Pa-hng development and diversity

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1. Introduction. The Pa-hng 巴¥ or Red Yao 红 T
have traditionally been classified as belonging to the Hmongic
Branch of Hmongic-Mienic, Bunu type, cf. Meng et al 1982. However, Paul K. Benedict (1975:xxi, 1986) and Strecker (1987a, 1987b)—in light of its special features—have contemplated assigning Pa-hng to a separate branch of Hmong-Mien (Miao-Yao) along side Hmongic, Mienic, Ho Nte (She), and others. Strecker (1987b), however, reports that some Chinese linguistics regard this reclassification as hasty and seem more inclined to persevere in a tripartite division of Proto-Hmong-Mien. A second issue raised by Strecker (1987a, 1987b) was to divide Pa-hng into Northern and Southern forms. The Southern form would be represented by the Pa-hng of Guangxi Sanjiang Wenjie (cf. Mao et al) and perhaps also by the outlier Na-e of Vietnam (Bonisfacy 1905), whereas Guizhou Gundong would be characteristic of the Northern type. The modest aim of this paper is not to broach the question of the ultimate placement of Pa-hng in the larger Stammbaum of Hmong-Mien from the top down, but instead to consider the pattern of microcosmic change from location to location as an aid to understanding where sound changes began and what areas they reached last. My result will require a more subtle differentiation than a dichotomous separation into Northern and Southern Pa-hng in which the dominant physical landmark of the area, the Rongjiang River namely, seems to have played a major role. Simultaneously I wish to present a corpus of data gathered at about ten locations that might be of further use in the solution to the questions of the history and development of the Hmong-Mien language group.

The Pa-hng live mostly in the NE corner of Guangxi-Zhuang Autonomous Region in Rongshui, Sanjiang, and Longsheng Counties and in adjoining areas of Guizhou Province at Liping, Congjiang, and Rongjiang Counties on both banks of the Rongjiang River. According to Mao et al (1982), the Pa-hng
throughout China numbered 10,375 in the late seventies. Outside of China there is an outlier group of about 2,000 Pa-hng living in Vietnam according to 1982 figures, where they call themselves Batian or Baxing, and where they are referred to as the Lai Miao 'Immigrant Miao' or Hua Miao 'Flowery Miao' by the local people (Fan Honggui et al 1986). They say they migrated to Vietnam 200-300 years ago, coming over the sea. They live in three areas of Vietnam: (1) Zhanhua County Linfu Township and Anshan County Zhongshan Township; (2) includes Hexian Province Zhanhua County Youchan, Beiguang, and Hongguang Townships; (3) in Beiguang County on the right bank of the Jing River there are three Townships: Xinzheng, Xinli, and Yanping Townships, according to the Chinese translation of the Vietnamese original. They lived mixed with the Yao, Tai, and Sui peoples, raising two major crops: wet paddy rice (both glutinous and long-grain) and corn. Bonifacy (1905) recorded a few lexical items of their language to constitute the first contact by foreign scholars. Haudricourt (1954, 1971) has pointed out that this group is identical to the Pa-hng.²

The Pa-hng language data in larger amounts is found in Chang Kun (1947:96 and passim), who personally gathered vocabulary on Congjiang Xishan Dahua Pa-hng in 1941. Chinese specialists in Hmongic languages, notably Professors Wang Fushi and Chen Qiguang of Central Institute of Nationalities, have included some data in a number of their papers. The most extensive study has been performed on Guizhou Liping Gundong Pa-hng by Zhang et al (1985).

In the winter and early spring of 1990 Professor Yang Quan of the Central Institute of Nationalities and I were able to collect a body of vocabulary from about ten locations in Sanjiang and Rongshui Counties. In Sanjiang County these people are found in three settlement areas: Tongle 同樂,³ Laobao 老刀 and Gaoji Gongjiang 高基弓江.⁴ We were fortunate enough to obtain language help for Laobao and Tongle. The inaccessibility of Pa-hng villages made an onsite visit impossible, as the Pa-hng live in the most mountainous, most isolated, least fertile areas of Sanjiang County off of any public roads. They also plant only one crop of rice per year. These circumstances result in the Pa-hng being among the most impoverished of the minorities peoples of Sanjiang. Indeed, it seems to be a characteristic feature of the Pa-hng to crave isolation and hence it
is also their fate to endure a more austere existence than some of their brethren. Li (1985) likewise documents the Pa-hng’s lamentable resistance to organized education and the Han language. This sad state of affairs is especially true among females, not a single one of which in Guizhou Province ever having finished elementary school, and not a single Pa-hng ever having graduated from college.

