breathy	unrounded	breathy	rounded	breathy	rounded	breathy	unrounded	breathy	rounded
Close	i̤(13)	i(77)					ṳ(1)		ʉ̤(30)	u(50)
Near-close	ɪ̤(6)	ɪ(25)								
Close-mid	e̤(31)	e(45)							o̤(18)	o(87)
Mid					ə̤(1)	ɔ(38)				
Open-Mid	ɛ̤(61)	ɛ(100)	œ̤(3)	œ (4)					ɔ̤(22)	ɔ(66)
Open	a̤(47)	a(109)								

Nasalization	ẽ(1)
	õ(1)

Table 51: Raw vowel phone chart in Geba 1 and frequency counts

3.2.2.1 Co-occurrence Charts

The following table illustrates the vowel phones which occur with initial and medial elements.

	i	i̤	ɪ	ɪ̤	u	ṳ	e	e̤	ē	o	o̤	õ	ɛ	ɛ̤	œ	œ̤	ɔ	ɔ̤	ɔ	ɔ̤	a	a̤
b					2		5			2			3						1		4	
d	2		4				4			4			2						5		4	
θ	2				2		2			10			7		1				1		5	
ʔ	2						2			4									5		3	
h	3						1			4			3								3	
j						1		1			2			1			1					2
p					1		3		1	5			3				1		1	1	2	
p^h			1		3		1			1			1						1		1	
ɟ											1			2								
k	2							2		1	5		3	1			4	1		1	2	8
k^h	2				1								3				1		4		10	
l		1				6		4			1	1		2		3				2	2	7
ɬ			1		1		1			1			1								2	
m		3		1	1	1		1			2			8					1	2		3
ʍ	1						1						4									
n		2						1						4								
s					10	1	2			1			1						1			
s^h	2		4		2					5			4						7		2	
$ʃ^h$			2							1			1						1		1	
t	3		1		1					1			1	7			12		2		3	6
t^h	3				3					6			2		1				3		4	
w		1						1						1								2
θw	1																					
hm	6		1										2								1	

Table 52: The initial elements and vowels in Geba 1

	i	i̤	ɪ	ɪ̤	u	ṳ	e	e̤	ẽ	o	o̤	õ	ɛ	ɛ̤	œ	œ̤	ə	ə̤	ɔ	ɔ̤	a	a̤
hn	1				1								1								1	
hl													1									
jw								1														
pj																						2
kl													1						1			
kw																					1	
k^hl		3								1									1		1	
lw			2																			
pl	1		1					2					1								1	
p^hl										1											1	
sw	1						1															
tɕ													1									
mj							1															
t^hw	1																					
k^hw	1																					
pw				1			2	1						2								

Table 52: The initial elements and vowels in Geba 1

	i	i̤	ɪ	ɪ̤	ɯ̤	u	ṳ	e	e̤	o	o̤	ɛ	ɛ̤	œ	ə	ɔ	ɔ̤	a	a̤
b			1					1		1		2	1			4		12	1
d	2		2			8	1	2								2		1	
θ	6									3		10						2	
ɢ		1																	
ʔ	1					1		1		5		3				2		3	
h	2					1						4							
j							1	1	2				1				6	2	1
k			1	1	1	1	3	1		1		1		1	2	2		5	

Table 53: The medial elements and vowels in Geba 1

	i	i̤	ɪ	ɪ̤	ɯ̤	u	ṳ	e	e̤	o	o̤	ɛ	ɛ̤	œ	ə	ɔ	ɔ̤	a	a̤
k^h	3					2				7		4		1	2	6		1	
l			1	1			2	1	1	1		1	6				3	3	7
ɬ						1						1						1	
m	4	1				1	5		4		2	1					2		
ʍ	1																		
n				1		2	5		2		1		4				3	1	3
p	1	1					1		1		4	3				1	1	3	1
p^h	1							3		10								2	
r								2											
s	1		1				1	3		1					1	3		2	
s^h	3					1				2		6				5		4	
$ʃ^h$												1							
t						1	2		3	4			8		14	1		2	3
t^h	8		1							2		4				1		8	
w	3								2				1						1
x																1			
hn						1													
hm	2					2										1		2	
mj								1											
kl								1		1		5				1	1		
k^hl												1							
k^hw	3											1							
pl												1				1			
p^hl										1								1	
lw				1															
pw			1						1			2	12						
pj								1											

