THE VOWELS OF PROTO-GUANG

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The present work describes the vowel system of the latest common ancestor of the Guang languages (proto-Guang), a relatively low node on the Kwa genetic tree, and traces changes to that system through to the present. By examining vocalic change at this low node of reconstruction (as opposed to a higher node) we sacrifice the advantages of studying many changes for the advantages of obtaining a more close-up picture of the (fewer) changes involved.

Proto-Guang roots are reconstructed as having had an underlying vowel system that consisted of seven oral vowels and five nasal vowels. Vowel harmony, involving the features [+ATR] and [+Round], existed between prefix vowels and root vowels and between V1 and V2 in disyllabic roots. Changes to this proto-system included a merger of the underlying oral vowels in North Guang languages and a phonemic splitting of oral vowels whereby the seven vowel system became a nine vowel system in some present-day Guang languages.

Ce travail décrit le système vocalique du dernier ancêtre commun des langues guang (proto-guang dont le noeud se trouve au niveau relativement bas dans l'arbre génétique kwa), et en voleur les changements vocaliques affectant ce noeud bas de la réconstruction (en opposition à un noeud plus haut) nous sacrifions les avantages d'étudier un grand nombre de changements, mais nous gagnons l'avantage d'obtenir une impresssion plus présise des changements en question (qui seront, évidemment, moins nombreux).

Les racines du proto-guang sont réconstruites ayant un système vocalique sous-jacent de sept voyelles orales et de cinq voyelles nasales. L'harmonie vocalique, mise en voleur par les traits [+ATR] et [+Arrondi], existe entre les voyelles du préfixe et les voyelles de la racine, et entre V1 et V2 dans les racines disyllabiques. On trouve parmi les changements de ce proto-système une fusion des voyelles nasales sous-jacentes avec les voyelles orales sous-jacentes, et une division phonémique des sept voyelles orales; à partir duquel le système de sept voyelles est passé à un système de neuf voyelles dans quelques langues guang contemporaines.
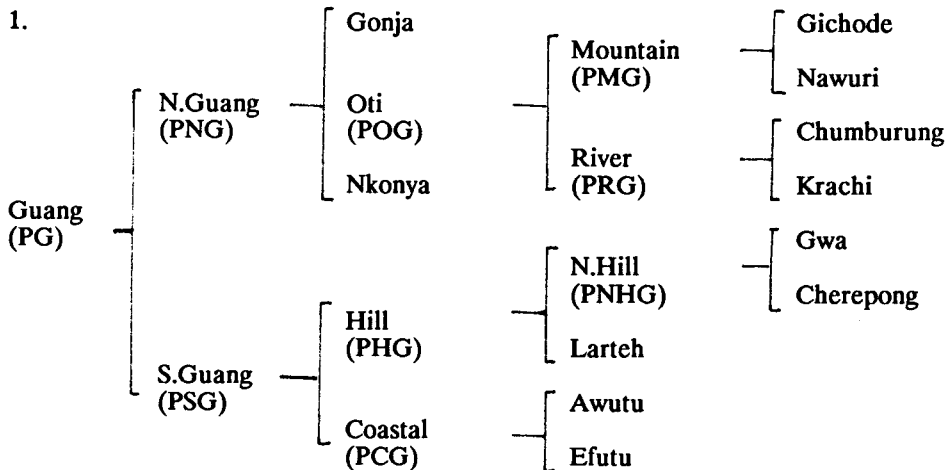
0. INTRODUCTION

The Guang language group consists of some fifteen languages spoken by societies that tend to be grouped in the vicinity of the southern portion of the Volta River in Ghana. Thew genetic unity of this group is well-established (cf. Westermann, 1922; Goody, 1963 and Painter, 1967), and the group forms a branch of Tano within Stewart's (New) Kwa (Stewart, 1989).

In the present study [1] I attempt to reconstruct the vowel system of the latest common ancestor of the present-day Guang languages. I have limited the scope of this work to include only the reconstruction and subsequent history of the proto-Guang (PG) vowel system of the lexicon (i.e. of words). Comparative research on postlexical processes in Guang languages has therefore not been carried out. Elements that have been borrowed into various Guang languages since the period of their latest common ancestor are also not taken into account. While some of the North Guang (NG) languages can be demonstrated to use vowel length contrastively (e.g. Chumburung; cf. Hansford, 1988), from the comparative data at my disposal it has not been possible to reconstruct long vowels at a higher level.

The reconstruction I propose is based mainly on two sources: Snider (1989) and Stewart (1966), both of which are comparative lists involving the same 850 item wordlist. Of the two sources, the first compares lexical items in Gonja, Chumburung, Nawari, Gichode, and Krachi, while the second compares lexical items in Awutu, Larteh, Nkonya, and Krachi. Unless noted otherwise, Krachi examples used are taken from the first source. Since Awutu and Larteh are the only South Guang (SG) languages included in the main sources, I have supplemented the data base with my own unpublished Swadesh 100 wordlists for Gwa, Cherepong and Efutu.[2] Unfortunately, the scarcity of data for Gwa, Cherep[ong and Efutu leaves unanswered many questions concerning these languages and the languages of their latest common linguistic ancestors.

In this paper I consider the genetic relationships presented in 1 below, to hold for the Guang languages of the study, based on Snider (1988) and Snider (forthcoming).

1.

		Gonja		Gichode
	N.Guang		Mountain	
	(PNG)	Oti	(PMG)	Nawuri
		(POG)		Chumburung
Guang		Nkonya	River	
(PG)			(PRG)	Krachi
			N.Hill	Gwa
		Hill	(PNHG)	Cherepong
	S.Guang	(PHG)	Larteh	
	(PSG)		Awutu	
		Coastal	Efutu	
		(PCG)		

1. SURFACE VOWEL SYSTEM

I now present the reconstructed PG <u>surface</u> vowel system, as opposed to the <u>underlying</u> system (Sec.2). Leaving aside, for the moment, a number of distributional facts, I reconstruct at a systematic phonetic level the following vowels.

2.

	Oral			Nasal		
	i	ɨ	u	ĩ	ɨ̃	ũ
	ɩ	ɩ	ɷ	ɩ	ɩ	ɷ
		ə	o			
	ɛ	ʌ	ɔ	ɛ	ʌ	ɔ
		a			ã	

In order to facilitate the following discussion, where reference is made to various natural vocalic classes, the feature chart in 3 is provided. This chart characterizes the natural classes of <u>surface</u> vowels only.

(3)	i	ɨ	ɪ	ᵻ	ɛ	ʌ	ə	a	ɔ	o	ɷ	u	ĩ	ɨ̃	ɪ̃	ᵻ̃	ɛ̃	ʌ̃	ã	ɔ̃	õ	ũ
BACK	−	+	−	+	−	+	+	+	+	+	+	+	−	+	−	+	−	+	+	+	+	+
ROUND	−	−	−	−	−	−	−	−	+	+	+	+	−	−	−	−	−	−	−	+	+	+
HIGH	+	+	+	+	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	+	+
LOW	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	+	−	−	−
ATR	+	+	−	−	−	−	+	−	−	+	−	+	+	+	−	−	−	−	−	−	−	+
NASAL	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+

NATURAL CLASSES OF SURFACE VOWELS IN PROTO-GUANG

Since the prefix vowel system differs somewhat from the root vowel system, we first discuss the system pertaining to roots (1.1) and then that pertaining to prefixes (1.2).

