Kirikiri and the Western Lakes Plains Languages: Selected Phonological Phenomena

Heljä and Duane Clouse
Summer Institute of Linguistics, Indonesia

1   Introduction

Eighteen languages are spoken in the western Lakes Plains (WLP) region of Irian Jaya, Indonesia. Seventeen of these are shown in Map 1. The eighteenth, Kwerisa, is spoken in one of the Kai villages. According to Silzer and Clouse (1991), the largest of these languages has only 1000-1200 speakers. Nine have 250 speakers or less.

According to Silzer and Clouse (1991), the twelve easternmost languages make up two of the families in the Tor-Lake Plain stock, Northern (Border-Tor-Lake Plain) sub-phylum
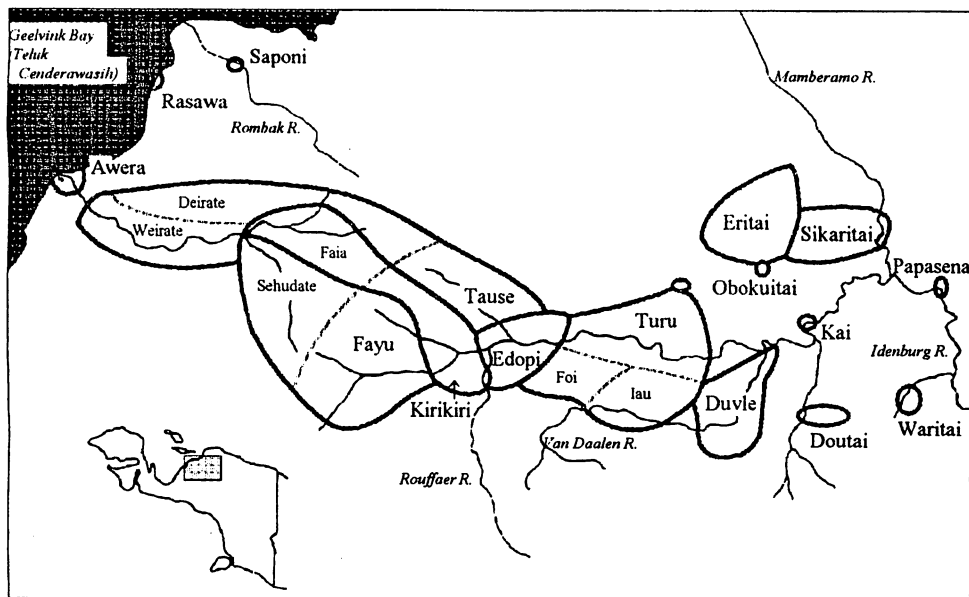
MAP 1: LANGUAGES OF THE WESTERN LAKES PLAINS REGION

CHART 1: WLP CONSONANT SYSTEM

	t	k
b	d	
ɸ	s	

There is some variation in the phonemic representation of the voiceless bilabial. In most WLP languages there is a [ɸ], but no phonetic [p]. Therefore, we have indicated the phoneme as /ɸ/ in chart 1. In Awera, Doutai, Edopi, and Kirikiri, however, the phone [p] does occur. It may be reasonable to posit /p/ as the phoneme in some of these languages, especially in Awera were no fricative variants occur.

In addition to these six consonants, /ɣ/ occurs in Fayu (Kügler and Kügler 1990) and /g/ occurs in Doutai (McAllister and McAllister 1991). Kim and Kim (1991a) also posit a phonemic contrast between fortis and lenis /t/ in Edopi. Acoustically, the fortis /t/ is prenasalized with a voiceless nasal. However, it is very rare and not definitely confirmed. In Sikaritai, Doutai, Tause, and Edopi the analysts also suggest one or two semivowels. Semivowels are discussed further in section 4.

The phone [dʒ] occurs as a separate phoneme in Fayu (Kügler and Kügler 1990) and in Edopi (Kim and Kim 1991b), and has been analysed as an allophone of various phonemes in Deirate in the west and Doutai, Sikaritai and Obokuitai in the east. In Doutai there is some evidence that [dʒ] comes from [dj] (McAllister and McAllister 1991:129). When the suffix /-ja/ 'my' is affixed to a root ending in /d/, [dʒ] results as in /id+ja/ → [idʒa] and /ud+ja/ → [ụdʒa]. Additionally, in some cases [dʒ] fluctuates freely with [d], as in [bịdiwe~bịdʒiwe] and [kegịdi~kegịdʒi]. Finally, cognate sets apparently exist in which [dʒ] is cognate with [d], [ị], or [i]. In 'matoa tree sp', shown in (1), [dʒ] in Edopi is apparently cognate with [ị] in Kirikiri, while in 'cassowary', in (2), [dʒ] in Fayu and Weirate is apparently cognate with [d] in Edopi, Kirikiri, and Iau, and with [i] in Tause.