Table 53: The medial elements and vowels in Geba 1

	i	i̤	ɪ	ɪ̤	ɯ	u	ṳ	e	e̤	o	o̤	ɛ	ɛ̤	œ	ə	ɔ	ɔ̤	a	a̤
tɕ												1							
$tɕ^h$	1																		
t^hw												2							
ɵw	1																		
sw	1							1											
jw									1										
lw				3															

Table 53: The medial elements and vowels in Geba 1

3.2.2.2 Vowel Phoneme Contrasts

Selected contrasts between phonetically similar segments are illustrated in analogous environments or minimal pairs in the following section.

a) [i] – [i̤] taɬ.wiɬ *'to be hungry'* wi̤ɬ *'cane/rattan'*
[ɪ] – [ɪ̤] tɪɬ.kɪɬ.p^{h}oɬ *'to be few'* ʃ^{h}oɬ.kaɬ.kɪ̤ɬ *'easy'*

b) [e] – [e̤] dɔɬ.saɬ.siɬ.keɬ *'to answer'* ke̤ɬ.baɬ *'to return'*

c) [ɛ] – [ɛ̤] peɬ.lɛɬ 'sea' lɛ̤ɬ *'warm'*

d) [a] – [a̤] laɬ.ʔoɬ *' to sink'* la̤ɬ *'to be the same'*

e) [u] – [ṳ] suɬ.k^{h}ɔɬ *'hand'* sṳɬ *'mushroom'*

f) [o] – [o̤] poɬ.ʔoɬ *'termite'* po̤ɬ *'cow'*

g) [ɔ] – [ɔ̤] mɔɬ.k^{h}oɬ *'sky'* mɔ̤ɬ *'gong'*

h) [i] – [e] θiɬ *'comb'* θeɬ *'liquor'*

i) [i] – [ɛ] hiɬ *'house'* hɛɬ *'to walk'*

j) [ɪ] – [e] dɪɬ *'frog'* deɬ *'wing'*

k) [ɪ] – [ɛ] k^{h}ɔɬ.bɪɬ *'cockroach'* bɛɬ *'fat'*

l) [u] – [o] t^{h}uɬ *'lime'* t^{h}oɬ *'drum'*

m) [ə] – [o] təɬ.klɔɬ.θɛɬ *'garlic'* tɕɛɬ.toɬ.boɬɬ *'ginger'*

n) [o] – [ɔ] do˧ *'to be big'* dɔ˧ *'to tell'*

o) [a] – [ɔ] ba˧ *'bamboo shoot'* bɔ˧ *'to be fat'*

(a-o) illustrates major phonological contrasts of manner. (a) demonstrates a contrast between a high front unrounded vowel and a breathy high front unrounded vowel. (b) between a close-mid front unrounded vowel and a breathy close-mid front unrounded vowel. (c) between an open-mid front unrounded vowel and a breathy open-mid front unrounded vowel. (d) between an open front unrounded vowel and a breathy open front unrounded vowel. (e) between a close back rounded vowel and a breathy close back rounded vowel. (f) between a close-mid back rounded vowel and a breathy close-mid back rounded vowel. (g) between an open-mid back rounded vowel and a breathy open-mid back rounded vowel. (h) between a close front unrounded vowel and a close-mid front unrounded vowel. (i) between a close front unrounded vowel and an open-mid front unrounded vowel. (j) between a near-close front unrounded vowel and a close-mid front unrounded vowel. (k) between a near-close front unrounded vowel and an open-mid front unrounded vowel. (l) between a close back rounded vowel and a close-mid back rounded vowel. (m) between a mid central unrounded vowel and a close-mid back rounded vowel. (n) between a close-mid back rounded vowel and an open-mid back rounded vowel. (o) between an open front unrounded vowel and an open-mid back rounded vowel.

3.2.2.3 Allophones

There is one vowel that has an allophonic variant. The following example shows the difference by closure, unrounded of contrast in a specific environment. The breathy close back rounded vowel [ṳ] becomes a breathy close back unrounded vowel [ɯ̤] when it changes from a verb to noun. This phenomenon can be expressed though the following rule.