1.1 VOWELS OF NOUN AND VERB ROOTS

Since the [+ATR, -High] vowels are restricted to the prefix system of PG (where they alternate with [-ATR] vowels, depending on the ATR quality of the root they are prefixed to), in noun and verb roots the vowel system is limited to the oral and nasal sets of 4.

4.

	Oral			Nasal	
i	ɨ	u	ĩ	ɨ̃	ũ
ɪ	ᵻ	ɷ	ɪ̃	ᵻ̃	ɷ̃
	ə	o			
ɛ	ʌ	ɔ	ɛ̃	ʌ̃	ɔ̃
	a			ã	

Evidence supporting the proposed reconstruction of the surface vowel sounds of PG roots may be found in 5 (oral vowels) and 6 (nasal vowels) where the numerals to the right of each sound correspond with the numbers of the appropriate cognate sets located in Appendix A.[3] In 5 and 6 I reconstruct each sound in its environments and then immediately below that I make certain generalizations with regard to a number of distributional facts.

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[3] It is important to note that only forms which are cognate with each other are included in Appendix A. When comparing cognate words in Guang languages, one occasionally finds a form in one language which is realized in the ATR harmony set opposite to that of the other languages (e.g. [ɷ] instead of [u]. While I have included such occurrences in the examples when they are obviously cognate with the proto-form, I do not account for these 'exceptions' in the analysis since they are not regular sound correspondences. Although the Guang languages are tonal, since tone has played no role in the historical development of the vowel system, I ignore all tonal distinctions in the data in order to keep the examples as uncomplicated as possible.

5. Nonfinal	Final or before glottal stop[4]
*i	1, 27, 33
*ɨ 27, 60	
*ɪ	8, 9, 16, 31, 32
*ɛ 6, 26	
*ɛ	10, 11, 12

*a open syllables: 6, 14, 15, 16, 17, 26, 56, 57
*ʌ closed syllables: 28, 59
*ɔ all environments: 31, 32, 35, 36, 53, 54, 58
*ɷ all environments: 8, 25, 29, 30, 54
*u all environments: 19, 20, 22, 24, 52, 56, 57, 63

6. Nonfinal	Final or before glottal stop
*ĩ	2, 3, 4, 5, 37, 38, 39
*ɨ̃ 4, 5, 37, 38	
*ɪ̃	7, 21 (after nasal consonants))
*ɛ̃ 18 (after nasal consonants)	
*ɛ	40, 41, 61, 62

*ã open syllables: 13, 18, 43, 44, 45
*ʌ closed syllables: 42
*ɔ̃ all environments: 34, 49, 50, 51
*ɷ following nasal consonants: no examples found[5]
*ũ all environments: 23, 46, 47, 48, 55

A study of reconstructed roots reveals a number of distributional facts:

a) [-Back] vowels occur only in final position and before (final) glottal stops (Cognate sets: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 16, 21, 27, 31, 32, 33, 37, 38, 39, 40, 41) and are in complementary distribution with their [+Back, -Round] counterparts (Cognate sets: 4, 5, 6, 18, 26, 27, 37, 38, 60).[6] It is probably also the case that [+Back, -Round] vowels do not occur following palatal consonants in nonfinal environments. There is an example of this in Cognate set 13, however the scarcity of relevant data makes this somewhat tenuous.

[4]Glottal stops in Guang languages occur only utterance-finally and are considered in Snider (1986) to 'mark' words that have historically undergone apocope (loss of a final segment or segments). [-Round, -Low] vowels which occur in preglottal position, though not strictly utterance-final, are nevertheless realized as [-Back], with a quality identical to those vowels which occur utterance-fianlly.

[5]I attribute this to a lack of sufficient data. As discussed more fully in sec.2, vowels do not contrast with respect to nasality following nasal consonants (consonants, on the other hand, do contrast with respect to nasality before nasal vowels). Vowels following nasal consonants are therefore always nasalized and there is no reason to suspect that htis does not include PG*ɷ. Based on symmetry with PG*ɪ, which, unlike the other vowels (excluding PG*ɷ), only occurs following nasal consonants, I reconstruct PG*ɷ following nasal consonants only.

[6]While the data of Snider (1989), which includes Krachi, transcribes 'central' ([+Back, -Round]) vowels, that of Stewart (1966), which also includes Krachi, does not. The claim, therefore, that proto-Guang had central vowels can be questioned since it could just as easily be said that the presence of central vowels is a North Guang innovation. Since Stewart (1966) does not transcribe central vowels for Krachi, he may therefore have ignored their presence in the other languages as well for whatever reason. Given this, and the fact that the occurrence of central vowels is not uncommon in other (more distantly realated) non-Guang languages such as Kpokolo (Kaye, Lowenstamm and Vergnaud, 1985), I reconstruct a set of [+Back, -Round] vowels for proto-Guang.

b) *a/ã and *ʌ/ʌ̃ are in complementary distribution in that *a/ã never occurs in closed syllables (Cognate Sets: 6, 13, 14, 15, 16, 17, 18, 26, 43, 44, 45, 56, 57) and *ʌ/ʌ̃ never occurs in open syllables (Cognate Sets: 28, 42, 59). One would also expect *ʌ to be in complementary distribution with *ɛ; *ʌ occurring only in nonfinal positions (including open syllables), and *ɛ occurring only finally, parallel with the distributions noted for other [-Back] vowels. I have not, however, been able to reconstruct any instances in roots of nonfinal *ʌ that occur in open syllables (i.e. all occur in closed syllables). There are, however, occurrences of this in prefixes (Cognate Sets: 10, 40 and 62).

c) All vowels following nasal consonants are [+Nasal] (Cognate Sets: 2, 3, 4, 5, 7, 13, 18, 21, 23, 34, and 41). The converse, however, is not true; it is not the case that [+Nasal] vowels occur only after nasal consonants; they can also occur after oral consonants (Cognate Sets: 4, 5, 18, 21, 37, 38, 39, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 51 and 55).

d) [+High, -ATR, +Nasal] vowels (i.e. *ɪ̃, *ʊ̃ and *õ) never occur following oral consonants (Cognate Sets: 7, 18 and 20).

e) In disyllabic roots (there is no evidence for trisyllabic or greater roots), the second vowel is [+Round] only if the first vowel is [+Round] and the intervening consonant is a liquid (l or r). Compare Cognate Sets 19, 20, 52, 53 and 54 with Cognate Sets 21, 31 and 32.

f) In disyllabic roots where the first vowel is [+Round] and the intervening consonant is l or r, if the second vowel is not [+Round] it must be [+Low] (*a - Cognate Sets 56 and 57).

g) In disyllabic roots, the second vowel is [+ATR] only if the first vowel is [+ATR], and if the first vowel is [+ATR] the second vowel must be either [+ATR] or [-High]. Compare Cognate Sets 4, 5, 19, 20, 37 and 52 with Cognate Sets 56 and 57.

We now turn our attention to those historical changes that have affected the vowel system since the period of the latest common linguistic ancestor. Rather than trace the history of each PG sound as an isolate, I focus instead on the changes as they have affected various 'feature groups', in order to capture, more readily, significant generalizations. These generalizations are discussed below and then stated formally in the list of historical changes in Appendix B.