1)	[dʒe]	Edopi	2)	[dʒai]	Fayu
	[dʒeri]	Fayu		[dʒari]	Weirate
	[ịji]	Kirikiri		[dei]	Edopi, Kirikiri
	[si]	Iau		[dai]	Iau
	[sedi]	Doutai		[iari]	Tause

Like many of the systems surveyed by Foley (1986:55), then, the consonant inventories of the WLP languages are small. Perhaps the most striking feature of this system is the lack of nasals. Foley notes that most Papuan languages have two nasal phonemes. Although phonetic nasals do exist in most WLP languages, they do not contrast with the corresponding voiced stops. The easternmost languages, Doutai, Sikaritai and Obokuitai, lack even phonetic nasals. Also lacking is a liquid phoneme in any WLP language.[3]

[3] Claims that /r/ is a separate phoneme have been made for Fayu (Kügler and Kügler 1990) and Edopi (Kim and Kim 1991a), but we failed to find justification for these claims.

WLP have a wide range of allophonic variation in consonants, as is not uncommon in Papuan languages with a small inventory of consonants (Foley 1986:55). In general, the western languages have more variation than the eastern languages. Iau has the least variation. Kirikiri seems to have the most variation, but this may be due to a more detailed transcription. The Kirikiri range of variants is as in (3).

3) /ɸ/   [ɸ h β p]
    /t/   [t d]
    /k/   [k g x ɣ]
    /b/   [b β m mb]
    /d/   [d n nd l ɾ]
    /s/   [s z ʃ ʒ]

In the following sections we examine several aspects of the WLP consonant systems in more detail. First we examine lenition of consonants, then the variants of the phoneme /ɸ/, and then palatalization. Finally, we examine the status of nasal consonants, and make some suggestions regarding their historical development.

2.1 Lenition

Much of the allophonic variation in the stops is due to various types of lenition including intervocalic voicing, fricativisation and aspiration, and flapping or lateralisation. Lenition reported in WLP languages is summarized in Chart 2.

CHART 2: LENITION IN WLP LANGUAGES

	Voicing				Fricativ.		Flapping
	ɸ	k	s	t	b	k	d
Awera	x	?			x	x	x
Faia	x	x	?	?	x	x	x
Kirikiri	x	x	x	x	x	x	x
Tause	x	x	x		x	x	x
Fayu	x	x	x	?	x	x	x
Edopi	x		x		x		x
Doutai		x			x	v	x
Sikaritai		x				v	x
Obokuitai		x					x
Iau							?

v = always voiced

Intervocalic voicing of consonants is present throughout most of the WLP languages, although it is less prevalent in the easternmost languages Doutai, Sikaritai, and Obokuitai. No intervocalic voicing is reported for Edopi or Iau. This, however, may be due to the investigators not writing it. We digitalized Edopi utterances and found intervocalic voicing, as indicated in the chart. Another linguist digitalized Iau utterances (collected from tapes) and also found voicing, although we have not indicated it in the chart.

The labial and velar stops /b/ and /k/, but not the alveolar stops, undergo fricativisation in WLP languages. As with voicing, fricativisation happens least in the easternmost languages. No fricativisation is reported in Iau and Obokuitai. In Sikaritai, only the velar fricativises, which is then always voiced. In Doutai both the labial and velar fricativises, with the velar also being voiced.[4]

Turning to the voiceless bilabial, fricativisation (resulting in [p~ɸ] variation) and/or aspiration (resulting in [ɸ~h] or [p~h] variation) seem to apply in all WLP languages except Awera, in which the phoneme /p/ does not have any fricative allophones. The only language in which a synchronic rule of fricativisation can be motivated is Doutai which shows allophonic variation between [ɸ] and [p].[5] Aspiration apparently applies in all languages other than Awera and Doutai. In all but Edopi and Fayu, free variation is reported between [ɸ] and [h]. Claims have been made that /h/ and /ɸ/ are separate phonemes in Fayu (Kügler and Kügler 1990) and /h/ and /p/ are separate phonemes in Edopi (Kim and Kim 1991a),[6] but the evidence for this is scanty.[7] Thus, it is possible that [h] is an allophone of /ɸ/ or /p/ in these languages also. In Edopi and Faia, [h] seems to be more common than [p] or [ɸ].[8]

In almost all the WLP languages, /d/ is realised as [ɾ], [l] or some similar flap[9] in intervocalic position.[10] The only exception to this is Iau, where Bateman (1989) does not report any flapping. Both [ɾ] and [l], however, are included in another linguist's transcriptions of Iau. Flaps also occur as the second member of consonant clusters.[11]

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[4] In Fayu, Kügler and Kügler (1990) report that [w] may be the fricativized allophone of /b/.

[5] The phones [p] and [ɸ] are in free variation in Doutai.

[6] Kim and Kim do not report phonetic [ɸ] at all.

[7] Kügler and Kügler do not mark tone for the few minimal pairs; Kim and Kim list only two minimal pairs. Fayu and Edopi words with [h] are cognate with Kirikiri words with [ɸ]. Also, [p] is pronounced [ɸ~h] in Indonesian loan words by most WLP speakers.

[8] It should be noted that we have observed, in Kirikiri, that there are speakers who use the velar stop [k] as a variant of /h/. At this writing, we cannot yet explain this phenomenon.