[u̟] ⇨ [ɯ̟] / **derivation (verb to noun)**

Example:

a) nɛ̟ɬ.ku̟ɬ.tu̟ɬ.ʔo˥ *'to be deaf'* b) nɛ̟ɬ.ku̟ɬ *'ear'*

In this section, we found that [u̟] is an allophone of /u̟/ in a specific environment. From table 51, /ẽ, õ/ are very low frequency and have been assigned to residue. There is only one example of /ə̟/, in this data we will retain it since it is symmetry of similarity to other languages. The following table shows the inventory of vowel phonemes which occur in Geba 1.

	Front				Central		Back	
	breathy	Unrounded	breathy	rounded	breathy	unrounded	breathy	rounded
Close	i̟(13)	i(78)					u̟(30)	u(50)
Near-close	ɪ̟(9)	ɪ(25)						
Close-mid	e̟(31)	e(45)					o̟(18)	o(87)
Mid					ə̟(1)	ɔ(38)		
Open-Mid	ɛ̟(61)	ɛ(100)	œ̟(3)	œ (4)			ɔ̟(22)	ɔ(66)
Open	a̟(47)	a(109)						

Table 54: Vowel phoneme Chart in Geba 1 and frequency counts

The following examples represent vowel formational statements in Bwe.

/i/, a close unrounded front clear vowel.

Examples:

θ iɬ *'comb'*

/i̤/, a close unrounded front breathy vowel.

Examples:

m ˧i̤˧ *'grass'*

/ɪ/, a near-close unrounded front clear vowel.

Examples:

ʃʰ ɪ˥ *'chicken'*

/ɪ̤/, a near-close unrounded front breathy vowel.

Examples:

˧ɪ̤˧ .kʰo˧ *'forehead'*

/u/, a close back round clear vowel.

Examples:

j u˩ .pʰo˩ *'rat'*

/ṳ/, a close back round breathy vowel.

Examples:

l ṳ˧ .mṳ˧ *'sun'*

/e/, a close-mid front unrounded clear vowel

Examples:

ʍ e˥ 'to be dry

/e̤/, a close-mid front unrounded breathy vowel

Examples:

k e̤˧ .ba˧ 'to return

/o/, a close-mid back round clear vowel.

Examples:

ʔ o˧ *'bite'*

/o̤/, a close-mid back round breathy vowel.

Examples:

k	o̤˩	.po̤˩	*'pot (cooking)'*

/ɛ/, an open-mid front unrounded clear vowel.

Examples:

ʍ	ɛ˧	.ba˧˧	*'to winnow (rice)'*

/ɛ̤/, an open-mid front unrounded breathy vowel.

Examples:

θo˧.m	ɛ̤˩	*'tooth'*

/œ/, an open-mid front rounded clear vowel.

Examples:

tʰ	œ˧	.je̤˩.bɔ˩	*'to rub, scrub'*

/œ̤/, an open-mid front rounded breathy vowel.

Examples:

l	œ̤˩	*'stone'*

/ə/, a mid central unrounded clear vowel. It mostly occurs in minor syllables. In major syllables, it occurs in three words in the word list.

Examples:

t	ə˩	.klɔ˩.θɛ˩	*'garlic'*

/ə̤/, a mid central unrounded breathy vowel. It mostly occurs in minor syllables. In major syllables, it occurs in three words in the word list.

Examples:

k	ə̤˩	.so˧˧	*'gibbon'*
t	ə̤˩	.we̤˩.nɔ˩	*'to be bad'*

/ɔ/, an open-mid back rounded clear vowel.

Examples:

ʔ ɔ˧ .bɔ˧ *'to be near'*

/ɔ̤/, an open-mid back rounded breathy vowel.

Examples:

tʰɔ.m ɔ̤˧˧ *'knife'*

/a/, an open front unrounded clear vowel.

Examples:

ʔ a˧ *'to eat'*

/a̤/, an open front unrounded breathy vowel.

Examples:

do˧.l a̤˧ *'to flow'*

3.2.3 Geba 1 Tones

According to Saw Lar Baa, there are three level pitchs in Geba: high, mid, and low (44, 33, 22). He noted that there is a high falling tone which occurs with creaky voice quality, transcribed as /54ʔ/.

Fraser Bennett who recorded data in Geba 1 found 14 tones. Shown below is the phonetic transcription of the data and the frequency counts.