1.1.1 Changes affecting [-ATR, +High] vowels

In my unpublished (minimal) research on Awatu, which includes audio recordings, vowels that I transcribe as [ɪ] and [ʊ] are transcribed in Stewart (1966 - the primary source for the present data on SG languages) as [e] and [o], respectively. Based on this data, Stewart (1970) proposed an Awatu innovation whereby PG*ɪ and *ʊ became [e] and [o], respectively, in Awatu. In most Guang languages the problem of distinguishing these vowels is not particularly difficult to solve, in spite of the fact that acoustically [ɪ] and [ʊ] are difficult to distinguish from [e] and [o]. Normally when it is difficult to determine which vowel one is hearing, one listens to the prefix vowel. If it is, say, [ɔ-] (easy to distinguish from [o-]), then one knows that the root vowel must be [-ATR] and is therefore [ɪ] or [ʊ]. In Awatu, this 'solution' is not possible as prefix vowels, with the possible exception of [a-], are always [+ATR] and do not harmonize with the ATR quality of the root (e.g. o-kɛ 'tomorrow'). Given this state of affairs, I leave open the question of whether the vowels in focus are, respectively, ɪ and ʊ, or e and o, until such time as further research on the matter is

conducted. For the present purposes, however, my analysis must remain faithful to what I think I hear.

From 7 and 8 it is apparent that, apart from the NG loss of nasality in vowels following oral consonants, the PG set of [-ATR, +High] vowels has been inherited without change in most present-day Guang languages.

7.   Non-utterance-final PG [+ATR, +High]
      *ι 6, 26
      *ῖ 18
      *ω 8, 25, 54

8.   Uterance-final [-ATR, +High]
      *ι 8, 9, 16, 31, 32
      *ῖ 7, 21
      *ω 25, 29, 30

There are, however, the following innovations by the Montain Guang (MG) subgroup. In the MG subgroup, *ι/ῖ is realized utterance-finally in Nawuri as [ει/ēῖ], and in Gichode most usually as [ε/ē], but occasionally also as [ει/ēῖ]. That this is utterance-final only is demonstrated by comparing Nawuri reflexes of PG *a-nῖ 'our' in the following utterances: [anēῖ] 'our' vs. [anι časει] 'our chicken'. From this pair it may be seen that in utterance-medial environments PG*ι is realized as [ι] in Nawuri. The same case can be made equally well for Gichode.

In Gichode, there is a parallel development where [+Round] *ω is realized utterance-finally as [ɔ]. That this is utterance-final only may be seen by studying the Gichode reflexes of PG*ɔ-dɔ-pω 'farmer' with [Ø-dɔ: -bω gɔ-nɔ̃] 'farmer's mouth', it is clear that PG*-pω is realized as [-bɔ] only utterance-finally in Gichode.

As argued in Snider (1986), Guang languages have a process whreby words that have undergone apocope end in a glottal stop when pronounced utterance-finally. Since the fianl vowels in such words are therfore never truly utterance-final, it is not surprising that for MG languages [-ATR, +High] vowels in this environment are not realized with the [-High] allophone.[7]

9.   Gichode   Nawuri
      ɔ-nʌndι:ʔ   'tongue'   ɲ-yι:ʔ   'body'
      ɔ-čι:ʔ   'woman'   ɔ-či:ʔ   'woman'
      a-kalω:ʔ   'whitewash'   Ø-bʌɲčι:ʔ   'cassava'
      ɔ-dω:ʔ   'trap'   gʌ-sʷι:ʔ   'fireplace'

The innovations involving [-ATR, +High] ---> [-High] in MG are summed up in 10.

10.   *ι/ῖ *ω/ω̃   (in utterance final position only
                  POG
                   |
                *ει/ēῖ *ω/ω̃   (Historical change 4)
                  PMG
                 ╱   ╲
      ει/ēῖ ω/ω̃   ει/ēῖ,e/ē ɔ/ɔ̃   (Historical Change 5)

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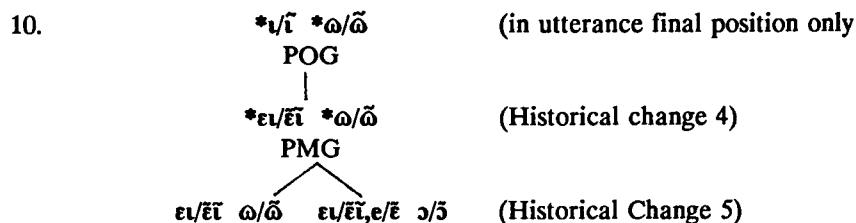
[7]In MG languages, the final vowel of words that end with a glottal stop utterance-finally is slightly lengthened (cf. Snider, 1986).

Taken together, the above facts suggest a sound change in progress. If sound change is viewed as involving a 'beginning-point' and a 'target-point', the beginning point for the above change would be [-ATR, +High] and the target point might be [-ATR, -High]. Assuming these points to correctly characterize this process in MG, the progressive aspect may be seen in th following incomplete aspects of the change.

a) Not all environments have completed the change in that only utterance-final environments have been affected.

b) Not all languages have completed the change. Gichode has clearly undergone more change than Nawuri in that while most Gichode reflexes of PG*i/ɪ are realized as [e/ɛ] (the target point) and only a few are realized as the diphthong [ɛɪ/ɛ̄ɪ] (an intermediate point in the historical process), all utterance-final occurrences of PG *ɪ/ɪ̄ are realized in Nawuri as the intermediate diphthong [ɛɪ/ɛ̄ɪ].

c) Not all sounds have completed the change. This may be seen in that while PG*ɪ/ɪ̄ and PG*ʊ/ʊ̄ have both been affected in Gichode, only PG*ɪ/ɪ̄ has been affected in Nawuri.

It would appear that the [+Round] vowels are not undergoing the diphthongization process that has affected the [-Round] vowels. If the [+Round] vowels were following a development completely parallel to that of the [-Round] vowels, one would expect to see the diphthong ɔʊ/ɔ̄ʊ̄ in (at least) Gichode. But this is not the case.

1.1.2 Changes affecting PG [-High, -Low] vowels

Two similar, though apparently unrelated changes affected [-High, -Low] vowels. The first (Historical Change 12), was limited to Larteh and was initially proposed in Stewart (1970). Affecting only vowels that occurred root-finally and were [-Nasal], this change involved PG vowels that were [-High, -Low, -Nasal] becoming [+ATR] (i.e. ɛ, ɔ > e, o). Consider the Cognate Sets of 11.

11. Root-final PG [-High, -Low, -Nasal]
        *ɛ>e   10, 11
        *ɔ>o   35, 36, 58

In order to establish that the feature [-Nasal] is crucial, the examples in 12 show that the environments where only the feature value for [Nasal] differs the change did not occur.

12. Root-final PG [-High, -Low, +Nasal]
        *ɛ̃   40, 41, 62
        *ɔ̃   34, 49, 50, 51

Vowels that differed only with respect to the feature [High] were also immune to the change, as in the Cognate Sets of 13.

13. Root-final PG [+High, -Nasal]
        *ɪ   8, 9, 31
        *ʊ   8, 25, 29, 30

It is also necessary to confirm that the root-final environment was crucial to the change. In 14 the examples show that in word-medial and pre-glottal stop position the change did not occur.[8]

14. Nonfinal PG [-High, -Low, -Nasal]
    *ɔ 31, 32, 54

Finally, the specification [-Low], which rules out a, is crucial. In 15 *a remained unchanged.