[9] Kügler reports a "retroflexed d."

[10] As mentioned above, Kim and Kim (1991a) suggest /r/ and /d/ are separate phonemes, but this analysis is not conclusive.

[11] An exception to this is the Faia dialect of Kirikiri. The second member of consonants clusters beginning with /ɸ~h/ becomes [n], so that [ɸli] 'louse' in Kirikiri is [hni] in Faia.

2.2   Nasals

Foley (1986:56) states: "All Papuan languages have at least the nasal sounds [m] and [n], but in a few Papuan languages the phonemic status of these can be in question." The WLP languages Doutai, Sikaritai, and Obokuitai do not conform to this, in that no nasals, phonemic or phonetic, have been reported. In the rest of the WLP languages, there is no phonemic distinction between nasals and their corresponding voiced stops. Only [m] and [n] are evidenced phonetically in any WLP language, and their distribution is more restricted than that of their oral stop counterparts.

In WLP languages where phonetic nasals occur, [m] occurs mainly preceding [a].[12] It occurs in free variation with [b], [mb] and [β]. The distribution of [n] is somewhat wider. Although in Iau and Fayu [n] only occurs preceding [a], in Kirikiri, Tause and Edopi [n] can precede other vowels. In all WLP languages, nasals seem only to occur word or morpheme-initially. Within a morpheme, the voiced bilabial is normally realised as a fricative (or a stop), and the alveolar is realised as a flap. In Kirikiri, Fayu, Edopi and Tause, prenasalized variants of the voiced stops (which occur in word-initial positions) are more common than the nonprenasalized variants.

Since this lack of phonemic and phonetic nasals is a rare phenomenon in Papuan languages, the question arises, are the nasals appearing or disappearing? McAllister and McAllister (1991) hypothesize that they are disappearing. They note that nasals occur in older wordlists of Sikaritai and Papasena (Voorhoeve 1975[13]) and state that "now [the nasals] manifest [themselves as] imploded bilabial stops." (p.137)[14] For Kirikiri, on the other hand, it seems that nasals are gaining ground. Evidence for this comes in light of the general weakening of all consonants throughout the region. Consider the forms for 'cassowary' given in (2) above, repeated here as (4).

4)   [dʒai]   Fayu
     [dʒaɾi]   Weirate
     [dei]   Edopi, Kirikiri
     [dai]   Iau
     [iaɾi]   Tause

As indicated above, the [dʒ] in the Fayu and Weirate forms must have developed from *d, not *n. If *n was the earlier form, it would have had to become *d, which in turn would have undergone palatalisation to produce the present [dʒ]. However, in all of these languages, the fluctuation between [d] and [n] is a current phenomenon.

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[12] In Kirikiri and Edopi [m] also occurs before other non-high vowels.
[13] Sikaritai is listed as Aikwakai in Voorhoeve (1975).
[14] Doutai and Iau also report implosive bilabial stops with Iau having nasal variants. It is possible that the development of the stops in these eastern languages was different than that of the stops in the western languages.

Other evidence that nasals are gaining ground in the westernmost languages comes from the tendency in these languages to eliminate the syllable initial consonant clusters. Assuming the simplification of consonant clusters is a synchronic process, the cognate forms in (5) indicate that [m] and [n] are recent developments.

5)		Kirikiri	Faia	
	a.	*abla*	*oma*	'tongue'
	b.	*ɸli*	*hni*	'louse'
	c.	*ɸla*	*hna*	'ground'

In (5b,c) the *ɸl* cluster in Kirikiri (and many other WLP languages) seems to have developed into a preaspirated nasal in Faia.[15]

Furthermore, as nasals occur in most languages of the world, it seems less likely that the shift from nasals to obstruents (resulting in the loss of all nasals) would be occurring in several languages at the same time, especially since the speakers have had very little contact with each other. The reverse process, acquiring nasals, thus moving towards a more common system, would be more likely. The less likely process, the loss of nasals, would then have occurred only once, in the proto-language.

3   Vowel System

Characteristic of the vowel systems of WLP languages are the high, tense, "fricativised vowels", in addition to the high vowels [i u]. In some of the WLP languages, the fricativised vowels are allophones of [i] and [u], while in others they are separate phonemes. In section 3.1 the status of the fricativised vowels is outlined. Then, in section 3.2 it is argued that the origin of these vowels can be traced to the loss of a consonant. In some of these languages the consonants have not been totally lost, and so the process can still be seen.

3.1   Synchronic Vowel Systems

Sikaritai and Obokuitai have the five vowel system /i e a o u/. In Obokuitai, a syllable can end in an unreleased [g] if the preceding vowel is [i], or an unreleased [b] if the vowel is [u]. In Sikaritai, syllables can end in unreleased [g] or [d] preceded by any vowel. In Obokuitai, [i] preceding a syllable final [g] is "backed, tense and with friction." (Jenison and Jenison 1991a) In Sikaritai the [i] in the same position "becomes 'fricativised', as if the [g] is being absorbed into /i/." (Martin 1991)[16]

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[15] The /hn/ sequence is listed as a secondary nasal consonant, analysable as a single phoneme, in Ferguson (1966:57).