Phonemic Notation	Frequency counts	Phonetic transciption
[11]	55	˩
[22]	10	˧
[33]	523	˦
[44]	12	˥
[55]	104	˥
[43]	17	˦˥
[24]	1	˧˦
[23]	3	˧˦
[21]	1	˧˩
[45]	46	˥˥
[34]	5	˦˦
[32]	3	˦˧
[54]	2	˥˥
[42]	3	˥˧

Table 55: Raw tones chart in Geba 1 and frequency counts

3.2.3.1 Co-occurrence Charts

The following table shows the co-occurrence of consonant and vowel phones as transcribed in the word list. The numbers used in the table correspond to the frequency counts of the co-occurrence of consonant phones and vowels which occur in the list.

	˧	˨˧	˩	˧˥	˧˦˧	˥	˥˦˥	˦˧	˥˩	˦˥˧	˦˥	˥˧	˦˥˦	˧˥˧
b	28	6				1				8	1			
d	22	12		1	2					6				
θ	31	12	2	1						2				
ʔ	19	6	1	1	2					2			1	
h	12	3		2	1						2			
j	10		8											
p	7		1											
ɟ	3													
k	29	5	3		1	1				3		1		
k^h	28	3		1	1	1				4				1
tɕ			1											
l	44		8		1	1	1		1		1			
ɬ	4	3								3				
m	34	2	3	2							1			2
ʍ	5	2		1										
n	15		6									1		
r	2													
x	1													
w	10		3			1								
p^h	19	3	1							2				
t^h	20	13				1				4	1	1		
t	35	5	3	1		3				1				
s	25	1	1							1				
s^h	26	11		1	4					3		1		
$ʃ^h$	5	2			1									
θw	1													
hm	1	2								1				
hn														

Table 56: The co-occurrence of initial/medial consonants and tones in Geba 1

	˦	˧	˨	˩	˦˧	˦	˦˩	˦˦	˦˨	˧˧	˦˩	˦˨	˧˦	˧˦
hl		1												
jw								1						
p^hj								1						
kl	10		1											
kw	1													
k^hl	3	2			1					1				
k^hw	4					1								
lw			3											
pl	4	1	1							2				
p^hl	5													
t^hw	3													
mj	1													
pj	2													
pw	16	2	4											
sw	1											1		
tɕ		1												
tɕh	1													

Table 56: The co-occurrence of initial/medial consonants and tones in Geba 1

All vowel occurs with tones except /ə , ɐ̯, a/ in minor syllables. The following table illustrates the co-occurrence of vowels and tones which occur in the list.

	˦	˧	˨	˩	˦˧	˦	˦˩	˦˦	˦˨	˧˧	˦˩	˦˨	˧˦	˧˦
i	39	25		4	1					5				1
i̯	9		3											
ɪ	12	6	1	2	2					3				
ɪ̯	4		3											
u	27	15	1							5			1	

Table 57: The co-occurrence of vowels and tones in Geba 1

	˦	˨˦	˧˩	˨	˦˥	˧	˨˧	˦˧	˧˧	˨˩	˨˧	˦˩	˨˦	˥˦
u̟	23		3		1		1	1				1		
e	30	7		1				1		2				2
e̟	24		10			2		1						
ẽ	1													
o	51	3	3		3	1				9	1	1		1
o̟	14	12	4			3								
õ	1													
ɛ	75	10		1	3	1				5	3			
ɛ̟	45		11						1					
œ	2	2												
œ̟	3													
ə	1													
ə̟	2													
ɔ	42	10	2	1	2	2				2			1	
ɔ̟	10		6		1						1			
a	71	14		3	4					15		1		
a̟	37		8			1								

Table 57: The co-occurrence of vowels and tones in Geba 1

Fourteen phonetic tones were transcribed in this word list, but this study would posit only four phonemic tones depending on the phonetic similarity and the frequency counts of the tones which are occur in the list. From table 55, only mid and high tones had a very high frequency counts. Low tone and half-high rising tone had a medium occurrence. Thus it appears that the other ten tones are very low frequency and have been assigned to residue. For the phonetic similarity, [˨], [˨˥] may be a high tone, [˨˦], [˦˦] and [˧˦] may be a mid tone, [˧], [˧˩] and [˨˧] may be a low tone and [˧˨] and [˦˨] may be a half-high rising tone. If this assumption is true, two

words with the same tones may be homophones. The following table illustrates the frequency countss of all tones. Thus, it was concluded in this study that there are 4 tones in Geba 1. The following table illustrates Geba 1 tones

Phonemic Notation	Description	Tone stick	Frequency counts
/11/	Low tone	˩	55
/33/	mid tone	˧	523
/55/	High tone	˥	104
/45/	Half-high rising tone	˧˥	46

Table 58: Phonemic tone chart in Geba 1 and frequency counts

From table 58, /11/ represents [˩], a low-level tone. The pitch pattern of this tone starts at a low-level pitch and continues at the same range.