15.   Root-final PG [+Low]ow, -Nasal]
       *a 6, 14, 15, 56, 57

The second change (Historical change 7) that affected proto-River Guang [-High, -Low] vowels seems to have occurred only in Chumburung. This was similar to the proto-Hill Guang to Larteh change in that it also involved a shift of [-ATR] to [+ATR]. It was different in a few respects, however. First, only [-Back] *ɛ underwent the change. Secondly, the change was not restricted to root-final positions, and thirdly, the nasal feature did not play a role. The Cognate Sets listed in 16 show that proto-River Guang *ɛ changed to e in Chumburung, and those in 17 show that other pootential candidates for the change did not undergo it.

16. PRG [-High, -Low, -Back]
    *ɛ>e 10, 11, 12, 40, 61, 62

17. PRG [-High, +Back]
    *ɔ 32, 34, 35, 36, 49, 50, 51, 58
    *ʌ 28, 42, 59
    *a 6, 13, 14, 15, 16, 17, 18, 43, 44, 45

1.1.3 Changes affecting PG [+Round] vowels

From the Cognate Sets of 18 one can see that in PG monosyllabic roots with [+Round] vowels, the feature [+Round] tends to be somewhat unstable in root-final environments. There are examples of its change to [-Round] in the Nkonya reflex of PG*sɷ-kı 'to unload' (Cog. set 8) and in the Chumburung reflex of PG*ɔ-fũʔ 'wind')Cog. set 55). Then in the Hill Guang (HG) subgroup we find two more examples that involved Gwa (Cognate Sets 35 and 58) and one (shared with Gwa) that involved Larteh (Cog. set 58). Given the sporadic nature of roots affected and the sporadic nature of languages involved, I suggest that the derounding of [+Round] vowels in root-final position is, perhaps, in the beginning stages of a general sound change. In environments where derounding occurs and where there is no preceding [+Round] vowel, the consonant immediately preceding the derounded vowel is rounded. In Casali (forthcoming), instrumental evidence is presented showing that in Nawuri, at least, consonants which precede [+Round] vowels are also [+Round]. Casali concluds that in environments where the vowel becomes [-Round] and appears to 'shift' its [+Round] specification to the preceding consonant, that what in fact happens is that the consonant merely retains an already [+Round] specification gained by its proximity to the following [+Round] vowel. The [+Round] quality of the consonant is then more easily perceived due to the contrast created with the following (now) [-Round] vowel.

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[8]Within comparative Guang literature, so far as I am aware, only my work records occurrences of the glottal stop. Thus the absence of the glottal stops in the Larteh data is not crucial to the argument.

18.   PG roots with [+Round] vowels

         Monosyllabic: 8, 22, 23, 24, 25, 29, 30, 34, 35, 36, 46, 47, 48, 49, 50, 51, 55, 58, 63

         [+Round] [-Round]: 31, 3, 56, 57

         [+Round] [+Round]: 19, 20, 52, 53, 54

From the Cognate Sets listed in 18 it appaears that the PG feature [+Round] has remained stable in disyllabic roots where the first vowel is [+Round] and the second [-Round]. As noted above, where the second vowel is [+Round], the first vowel is also [+Round] and the intervening consonant is l or r.[9]

One change that is immediately obvious in 18 concerns Gonja in which the second vowel in the examples has undergone apocope and is replaced by an utterance-final glottal stop that follows the liquid consonant. This innovation (Historical Change 2) is not influenced by the feature [+Round], however, for it may be seen to have occurred to all disyllabic roots inherited from PG where the intervening consonant is [+Continuant] (cf. Cognate Sets 4 and 5 and Snider, 1986).

Looking first at those disyllabic roots where the intervening consonant is *l (Cognate Sets 19 and 20), with the exception of the Chumburung reflexes of Cognate Set 20, the second vowel can be seen to have become [-Round] in the Oti Guang subgroup (Historical Change 3). In those disyllabic roots where the intervening consonant is *r, the situation is more complex.

In Cognate Sets 52, 53 and 54, in Nkonya and the River Guang languages the final syllable has undergone apocope <u>and</u> the remaining 'initial' vowel has become [-Round] (Historical Change 6). In the Mountain Guang subgroup, Nawuri has undergone the same innovation (Historical Change 10) that the SG languages have (i.e. loss of the final syllable, marked by presence of an utterance-final glottal stop). I propose that Gichode alone has retained the original [+Round] r [+Round] sequence.

Continuing our investigation of PG disyllabic roots where both vowels are [+Round] and where the intervening consonant is *r, we see that the SG languages have undergone a clear innovation. In PSG the final syllable has undergone apocope[10] but, unlike Nkonya and the River-Guang languages, the initial vowel has retained the feature [+Round] (Historical Change 10).

1.1.4 Changes affecting PG [+Low] *a/ä

There have been two (independent) processes that have operated historically on [+Low] vowels. While both (Historical Changes 8 and 9) involve [+Low] > [-Low, -Back], the first (Historical Change 8) involves the additional [-ATR] > [+ATR]. The

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[9]Given that the reflexes of the second vowel in some of these Cognate Sets are [-Round] for some languages and [+Round] for others, it could logically be the case that the PG roots consisted of [+Round] [-Round] vowels, as opposed to the proposed [+Round] [+Round]. I propose the latter option for two reasons: a) Twi (non-Guang but still Tano) roots that are cognate with the PG roots in question have [+Round] final vowels thus suggesting that the proto-Tano roots, from which both the Akan and Guang reflexes originated, had [+Round] [+Round] vowels (cf. Twi kûnû and PG*kulu 'husband'). b) the general direction of change appears to be [+Round] > [-Round] in monosyllabic roots thus suggesting that the same holds for the final syllable of bisyllabic roots.

[10]Cognate Set 54 would suggest that the remaining syllable in Larteh is the final syllable. It is not clear to me at this point what the solution to the problem is. Given that the Twi cognate for this root (cf. Stewart, 1966) is hɔrɔ 'to wash', one possibility is that the PG root would be better reconstructed as PG*fɔrɔʔ. I leave the matter open.

independence of the two processes is suspect, due to the two features that are shared (i.e. [-Low] and [-Back]). Nevertheless, the independence of these two processes asserts itself in that while at least one language (Gwa) appears to have undergone both historical processes, some languages (Larteh and Krachi) have undergone the second (Historical Change 9) but not the first, while another, Chumburung, has undergone the first but not the second.

Comparing final with non-final occurrences of [+Low] vowels in 19 below, one can see that the ionnovations described above are restricted to root-final occurrences. From the cognate sets involved it is clear that PG*a/ā has gone to ɛ/ē in Krachi[11] and all the Hill Guang languages (Historical Change 9).

19.   PG [+Low] vowels
        Final: 6, 13, 14, 15, 17, 18, 26, 43, 44, 45, 56, 57
        Non-final: 16, 17

When PG*a (and probably PG*ā) is preceded by a syllable with a [+ATR] vowel, its reflex in Chumburung and Gwa is e (Historical Change 8, cf. Cognate Sets 56 and 57). In Cognate Set 57, Gichode has also undergone this change.

1.1.5 Changes affecting PG [+Nasal] vowels

Examination of the Cognate Sets in Appendix A shows that vowels following nasal consonants are always [+Nasal] in all Guang languages. These listed in 20 where, apart from PG*ɔ, all PG oral vowels have a nasal counterpart following nasal consonants. Although examples of nasal PG*ã following nasal consonants have not been reconstructed (examples of oral PG*ɔ following nasal consonants have also not been reconstructed), I do believe they existed. It is important to note that though not necessarily cognate with each other, occurrences of nasal [ã] following nasal consonants are found in many, if not all, Guang languages (e.g. Chumburung [mã] 'I', Nkonya [a-mã] 'that', LArteh [ɛ-mã] 'rice'). These facts, taken together, suggest that the inability to reconstruct nasal PG*ã following nasal consonants is due more to a lack of sufficient data than to anaything else.