[16] Neither Martin nor Jenison say what the phonetic quality of [u] is before syllable final consonants.

Doutai and Kirikiri have the seven vowel system shown in Chart 3.[17]

<div align="center">

CHART 3: SEVEN VOWEL SYSTEM

ɪ̝   ʊ̝

i   u

ɛ   ɔ

a

</div>

In Kirikiri, the range of /i/ varies from [i] to [e], and /u/ varies from [u] to [o]. In addition, the [ʊ̝] is more fronted. The fricativised vowels and high vowels contrast in Doutai and Kirikiri. An example of contrast between /i̝/ and /i/ in Kirikiri is given in (6).

6)   [di̝]   'ironwood'
     [di]   'string bag'

Fricativised vowels have also been analysed as separate phonemes in other WLP languages. In Iau, Bateman (1989) posits a "high unrounded fricativised vowel /i/"; while in Tause, Munnings (1991a) posits "a high close rounded fricative back vocoid". The overall vowel systems in the other languages differ somewhat from that in Chart 3, but they are all more complex than the five vowels posited for Sikaritai and Obokuitai. Seven vowel systems are posited for Iau and Fayu, but Bateman (1989) claims four are front vowels and three are back in Iau, while Kügler and Kügler (1990) claim three are front, three are back, and one is high central in Fayu.[18] Six vowel systems are posited for Tause and Edopi; Munnings (1991a) posits two front vowels, three back vowels, and one central vowel for Tause,[19] while Kim and Kim (1991a) suggest Edopi has three front vowels and three back vowels.[20]

In order to check our auditory impressions of vowel qualities in Kirikiri, spectrographic analysis was made of the vowel qualities of eight Kirikiri speakers using the computerised speech analysis system developed by SIL. Figure 1 shows the ranges of Kirikiri single vowels as spoken by these speakers.[21] The areas marked by solid lines cover the range of all eight speakers, while the filled in areas cover the range of a single speaker. Figure 1 supports the claim that /i̝/ and /ʊ̝/ are higher and further forward than are /i/ and /u/. Furthermore, the range of each vowel is clearly delineated given single vowels.

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[17] McAllister and McAllister (1991) analyze Doutai as having a 5-vowel system. They analyse the fricativized vowels as sequences /Vk/ (with /k/ being arbitrarily chosen), but note that "this final consonant is realized only as friction on the previous vowel". Phonetically, then, there is no consonant.

[18] The front vowels have a total of four allophones.

[19] The front vowels have a total of four allophones, as do the back vowels.

[20] The front vowels have a total of four or five allophones; the back vowels have five allophones.

[21] All charts based on spectral data are plotted according to their formants, with F_1 on the vertical axis and F_2 minus F_1 on the horizontal axis. We have followed Ladefoged's (1975:173) suggestion and used F_2-F_1 instead of F_2 on the horizontal axis since the value of F_2-F_1 correlates to the backness of the vowel better than does the value of F_2.

FIGURE 1: RANGE OF SINGLE VOWELS
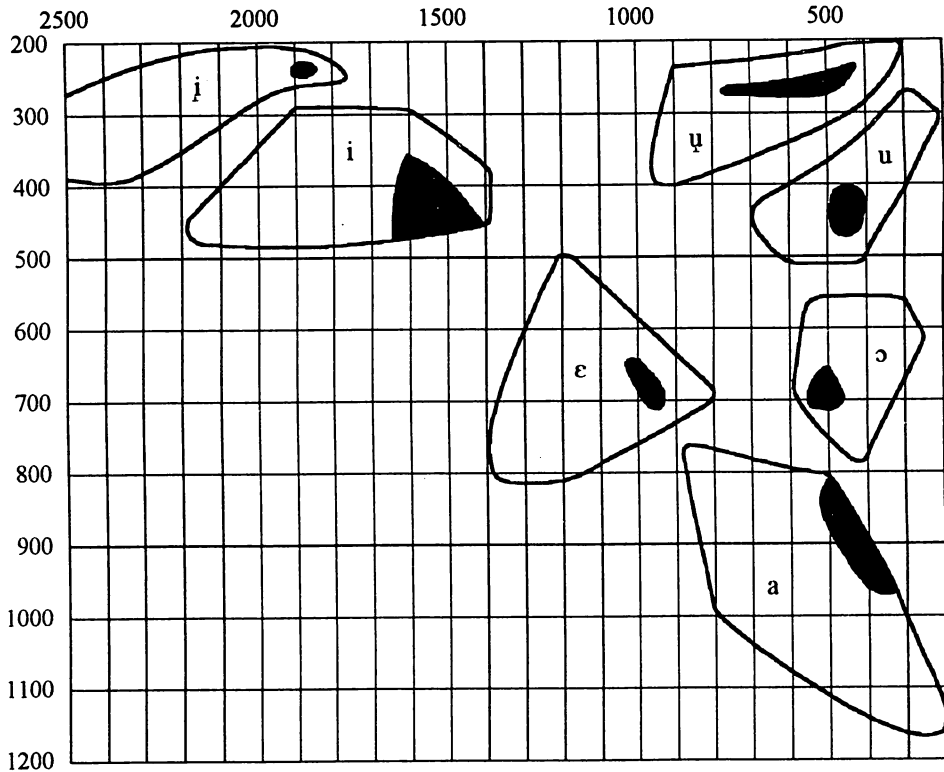
The distinction between high and fricativised vowels is maintained in diphthongs. In Kirikiri all diphthongs end in high or fricativised vowels. Examples of contrasts between /VV/ and /VV̯/ are given in (7).