Examples:

tʰoˀ˥˩.pʰo˧.pi̤˩	*'bird's nest'*
ʍɛ˧.sṳ˩	*'rain'*
ɬaˀ˥.wa̤˩.li̤˩	*'lightning'*
ʔɔ˩.je̤˩	*'to be far'*
ta˧.po̤˩	*'to sing'*

/33/ represents [˧], a mid-level tone. The pitch pattern of this tone starts at mid-level pitch and continues at the same range.

Examples:

ʃʰɔ˧	*'feather'*
tɔ̤˧	*'mat'*
θoˀ˥.mɛ̤˧	*'tooth'*
ʃʰɛ˧	*'star'*
θa˧	*'heart'*

/55/ represents [˥], a high-level tone. The pitch pattern of this tone starts at mid-level pitch and continues at the same range.

Examples:

tʰœ˥.jɐ̯˧.bɔ˧	*'to rub/scrub'*
ʃʰɪ˥	*'chicken'*
ʍe˥	*'to throw'*
ba˥	*'yellow'*
sʰɔ˥.ʔo˧	*'to wait'*

/45/ represents [˧˥], a half-high rising tone. The pitch pattern of this tone starts at half high-level pitch and rises to a high level pitch.

Examples:

pli˧˥	*'to be smooth'*
pu˧˥	*'to be thin'*
dɪ˧˥	*'cooked rice'*
kọ˧.bạ˧.pʰe˧˥	*'butterfly'*
tʰo˧˥	*'to be tall'*

3.2.3.2 Tone Contrasts

Selected contrasts between phonetically similar segments are illustrated in analogous environments or minimal pairs in the following section. It is noted that these are not established as tonemes.

(a) [˧] – [˥]	ba˧	*'bamboo shoot'*	ba˥	*'yellow'*
	di˧	*'egg'*	di˥	*'to be thick'*
(b) [˩] – [˧]	tạ˧.nɛ̯˩	*'what'*	nɛ̯˧	*'thou2s'*
(c) [˧] – [˧˥]	dɪ˧	*'frog'*	dɪ˧˥	*'cooked rice'*

(a-c) illustrate major phonological contrasts of manner. (a) demonstrates a contrast between a mid-level tone and a high-level tone. (b) between a low tone and a mid-level tone. (c) between a mid-level tone and a half-high rising tone. It is noted that these are not established as tonemes.

3.2.3.3 Allotones

Note that the following examples show the difference of contrast in a specific environment. The register tones become contour tones when a verb changes from a verb into a noun. This phenomenon can be expressed through the following rule.

Register tone  **Contour tone** / **derivation(verb to noun)**

Examples:

a)	sʰɔɬ.miɬ	*'to sleep'*	b)	lẹɬ.sʰɔ.miɬɬ	*'Sleeping area'*
	dɪɬ.kʰə.lụɬ	*'to cut (hair)'*		kʰə.lụɬɬ	*'hair'*

3.3 Syllable Structure

Saw Lar Baa concluded that the syllable of Geba is composed of an obligatory consonant (C_1) followed by an optional medial consonant (C_2). The nucleus can be any vowel. As for diphthongs, they are rare and occur only in borrowed words only. Tone T maps over vocalic elements. Thus the syllable structure appears as follows: $C_1(C_2)$ $V_1(V_2)T$. He noted that in minor syllables are composed of an initial consonant and a central mid open vowel /ə/. /ə/ is present only in minor syllables. The initial consonant is typically a stop; however, the lateral /l/, and the voiceless lenis affricate [d̥ʒ] may also appear as the initial consonant of minor syllables.

In this study, Geba 1 distinguishes between MAJOR SYLLABLES and MINOR SYLLABLES. 3.3.1 describes the structure of major syllables and 3.3.2 discusses minor syllables.

3.3.1 Major Syllables

Geba 1 syllables are generally open, without any coda. Onsets are not required. Only one word in the list was found with the closed pattern. The schematic structure is CVC as follows pẽjɨ 'opium' and has been assigned to residue. The initial consonant may be followed by one or two medial consonants. Therefore, syllables have the schematic structure of CV, CCV, or V . There are three words from the data with the V pattern. The nucleus of the V pattern occurs with the clear vowel.