20   PG [+Nasal] vowels following nasal consonants
        *ĩ/ɨ̃ 2, 3, 4, 5
        *ũ 23
        *ʊ̃/ɪ̃ 7, 18, 21
        *ã None reconstructed (but believed to have existed)
        *ɛ̃/ʌ̃ 61, 62
        *ɔ̃ 34
        *ã/ʌ̃ 13, 42

Not only do [+Nasal] vowels follow nasal consonants, but [+Nasal] vowels also follow oral consonants. The two sets of [+Nasal] vowels are not identical, however. While all oral vowels have [+Nasal] counterparts following nasal consonants, oral ɪ and ɔ do **not** have [+Nasal] counterparts following oral consonants. This was first established in Stewart (1970) where Stewart demonstrates that during the development of proto-Comoe (proto-Tano (PT) in Stewart, 1989 and in this paper) to proto-Guang,

[11]This was first proposed by Stewart (1970). In the Krachi data of Snider (1989 - used in the present study) not all occurrences of root-final PG*a/ā have gone to ɛ, although clearly a number have. The same forms in Stewart (1966) are, however, consistently realized as ɛ. I assume that the change has not affected all Krachi dialects in a similar manner.

PT*ĩ and PT*õ merged with PT*ɛ̃ and PT*ɔ̃ respectively, after oral consonants. Consider the Cognate Sets of 21.

21.   PG [+Nasal] vowels following oral consonants
        *ĩ/ɪ̃ 4, 5, 37, 38, 39
        *ũ 46, 47, 48, 55
        *ʊ̃/ɪ̃ None
        *õ None
        *ɛ̃/ʌ̃ 40, 41
        *ɔ̃ 49, 50, 51
        *ã/ʌ̃ 18, 43, 44, 45

From the Cognate Sets of 21 comes evidence suporting Stewart's (1970) further claim that PG [+Nasal] vowels became oral (i.e. [-Nasal]) following oral consonants in North Guang (Historical Change 1).

Since SG languages appear to have directly inherited PG [+Nasal] vowels, one might conclude that all [+Nasal] vowels that follow oral consonants in SG languages have come from this source. This is not true, however. [+Nasal] vowels which follow oral consonants in SG languages have their origin in two sources. The first, obviously, is that they were inherited directly from PG. The second is that they came from PG sequences of vowel followed by root-final nasal coda (most ususally ŋ). Examination of SG wordlists indicates that nasal codas are not often found in root-final position. In Cognate Sets 59, 60 and 63, root-final occurrences of PG nasal codas have undergone apocope in SG and have transferred their nasality onto the preceding vowel, thereby providing a second source for SG [+Nasal] vowels (Historical Change 11).

At least one question arises at this point: How do we know that the change was from vowel followed by nasal coda to nasal vowel rather than the other way round? If the change involved an NG innovation whereby PG root-final [+Nasal] vowels evolved into NG oral vowels (assuming a preceding oral consonant) followed by nasal codas, there is then the problem of why all of the PG [+Nasal] vowels did not undergo this innovation in NG (see Cognate Sets of 21 above). Since I see no immediate solution to the new problem that would be raised, I conclude that the change was as postulated.

Examination of Cognate Sets 59, 60 and 63 also shows that Nkonya, an NG language, has undergone this SG innovation.While it seems that the SG languages were the first to have undergone the change, it is a natural enough process that other Guang languages could have independently undergone it. Also, Nkonya is geographically the closet NG language to the SG languages and could therefore have undergone the change as a result of the innovation spreading, as per the wave theory.

1.2 VOWELS OF NOUN CLASS PREFIXES

Just as Sec.1.1 focusses on the surface vowel system of PG noun and verb roots, this section focusses on the surface vowel system of PG noun class prefixes. Noun class prefixes are found affixed not only to noun roots, but also to verb roots as pronominal 3rd pers. markers, concordant with the nouns they refer to. Any given noun root in PG belongs to any one of a number of noun root groups, these groups

being differentiated on the basis of their choice of singular/plural prefix pair. Singular and plural prefixes are paired, in Snider (1988), according to the schema in 22.[12]

22.   Singular   Plural
          *∅- ⟍⟍⟍⟍⟍ *ɩ-
          *kɩ- ⟍⟍⟍⟍ *a-
          *ɔ- ⟍⟍⟍⟍⟍ *bʌ-
          *kʌ- ⟍⟍⟍⟍ *ŋ-

In addition to their use as plural markers, the prefixes *ɩ-, *a- and *ŋ- are found affixed to 'mass' noun roots (e.g. 'water', 'smoke', 'soil').

The above PG noun class prefixes have the allophonic variants of 23. All prefix vowels alternate with respect to the feature [ATR], being realized as [+ATR] before roots whose first vowel is [+ATR], and as [-ATR] before roots whose first vowel is [-ATR]. The prefixes *kɩ-, *kʌ- and *bʌ- also alternate with respect to the feature [Round], being realized as [+Round] before roots whose first vowel is [+Round], and as [-Round] before roots whose first vowel is [-Round].

23.   Underlying   Surface Variants
       Prefixes   [-ATR]   [+ATR]

	[-Rd]	[+Rd]	[-Rd]	[+Rd]
kɩ-	kɩ-	kω-	ki-	ku-
kʌ-	kʌ-	kɔ-	kə-	ko-
bʌ-	bʌ-	bɔ-	bə-	bo-

ɩ-	ɩ-	i-
ɔ-	ɔ-	o-
a-	a-	ə-

2. UNDERLYING VOWEL SYSTEM

With the PG surface vowel system that emerges from Sec.1, any attempt to represent the underlying vowel system must take the following into consideration. In root-final position, oral vowels are limited to: *i, *ɩ, *ɛ, *a, *ɔ, *ω and *u. In nonfinal environments within roots, oral vowels are also limited to seven vowels: *i, *ɨ, *ʌ, *a, *ɔ, *ωN and *u, the [-Back] vowels being in obvious complementary distribution with their [+Back, -Round] counterparts. Further complementary distribution occurs between *a and *ʌ, *ʌ occurring in closed syllables (i.e. CVN) and *a occurring elsewhere. Thus the oral vowels of PG roots may be set out as in 24, with those vowels which are noncontrastive being boxed together.

24   Underlying Root Vowels (oral)

       | i   ɨ | u
       | ɩ   ɨ | ω
       | ɛ   ʌ | ɔ
              | a |

The feature [+Nasal] must be distinctive for consonants since nasal consonants contrast with oral (voiced and voiceless) consonants before [+Nasal] vowels. The feature [+Nasal] must also be distinctive for vowels since, with the exception of *ı, *ı, and *ω, all the oral vowels of 24 contrast with [+Nasal] counterparts following oral consonants. Thus, while in PG all vowels following nasal consonants are [+Nasal], it is nevertheless necessary to recognize the underlying set of [+Nasal] vowels in 25. Since the complementary distributions noted above for oral vowels also hold for their [+Nasal] counterparts, noncontrstive vowels are again boxed together.