7) a. /kaau/ 'hit'   /kaa/ 'another'
   b. /ɸai̯/ 'upper arm'   /ɸai/ 'stone'
   c. /ɸoi̯/ 'crocodile'   /soi/ 'dead'
   d. /ɸau̯/ 'ax'   /tau/ 'stomach'

There is generally contrast between fricativised and high vowels in diphthongs, except when there is only one degree of difference in height between the nucleus and offglide. Thus, the diphthongs /ei̯ ou̯/, but not /ei ou/, exist. We suggest that since the latter are articulatorily close, they have assimilated into one vowel. The following cognate forms would support this hypothesis.

8)   Kirikiri   Obokuitai
      [ti]   [tei]   'child'
      [tu]   [toub]   'breast'

   Figures 2 and 3 show the ranges of the high and fricativised vowels in the diphthongs /ai aị au aụ oi oị eị oụ/.[22] While there was no overlap between the high and fricativised single vowels, there is overlap between high and fricativised offglides in diphthongs. This overlap might occur in other WLP languages, too, and might account for the variety in the vowel systems outlined above.

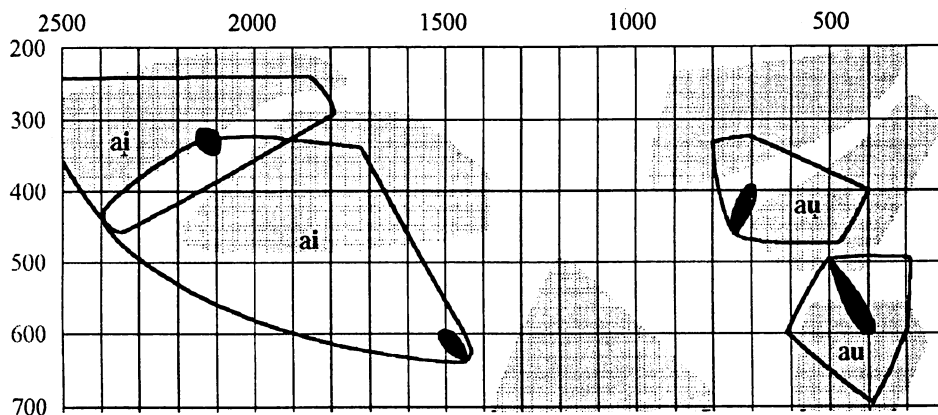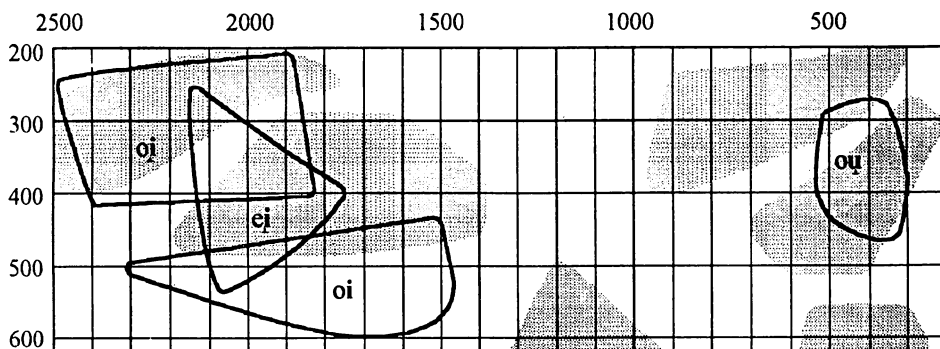FIGURE 2: RANGE OF HIGH VS FRICATIVISED VOWELS IN /ai aị au aụ/

FIGURE 3: RANGE OF HIGH VS FRICATIVISED VOWELS IN /oi oị eị oụ/

[22] One additional diphthong, [eụ], also occurs, but it is rare. The diphthong [eu] occurs in Tause, and [e.u] occurs in Sikaritai. The diphthong [æo] has also been reported in Edopi.

There is also contrast between high and fricativised vowels preceding another vowel. An example is given in (9).

9)   [ɸi̯.a]   'to plant'   [ɸia]   'fish'

The sequence with the fricativised vowel is phonetically bisyllabic, while the sequence with the high vowel is monosyllabic. The fricativised vowel preceding another vowel is realised as a lengthened vowel, with possible friction on the latter half. Figure 4 shows the ranges of the high and fricativised vowels when followed by /a/. In these sequence types the phonetic difference between the fricativised and the high vowels is most fuzzy, as the vowel quality is not essential to distinguish the forms since they syllabify differently. In addition, the fricativised vowels in the sequences /i̯ɛ/ and /u̯ɔ/ have a strong raising effect on the following mid vowels as shown in Figure 5.