The schematic structure of a major syllable is $(C_1)(C_2)$ V T

C_1	is any consonant
C_2	is an alveo-palatal fricative, nasal, a liquid, or a glide
V	is a vowel
T	is tone

	i	i̤	ɪ	ɪ̤	ɯ̤	u	ṳ	e	e̤	ẽ	o	o̤	õ	ɛ	ɛ̤	œ	œ̤	ə	ə̤	ɔ	ɔ̤	a	a̤
p	1	1				1	1	3	1	1	5	4		2						2	2	5	1
t	3		1			2	2		3	4	1			1	14			3		3		5	9
k	2		1	1	1	1	3	1	2		2	5		4	1	1			1	2	1	7	8
ʔ	3					1		3			9			3						7		6	
b			1			2		6			3			5	1					5		6	1
d	4		6			8	1	6			4			2						7		5	
ɟ												1			2								
p^h	1		1			3		4			11			1						1		3	
t^h	11		1			3					8			6		1				3		12	
k^h	5					3					7			7		1				10		11	
s	1		1			10	2	5			2			1				1		4		2	
s^h	5		4			3					7			10						13		6	
$ʃ^h$			2								1			2						1		1	
ʍ	2							1						4									
θ	8					2		2			13			17		1				1		7	
x																					1		
h	5					1		1			4			7								3	
m	4	4		1		2	6		5			4		1	8					1	4		3
n		2		1		2	5		3			1			8						3	1	3
ɬ			1			2		1			1			2								3	
l		1	1	1			9	1	5		1	1	1	1	8		3				5	5	14
r								2															
w	3	1							3						2								3
G		1																					
j							2	1	3			2			2			1			6	2	3

Table 59: The co-occurrence of consonants and vowels of a major syllable in Geba 1

	i	i̤	ɪ	ɪ̤	ɯ̤	u	ṳ	e	e̤	ē	o	o̤	õ	ɛ	ɛ̤	œ	œ̤	ə	ə̤	ɔ	ɔ̤	a	a̤
pl	1		1						2					2						1		1	
kl								1			1			6						2	1		
k^hl		3									1			1						1		1	
kw																						1	
k^hw	4													1									
t^hw	1													2									
tɕ														2									
hm	8		1			2								2						1		3	
mj								2															
hl														1									
hn	1					2								1								1	
p^hl											2											2	
p^hj								1															
pw			1	1				2	2					2	14								
θw	2																						
pj								1															2
sw	2							2															
jw									2														
lw			2	4																			
$tɕ^h$	1																						

Table 59: The co-occurrence of consonants and vowels of a major syllable in Geba 1

Examples are shown using the following data.

(a)	VT	poɬ.aɬ	*'to shave (beard)'*
		ɪɬ	*'excrement'*
		uɭ.s^{h}aɬ.t^{h}iɭ	*'to bathe'*

(b)	CVT	baˀ	*'yellow'*
		θiˀ	*'to die'*
(c)	CCVT	θwi˧	*'blood'*
		hmiˀ	*'ripe'*

(a) illustrates words with the V; (b) shows words with simple onsets with a single vowel; and (c) cite several examples of words with complex onsets.

3.3.2 Minor Syllables

Minor syllables have a reduced set of possible onsets and vowels. In addition, minor syllables never bear a distinctive tone. Minor syllables with onsets generally have an /ə/ nucleus, though /a/, /ɔ/, /ɛ̰/ and /ɛ/ are also found. Minor syllables without an onset always have an /a/ nucleus.

The shape of a minor syllable, therefore, consists of an optional initial consonant (most commonly a plosive stop). The nucleus is composed of a vowel. Paradigmatically, a minor syllable generally occurs before a major syllable but rarely in two consecutive syllables such as a.pwɛ̰˧.tə.kə.jɛ̰˧ 'hundred (persons)'. The schematic structure of a minor syllable is as follows: **$(C_1)V$.**