25. Underlying Root Vowels ([+Nasal])
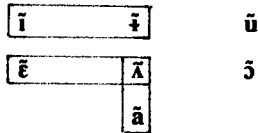
The alternations of prefix vowels, outlined in 23 above, are displayed in 26 where, as in 24 and 25, noncontrastive vowels are boxed together.

26. Underlying Prefix Vowels
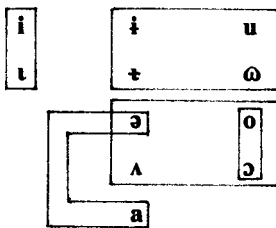
3. SUMMARY

To summarize briefly, in PG roots there is an underlying system of seven oral vowels (cf. 24) and five nasal vowels (cf. 25). In PG prefixes there is an underlying system of five oral vowels (cf. 26).

Not only is there harmonization with respect to the features [+Round] and [+ATR] between prefix and root vowels, but there is also a limited degree of harmonization involving these features between V^1 and V^2 in roots. In disyllabic roots, if the first vowel is [+Round] and the intervening consonant l or r, the second vowel must also be [+Round] or else [+Low]. It is also the case that if the second vowel is [+Round], the first vowel must also be [+Round].

With respect to [+ATR] harmony, there is a high degree of parallelism with [+Round] harmony. In disyllabic roots, if the first vowel is [+ATR] the second vowel must also be [+ATR (all [+ATR] vowels are also [+High]) or else [+Low]. Again, paralleling the case of [+Round] harmony, if the second vowel is [+ATR], the first vowel must also be [+ATR].

Subsequent to this state of affairs, a number of changes occurred. The present-day languages and the assumed intermediate proto-languages from 1 above, appear in 27, together with the changes to the PG vowel system that each is proposed to have undergone. The numerals below each name correspond to the numbers of the proposed Historical Changes listed in Appendix B.

27.

```
                           ┌ Gonja                      ┌ Gichode 5
                           │ 2              ┌ PMG      ─┤
                           │                │ 4         └ Nawuri 10
              ┌ PNG      ─┤  POG          ─┤
              │ 1          │ 3              │            ┌ Chumburung 7,8
              │            │                │ PRG      ─┤
              │            └ Nkonya         └ 6          └ Krachi 9
              │              6, 11
 PG         ─┤                                           ┌ Gwa 8
              │                              ┌ PNHG     ─┤
              │                              │           └ Cherepong
              │            ┌ PHG           ─┤
              │            │ 9              └ Larteh 12
              └ PSG      ─┤
                10, 11     │                 ┌ Awutu
                           └ PCG           ─┤
                                             └ Efutu
```
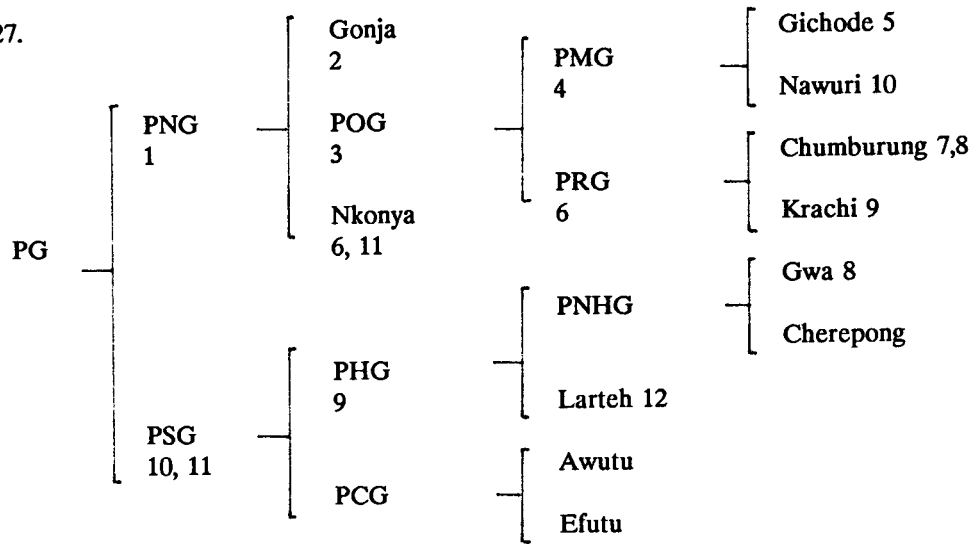
APPENDIX A: COGNATE SETS

	1. 'to eat'	2. 'to know'	3. 'tooth'
PG	*di	*nɪ	*kɨ-nɪ
Gonja	ji	ɲɪ	kɨ-ɲɪ
Chumburung	ji	ɲɪ	
Krachi	ji	ɲɪ (ST)	
Gichode	ji	ɲɪ	gɨ-ɲɪ
Nawuri	ji	ɲɪ	gɨ-ɲɪ
Nkonya	ji	ɲɪ	e-ɲɪ
Larteh	ji	nɪ	∅-ɲɪ-mɪʔ (SN)
Cherepong	ji	nɪ	ɲ-ɲɪ-biʔ
Gwa	ji	nɪ	e-ɲɪ
Awutu	di	nɪ	a-nɪ
Efutu	di	nɪ	e-nɪ

	4. 'excrement'	5. 'vein'	6. 'to seize/catch'
PG	*i-bɪnɪ	*o- tɪnɪ	*kɨta
Gonja	e-binʔ	ki- čɨnʔ	kɨta
Chumburung	i-jinɪ	kɨ- činɪ	kɨra
Krachi		kɨ- činɪ	kɨtɛ (ST)
Gichode	i-bɨŋ	o- čɨŋ	kɨda
Nawuri	i-bɨnɪ	o- činɪ	kɨta
Nkonya	m-bi	e-tsɪ	kɪta
Larteh	∅-bɪnɪ	n-tsɪnɪ	kɪtɛ
Awutu	e-bɪɲ	n- tɪnɪ	

	7. 'we'	8. 'to unload'	9. 'father'
PG	*a-nɪ	*sɷ-kɪ	*ɔ-sɪ
Gonja	ə-ɲɪ	sɷ-wɪ	
Chumburung	a-nɪ	sɷ-wɪ	∅-sɪ
Krachi	a-rɪ (ST)	sɷ-kɪ	ɔ-sɪ
Gichode	a-yɛ	sɷ-gɛ	ɔ-sɛɪ
Nawuri	a-nɛ̃ɪ	sɷ-gɛɪ	ɔ-sɛɪ
Nkonya	a-nɪ	sʷɪ:	ɔ-sɪ
Larteh	ɛ-nɪ	sɷ-čɪ	ɔ-sɪ
Cherepong	a-nɪ		
Gwa	ɛ-nɪ		∅-sɪ (P)
Awutu	a-nɪ	so-ke	∅-se
Efutu	ə-nɪ-fʊ:		

	10. 'oil palm'	11. 'rope'	12. 'witchcraft'
PG	*kʌ-bɛ	*ɔ-fɛ	*kʌ-kpɛ
Chumburung	kə-baŋ	∅-fe	kə-kpe
Krachi	kʌ-bɛ	ɔ-fɛ	kʌ-kpɛ
Gichode	gʌ-bɛ	ɔ-fɛ	gʌ-kpɛ
Nawuri	gɪ-bɛ	ɔ-fɛ	gʌ-kpɛ
Nkonya	ɛ-bɛ	ɔ-fɛ	ɔ-kpɛ
Larteh	e-be	∅-fe-bi	
Awutu	a-bɛ	∅-fɛ-bi	