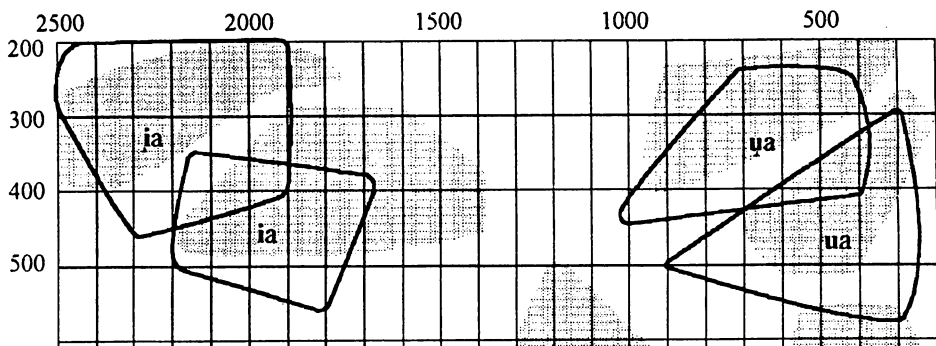FIGURE 4: RANGE OF HIGH AND FRICATIVISED VOWELS IN /ia i̯a ua u̯a/

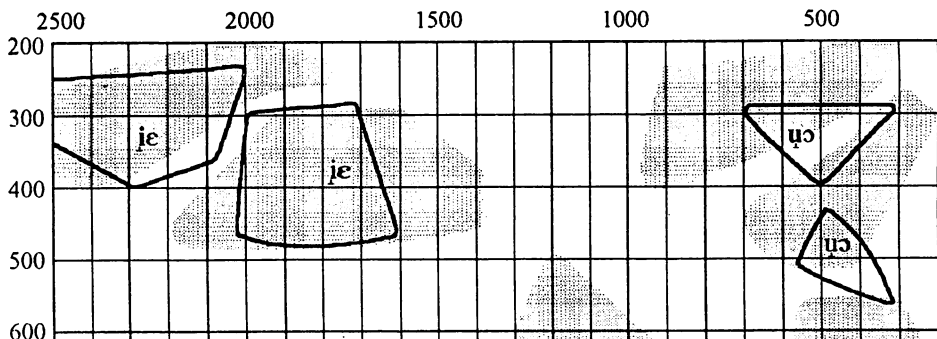FIGURE 5: RANGE OF VOWELS IN /i̯ɛ u̯ɔ/

Chart 4 shows the sequences of fricativised or high vowel followed by a vowel have been encountered in Kirikiri.

CHART 4: SEQUENCES OF FRICATIVISED OR HIGH VOWEL + VOWEL

	i	e	a	o	u
j̬	x	x	x	–	–
i̬	–	x	–	–	–
u̬	–	x[23]	x	x	–
u	x	x	x	–	–

In reviewing the data available on other WLP languages with more than five vowels, the posited vowel sequences look random and non-symmetrical. Perhaps this is because the vowels in sequences are not identical with any of the individual (non-sequence) vowels. Analyzing the vowel sequences separately from single vowels, and including spectrographic analysis, might produce better results.

3.2 Development of the Fricativised Vowels

The most likely source of the fricativised vowels is from a deleted consonant. Ohala and Kawasaki (1984:117) state:

> ...sound changes whereby the V preceding a C may 'take over' the distinctive function of the C so that the C is eliminated. This is especially true in the case of nasals–where a distinctively nasalised vowel is substituted, laterals–where some sort of back glide is substituted and other sonorants. It is also not unknown in the case of post-vocalic obstruents...

This regressive assimilation (a consonantal constriction spreading to the vowel) is clear in the case of Sikaritai and Obokuitai where the consonant has not been deleted. There are no closed syllables in Fayu, Kirikiri, Tause, Edopi and Doutai and in Iau they are very rare. We suggest that closed syllables existed in these languages, and that when the consonant was deleted the vowel quality was what was left to mark the contrast. This gave rise to the fricativised vowel phonemes.

The cognate forms in (11) support this diachronic analysis with regard to syllable final consonant deletion.

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[23] The sequence /u̬e/ is rare in Kirikiri as well as other WLP languages.

(11) Kinkiri   Obokuitai   Sikaritai

	Kinkiri	Obokuitai	Sikaritai	
	/kisí/	/kisig/	/kesig/	'tree kangaroo'
	/kdí/	/krig/	/kid/	'banana'
	/фú/	/hub/		'fat'
	/tú/	/atub/		'penis'
	/фaú/	/haub/		'axe'

There is also evidence from cognate forms that fricativised vowels preceding vowels also arose through the deletion of a consonant, even though the consonant was not syllable final.