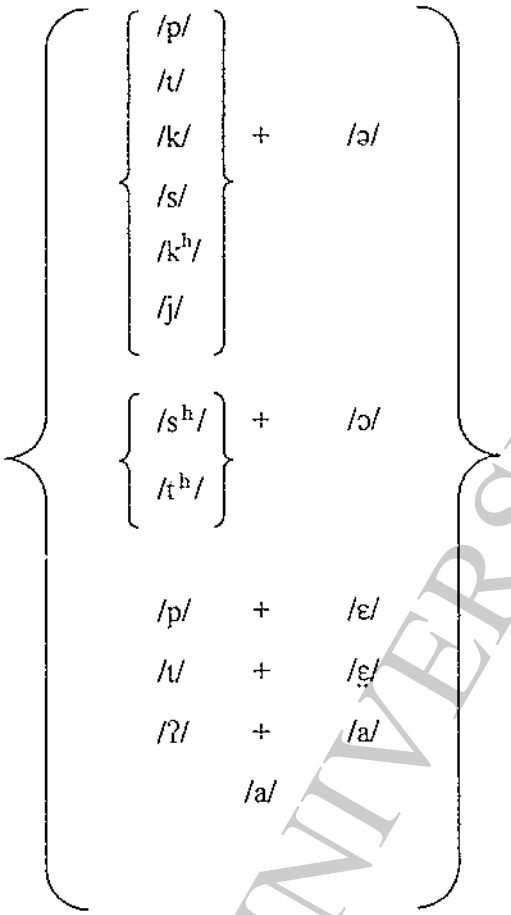
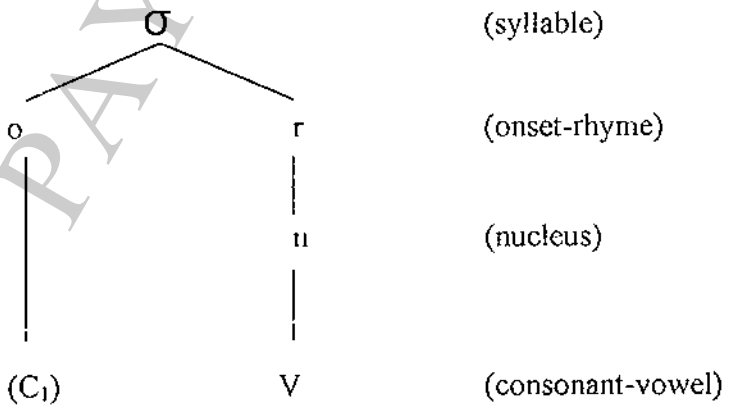


Figure 14: The structure of a minor syllable in Geba 1

The syllable structure of a Geba 1 minor syllable can be expressed as follows:



For example,

(a)	CV	mạ˧.tə.kụ˧	*'pangolin'*
		kə.s^{h}a˧˥	*'elephant'*
		s^{h}u˥.sə.ba˧	*'to wash'*
		jɔ.k^{h}ɔ˧˥	*'friend'*
		pɛ.nę˧	*'buffalo'*
		mę˧.tę.mę˧	*'to work'*
		tạ˧.ʔa.tɕhi˧.nę˧	*'when (past)'*
(b)	V	a.pwę˧.θa˥.to˧	*'six (persons)'*
		a.pạ˩.a.s^{h}ɛ˥	*'difficult'*
		a.pwę˧.lwị˩.θo˩	*'eight (persons)'*

The examples in (a) illustrate CV- minor syllables, on all possible nuclei; (b) illustrates V- minor syllables.

3.4 Conclusion

The phonological description of the Geba 1 language includes the phonemes and the syllables. The phonemes are divided up in three sections: consonant phonemes, vowel phonemes and tone.

Tones: There are 4 tones in Geba 1: low tone, mid tone, half-high rising tone, and high tone. The table below shows tones in Geba 1.

Phonemic Notation	Description
/11/	Low tone
/33/	mid tone
/55/	High tone
/45/	Half-high rising tone

Table 62: Phonemic tone chart in Geba 1

3.4.2 Syllable Structure

According to the syllable structure, there are two types of syllables: major syllables and minor syllables. The major syllables consist of all vowel phonemes and bear a distinctive tone or voice quality. Onsets are not required. There are three types of schematic structure: CV, V, and CCV. The CV syllable pattern is by far the most common.

Minor syllables are composed of an optional onset and vowel. The nucleus is composed of a vowel. Minor syllables with onsets generally have an /ə/ nucleus, though /a/, /ɔ/, /ɛ/ and /ɛ̰/ are also found. Onsetless minor syllables always have an /a/ nucleus.