	13.'to sit'	14.'path'	15.'to come'
PG	*čɩnã	*ɔ-kpa	*ba
Gonja	čɩnã	ɛ-kpa	ba
Chumburung	čɩnã	∅-kpa	ba
Krachi	čɩrɛ	ɔ-kpɛ	bɛ
Gichode	čɩnã	ɔ-kpa	ba
Nawuri	čɩnã	ɔ-kpa	ba
Nkonya	čia (SN)	ɔ-kpa	ba
Larteh	čɩnɛ̃ (SN)	ɔ-kpɛ	bɛ
Cherepong	čɩnɛ̃ɩ	a-kpɛ	bɛ
Gwa	čɩnɛ̃ɩ	a-kpɛ	bɛ
Awutu	čɩnã	e- pa	ba
Efutu	sɩnã	∅- pa (FG)	ba

	16.'to imitate'	17.'loan'	18.'to stick'
PG	*kasɩ	*ka-pala	*mɨtã
Gonja		ka-pʌŋ	
Chumburung	kasɩ	kɨ-para	mɨra
Krachi	kasɩ	ka-para	mɨtɛ
Gichode	kasɛ		
Nawuri	kasɛɩ	gɩ-pa:la	
Nkonya	kasɩ	ɩ-pã	
Larteh		a-ha	mɨtɛ̃
Awutu	kase	a-ha	

	19.'husband'	20.'urine'	21.'drum'
PG	*o-kulu	*m-bulu-fɔ	*kʊ-kɔ̃nɨ
Gonja	e-kul?		
Chumburung	∅-kuri	m-buru-fo	kʊ-kʷaɩ
Krachi	o-kuri	m-buri	kʊ-kʷɛɩ
Gichode	o-kuli	m-buli	gʊ-kɔrɛ
Nawuri	o-kuli	m-buli-fo	gʊ-kɔrɛɩ
Nkonya	o-kulu	o-bulu	ɩ-kʷɛ
Larteh	o-kuru	a-buru	∅-kɔ̃nɨ
Awutu	∅-kuri	a-bru-fɔ	∅-kɔ̃nɨ

	64.'to drink'
PG	*nʊ̃ŋ
Gonja	nʊ̃?
Chumburung	nʊ̃?
Krachi	nʊ̃?
Gichode	nʊ̃ŋ
Nawuri	nʊ̃:?
Nkonya	nʊ̃
Larteh	nʊ̃
Cherepong	nʊ̃:?
Gwa	nʊ̃:
Awutu	nʊ̃
Efutu	nʊ̃:

```
              22.'to die'    23.'to drink'      24.'water'
PG            *wu            *nʊ̃ŋ               *ɲ-ču
Gonja          wu             nʊ̃ʔ               ɲ-ču
Chumburung     wu             nʊ̃ʔ               ɲ-ču
Krachi         wu             nʊ̃ʔ               ɲ-ču
Gichode        wu             nʊ̃ŋ               ɲ-ču
Nawuri         wu             nʊ̃:ʔ              ɲ-ču
Nkonya         wu             nʊ̃                ɲ-ču (SN)
Larteh         wu             nʊ̃                ɲ-ču (SN)
Cherepong      wu             nʊ̃:ʔ              ɲ-ču
Gwa            wu             nʊ̃:               ɲ-ču
Awutu          wu             nʊ̃                ɲ-ču
Efutu          wu             nʊ̃:               n-su
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              25.'weaver'    26.'bitter'        27.'lizard'
PG            *ɔ-lʊ-pʊ        *ɔ-kɨta           *ø-kɨti
Gonja          ɛ-lʊ-pɔ
Chumburung     ɔ-lʊ-pʊ                           ø-kəri
Krachi         ɔ-lʊ-pʊ        ø-kɨta            ø-kɪtɪ
Gichode        ɔ-lʊ-bɔ                           ø-kɨdɛɪ
Nawuri         ɔ-lʊ-pʊ                           ø-kɨtɛɪ
Nkonya         ɔ-lʊ-pʊ        ɔ-kɪta            ø-kɪtɪ
Larteh         ɔ-lʊ-wʊ        ɔ-kɪta            o-kiti
Awutu          e-lo-ho                           e-kiti
```

```
              28.'blood'     29.'ear'   30.'to arrive (reach)'
PG            *ŋ-kalʌŋ        *kʊ-sʊ            *fʊ
Gonja          ŋ-kalʌŋ         kʊ-sʊ             fʊ
Chumburung                                       fʊ
Krachi                         kʊ-sʊ             fʊ
Gichode        ŋ-kalʌŋ         gʊ-sɔ             fɔ
Nawuri         ŋ-kalʌŋ         gʊ-sʊ             fʊ
Nkonya                         ɪ-sʊ (SN)
Larteh         ŋ-krɛ           ø-sʊ             fʊ
Cherepong                      ɛ-sʊ
Gwa                            ɔ-sʊ              fʊ (P)
Awutu          ŋ-kla           ə-sʊ (SN)         fo
Efutu          ŋ-kra           a-su-bi (FG)
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```
              31.'termite'   32.'to pound'      33.'seed'
PG            *ø-bɔtɪ         *wɔtɪ             *kɨ-bi
Chumburung                     wɔrɪ              ki-ji
Krachi         ø-bɔtɪ          wɔtɪ             ki-ji
Gichode        ø-bɔdɛɪ         wɔdɛ             gɨ-bi
Nawuri         ø-bɔtɛɪ         wɔtɛɪ            gɨ-bi
Nkonya                         wɔ               i-bi
Larteh         ŋ-fɔtɪ          wɔ               e-bi
Cherepong                                        e-bi
Gwa                                              e-bi
Awutu          ŋ-hɔte                            a-bi
Efutu                                            m-bi
```

	34. 'mouth'	35. 'illness'	36. 'in'
PG	*kɔ-nɟ	*kɯ-lɔ	*-tɔ
Gonja	kɔ-nɟ	kɯ-lɔ	-tɔ
Chumburung	ka-nɟ	kɯ-lɔ	-rɔ
Krachi	kɔ-nɟ	kɯ-lɔ	-tɔ
Gichode	gɔ-nɟ	gɯ-lɔ	-dɔ
Nawuri	gɔ-nɟ	gɯ-lɔ	-tɔ
Nkonya	ɔ-nɟ	ɩ-lɔ	-tɔ
Larteh	a-nɟ (SN)	∅-lo	-te
Cherepong	a-nɟ		
Gwa	a-nɟ	ɔ-lʷɛ (P)	
Awutu	a-nɟ	e-lɔ-bi	-tɔ
Efutu	a-nɟ		

	37. 'to wake up'	38. 'to taboo'	39. 'to leave sth.swh.
PG	*tɪŋkɪ	*kɪ-sɪ	*sɪ
Gonja	tɪŋŋɪ	ki-ši	ši
Chumburung	čɨŋŋɪ	kɨ-si	si?
Krachi	čɨŋŋɪ	kɨ-si	si
Gichode	čɨŋgi		
Nawuri	čɨŋŋɪ	kɨ-si	
Nkonya	tsiŋki	ki-si	si
Larteh	tsɪɲčɪ	čɪ	sɪ
Awutu	šɪŋkɪ	kɪ	šɪ