(12) Kinkiri   Tause   Faia

	Kinkiri	Tause	Faia	
	/фje/	/фide/		'pandanus'
	/kja/	/da/	/kida/	'go'

It is an open question as to whether synchronically the fricativised vowels should be analysed as separate phonemes or as high vowels followed by a C with no segmental features. For example, following Clements and Keyser (1983), we could analyse the difference between the single vowels in [di] 'ironwood' and [di] 'string bag' as in (13).

(13) C V C   C V
      | ⋁ | |
      d i   d i
   'ironwood'   'string bag'

Similarly, we could analyse the difference in the diphthongs in [kai] 'hit' and [kai] 'another' as the presence or absence of a syllable final C as in (14).

(14) C V V C   C V V
      | ⋀ | | | |
      k a i   k a i
     'hit'   'another'

Finally, the fricativised vowel in [фi.a] 'to plant' could also be analysed in terms of a following C as in (15).

(15) C V C V C   C V
      | ⋁ | | | ⋀
      ф i a   ф i a
    'to plant'   'fish'

This analysis also nicely captures the difference in syllabification between fricativised and high vowels.

4   Semivowels

In Kirikiri, a semivowel is a high vocoid that forms the onset of the syllable, that is, it is either initial in the word, or occurs between vowels. If a word consists only of an initial high vocoid followed by another vowel, it tends to syllabify as two syllables; there is no contrast between one and two syllable words.

16) a.   [i.a]   'mine/mother'
    b.   [u.a]   'beam'
    c.   [u.i]   'rain'

In longer words, an initial high vocoid often syllabifies as onset, especially preceding a low vowel.

17) a.   [wawi~u.awi]   'wet'
    b.   [wikia~u.ikia]   'it's raining'
    c.   [jaja~i.aja]   'my mother'

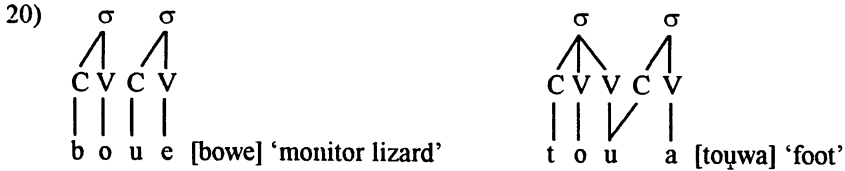Turning to intervocalic semivowels, we find contrasts in Kirikiri like those in (18-19).[24]

18) a.   [bowe]   'monitor lizard'
    b.   [toṵwa]   'foot'
19) a.   [teya]   'to open'
    b.   [beɪya]   'to rub'

The high vowel and semivowel in (18b,19b) is much higher than the semivowel in (18a,19a) as shown in Figure 6. Following the analysis presented above for fricativised vowels, we can analyse the forms in (18) as shown in (20).

FIGURE 6: RANGE OF INTERVOCALIC HIGH AND FRICATIVISED VOWELS

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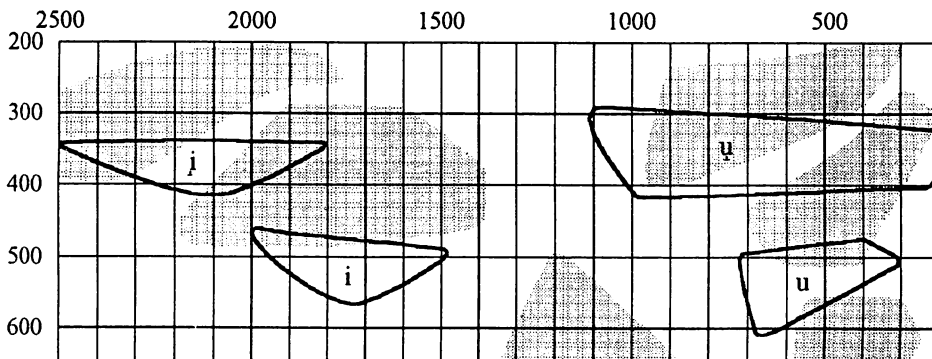
[24] Similar contrasts have been noted in Tause.

20)

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     σ   σ                          σ     σ
    /\  /\                         /|\   /\
   C V C V                        C V V C V
   | | | |                        | |  /  |
   b o u e  [bowe] 'monitor lizard'   t o u   a  [touwa] 'foot'
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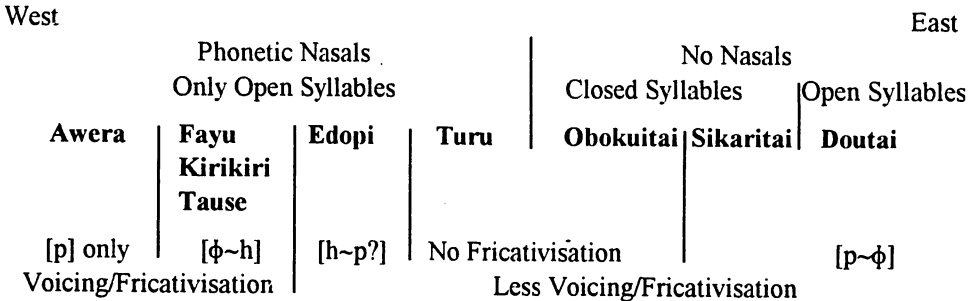
In this analysis, the high vocoid in [bowe] forms the onset of the second syllable whereas in [touwa] the empty C forms the onset.