	40. 'day'	41. 'tomorrow'	42. 'to wring out'
PG	*kʌ-kɛ	*ɔ-kɛ	*ɲʌ̃ŋ
Gonja	ka-čɛ		ɲʌ̃n-tɔ
Chumburung	kə-ke		ɲɜ̃n-no
Krachi	kʌ-kɛ	ɔ-kɛ	ɲʌ̃ (ST)
Gichode	gʌ-kɛ	ɔ-kɛ	ɲʌ̃ŋ
Nawuri	gʌ-kɛ	ɔ-kɛ	ɲʌ̃ŋ
Nkonya	ɛ-kɛ	ɔ-kɛ	
Larteh	a-kɛ	ɔ-kɛ	ɲã
Awutu	e-kɛ	o-kɛ	

	43. 'wife'	44. 'alcoholic drink'	45. 'life'
PG	*ɔ-kã	*n-tã	*ŋm-kpã
Gonja		n-sa	ŋ-kpa
Chumburung	∅-ka	n-ta	ŋm-kpa
Krachi	ɔ-ka	n-tɛ	ŋm-kpa
Gichode	ɔ-ka	n-ta	ŋm-kpa
Nawuri	ɔ-ka	n-ta	ŋm-kpa
Nkonya	ɔ-ka	n-ta	ŋm-kpa
Larteh	ɔ-kɛ	n-tɛ	ŋm-kpɛ
Gwa	ɔ-kɛ (P)	n-tɛ (P)	
Awutu	∅-kã	n-tã	m-pã

	46.'tail'	47.'fear'	48.'to cry'
PG	*o-dʊ?	*ku-fʊ?	*sʊ
Gonja	ka-du?	ku-fu?	šu
Chumburung		ku-fu	su
Krachi	o-du:?	ku-fu	su
Gichode	o-du:?	gu-fu:?	su
Nawuri		gu-fu:?	saɔ
Nkonya	o-du	i-fu	su
Larteh	o-dʊ	∅-fʊ	sʊ
Cherepong	ɛ-dʊ?		
Gwa	a-dʊ?		sʊ (P)
Awutu	e-dʊ	e-fʊ	sʊ

	49.'ash'	50.'to fight'	51.'to roast'
PG	*n-sɔ̃	*kɔ̃	*tɔ̃
Gonja	n-sɔ	kɔ	tɔ
Chumburung	n-sɔ	kɔ	tɔ
Krachi	n-sɔ	kɔ	tɔ
Gichode	n-sɔ	kɔ	tɔ
Nawuri	n-sɔ	kɔ?	tɔ
Nkonya	n-suo	kɔ	tɔ
Larteh	n-sɔ̃	kɔ̃	tɔ̃
Cherepong	n-sɔ̃		
Gwa	n-sɔ̃	kɔ̃ (P)	
Awutu	n-sɔ̃	kɔ̃	
Efutu	n-sɔ̃		

	52.'to dig'	53.'to build'	54.'to wash'
PG	*kuru?	*pɔrɔ?	*fɔrɔ?
Gonja	kur?	pɔr?	fɔr?
Chumburung	kʷi?	pʷɛ?	fʷɪ?
Krachi	kʷi?	pʷɛɪ?	fʷɛɪ?
Gichode	kuru:?	pɔrɔ?	fɔrɔ?
Nawuri	ku:?	pʷɔɪ?	fʷɪ:?
Nkonya	kʷi	pʷɛ	fʷɪ
Larteh	ku		fɔ
Awutu	ku	hɔ	fo

	55.'wind'	56.'chief'	57.'bury'
PG	*ə-fʊ?	*o-wura	*pula
Gonja	ə-fu?	o-wura	puli
Chumburung	ə-fʷi?	o-wure	pure
Krachi	ə-fu:?	o-wurɛ (ST)	purɛ
Gichode	ə-fu:?	∅-wura	pule
Nawuri	ə-fu:?	o-wura	pula
Nkonya	a-fu	o-wie	pula
Larteh	e-fʊ	o-wurɛ	hurɛ
Gwa	e-fʊ (P)	ə-wule (P)	
Awutu	a-fʊ		

	58.'oil'	59.'to grow'	60.'piece'
PG	*ŋ-fɔ	*dʌŋ	*kɨ-tɨŋ
Gonja	ŋ-fɔ	dʌŋ	kɨ-šiŋ
Chumburung	ŋ-fɔ	dʌŋ	kɨ-tɨŋ
Krachi	ŋ-fɔ	dʌŋ	kɨ-tɨŋ
Gichode	ŋ-fɔ	sʌŋ	gɨ-dɨŋ
Nawuri	ŋ-fɔ	dʌŋ	
Nkonya	m-fɔ	dã	i-tɪ
Larteh	m-fʷe	de	ø-tɪ
Cherepong			
Gwa	ŋ-fʷɛ		
Awutu	m-fɔ	da	
Efutu	ŋ-fɔ		

	61.'nasal mucus'	62.'belly'	63.'to bite'
PG	*ɪ-mɛ̃ʔ	*kʌ-mɛ̃	*duŋ
Gonja	kɨ-mɛ̃le		duŋ
Chumburung	i-mɛ̃ʔ	kə-mɛ̃	duŋ
Krachi	ɪ-mɛ̃ʔ	kʌ-mɛ̃	duŋ
Gichode	ɪ-mɛ̃lʌŋ		duŋ
Nawuri	ɪ-mɛ̃:ʔ		duŋ
Nkonya			dũ
Larteh		a-mɛ̃	dũ
Cherepong		a-mɛ̃	dɪ
Gwa		a-mɛ̃	dɪ
Awutu	e-mɛ̃		dũ
Efutu			dũ

APPENDIX B: HISTORICAL CHANGES

1. *V   >   V   /   C   __   (PG > PNG)
   [-Nasal]   [-Nasal]

2. *V > ? /   C   __#   (PNG > Gonja)
              [+Cont.]

3. *V$_2$ >   V   /   V$_1$ l __   (PNG > POG
        [-Round]   [+Round]

4. *ø > V   / __   V##   (POG > PMG)
   $\begin{bmatrix} -High \\ -Back \\ -ATR \end{bmatrix}$ $\begin{bmatrix} +High \\ -Back \\ -ATR \end{bmatrix}$

5. *V   >   V   / __##   (PMG > Gichode)
   $\begin{bmatrix} +Round \\ +High \\ -ATR \end{bmatrix}$ [-High]

6. *V$_1$ r V$_2$ >   V$_1$?   (POG > PRG,
   [+Round] [+Round]   [-Round]   PNG > Nkonya)

7. *V   >   V   (PRG > Chumburung)
   $\begin{bmatrix} -High \\ -Back \end{bmatrix}$ [+ATR]

8. *V$_2$ >   V   /   V$_1$ __   (PRG > Chumburung,
   [+Low] $\begin{bmatrix} -Back \\ +ATR \\ -Low \end{bmatrix}$ [+ATR]   PNHG > Gwa)

9. *V   >   V   / __#   (PRG > Krachi,
   [+Low] $\begin{bmatrix} -Back \\ -Low \end{bmatrix}$ PSG > PHG)

10. *V$_1$ r   V$_2$ >   V$_1$?   (PG > PSG,
    [+Round] [+Round]   [+Round]   PMG > Nawuri)

11. *V   C#   >   V#   (PG > PSG,
    [+Nasal]   [+Nasal]   PNG > Nkonya)

12. *V   >   V   / __#   (PHG > Larteh)
    $\begin{bmatrix} -Nasal \\ -High \\ -Low \end{bmatrix}$ [+ATR]

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