5   Conclusion

Research on the languages of the western Lakes Plains region appears to indicate that we are in the midst of several phonological changes. The evidence of such changes include the great amount of phonetic variation, loss of syllable closure, loss of consonant clusters, and movement from a five vowel system to a six to eight vowel system. These changes involve some interesting phenomena, including a lack of phonemic and phonetic nasals and very high, constricted vowels. Further research on these languages in the areas of syllable structure and tone will, hopefully, shed more light on the languages of the western Lakes Plains of Irian Jaya.

Figure 7 presents a summary of some of the phonological phenomena found in the Lakes Plains region.

FIGURE 7: SUMMARY OF PHONOLOGICAL PHENOMENA IN WLP LANGUAGES

West						East
	Phonetic Nasals Only Open Syllables			No Nasals		
				Closed Syllables		Open Syllables
Awera	Fayu Kirikiri Tause	Edopi	Turu	Obokuitai	Sikaritai	Doutai
[p] only Voicing/Fricativisation	[ɸ~h]	[h~p?]	No Fricativisation Less Voicing/Fricativisation			[p~ɸ]

References

Bateman, Janet. 1982. The languages of the Western Lakes Plains, Irian Jaya. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

_____. 1989. Iau segmental and tone phonology. *NUSA* 32:1-28

_____. 1991. Unpublished research notes, Summer Institute of Linguistics, Jayapura.

Clements, G. N. and S. J. Keyser. 1983. *CV phonology: A generative theory of the syllable.* Cambridge: MIT Press.

Clouse, Duane and Heljä Clouse. 1991. Unpublished research notes, Summer Institute of Linguistics, Jayapura.

Clouse, Duane. 1992. A linguistic investigation of the Wapoga River environs and the West Lakes Plains Irian Jaya, Indonesia: Preliminary survey results and reassessments. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

_____. 1993. A historical reconstruction and reclassification of Lake Plain languages. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

Ferguson, Charles A. 1966. Assumptions about nasals: A sample study in phonological universals. In *Universals of language*, ed. Joseph H. Greenberg. Cambridge: MIT Press.

Foley, William A. 1986. *The Papuan languages of New Guinea.* Cambridge: Cambridge University Press.

Goldsmith, John A. *Autosegmental and metrical phonology.* Oxford/Cambridge: Basil Blackwell.

Jenison, Scott D. and Priscilla B. Jenison. 1991a. Obokuitai phonology. In vol. 9 of *Workpapers in Indonesian languages and cultures*, ed. M. Hartzler and L. Wood, 69-90. Jayapura: Cenderawasih University.

_____. 1991b. Unpublished research notes, Summer Institute of Linguistics, Jayapura.

Kaye, Jonathan. 1989. *Phonology: A cognitive view.* London: Lawrence Erlbaum Associates Publishers.

Kim, Eui-Jung and Yun-Hwa Kim. 1991a. Edopi phonology. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

_____. 1991b. Unpublished research notes, Summer Institute of Linguistics, Jayapura.

Kügler, Klaus P. 1989. Vowel sequences in Fayu. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

_____. 1990. Fayu suprasegmental phonology. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

Kügler, Klaus P. and Doris M. Kügler. 1990. Fayu segmental phonology. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

Ladefoged, Peter. 1975. *A course in phonetics.* New York: Harcourt Brace Jovanovich.

Malmberg, Bertil. 1970. *Larobok i fonetik.* Lund: C W K Gleerup Bokforlag.

Martin, David L. 1991. Sikaritai phonology. In vol. 9 of *Workpapers in Indonesian languages and cultures*, ed. M. Hartzler and L. Wood, 91-120. Jayapura: Cenderawasih University.

McAllister, Lawrence and Kay McAllister. 1991. The process of phonological change in Doutai. In vol. 9 of *Workpapers in Indonesian languages and cultures*, ed. M. Hartzler and L. Wood, 121-141. Jayapura: Cenderawasih University.

Munnings, Peter. 1991a. Tause phonology. Unpublished manuscript, Summer Institute of Linguistics, Jayapura.

_____. 1991b. Unpublished research notes, Summer Institute of Linguistics, Jayapura.

Ohala, J. and H. Kawasaki. 1984. Prosodic phonology and phonetics. *Phonology Yearbook 1*. Cambridge: Cambridge University Press.

Silzer, Peter and Heljä Clouse. 1991. *Index of Irian Jaya languages*, 2nd ed. Jayapura: University Cenderawasih and Summer Institute of Linguistics.

Voorhoeve, C. L. 1975. *Languages of Irian Jaya: Checklist, preliminary classification, language maps, wordlists*. Pacific Linguistics B-31. Canberra: Australian National University.