In early January 1990 we arrived in Guangxi Sanjiang Kam Autonomous County to work principally on Kam. A survey of the languages spoken in Sanjiang revealed that the Pa-hng also inhabited this area and thus a brief session of data elicitation was arranged. Our first interviewee was Mr. Pan Shengwen, a Yao Mjen village leader and official from Tongle Jindai Village 近代, who grew up speaking both Yao Mjen and Pa-hng. Shortly thereafter, we were able to conduct a more extensive session with Mr. Wan Rensheng of Laobao Bianlang 邊浪. In a second session Mr. Wan brought along two additional speakers from this very remote village, Mr. Wan Yuqing and Mr. Tang Xiangcai. We were able to make comprehensive audio, computer, and airflow recordings of the sounds of these speakers and document about 500 vocabulary items.

Our travels to Rongshui County to the south of Sanjiang in late February 1990 also were rewarded with even more opportunities to study Pa-hng. In this endeavor we were aided by Chairman Pu (first name unfortunately unknown), a Pa-hng and member of the Minority Affairs Committee of Rongshui County. He informed us that there was a special school in Rongshui County Seat to try to break through the cycle of entrenched illiteracy among the Pa-hng. The next day he brought over seven students from the school, each from a different area of the county and all native speakers of Pa-hng. Because each of the seven speakers was to repeat the same elicited item, we were more limited in the total number of vocabulary we could gather. We elected to have all the speakers produce the list of minimal contrasts found in Chen Jin 1988.

2. Tones. There are seven or eight contrastive tones in Pa-hng. Historically speaking, the proto-tones A, C and D have each divided, while the original B tone did not split in the Pa-hng of Guangxi, resulting in seven tonal contrasts. The tone value and the number of tone categories are quite uniform in all the speakers we examined. We have provided composite pitch
plots of these seven tones for Mr. Wan Rensheng in Figures 1 and 2.6

**Figure 1: Pa-hng contour tone trajectories**

**Figure 2: Pa-hng level tone trajectories**
These plots show a tonal system quite typical for Hmong type languages. In fact, the two most distinctive characteristics are strongly in evidence: (a) lack of rusheng or checked tones and (b) the presence of a large number of level tones as opposed to falling, rising or more complex contours. In fact, it takes some practice to become accustomed to perceiving three or four level tones, i.e. 55, 44, 22, and 11.

The pitch trajectories in Pa-hng level tones are strictly speaking not level. There are rises at the beginning of high pitches and drops at the beginning of low pitches, noticeably Tones 3 and 4, which have in reality contours 211. The tonal system is exemplified in Figure 3:

| Tone 1 | pjà^{24} | five       | pi^{24} | to know |
|        | pjì^{24} | body hair  |         |         |
| Tone 2 | py^{22}  | flower     | mjè^{22} | person  |
|        | ljì^{22} | paddy      |         |         |
| Tone 3 | sò^{11}  | grass      | pjo^{11} | house   |
|        | rö^{11}  | salt       |         |         |
| Tone 4 | mè^{11}  | horse      | nhò^{11} | fish    |
|        | tì^{11}  | fire       |         |         |
| Tone 5 | me^{55}  | pig        | qò^{55}  | egg     |
| Tone 6 | te^{44}  | to die     | tso^{44} | chopsticks |
|        | mi^{44}  | soft       |         |         |
| Tone 7 | nà^{53}  | to weave   | tsa^{53} | to laugh |
|        | ?à^{53}  | duck       |         |         |
| Tone 8 | ji^{41}  | eight      | mjì^{41} | tongue  |
|        | ku^{41}  | ten        |         |         |

Figure 3: Examples of each of the tonal contrasts in Laobao Pa-hng

Some varieties of Pa-hng apparently have eight tones. Chang (1947:99) provides a often cited description of Bunu Yao from Guizhou Yongcong (today called Congjiang) Xishan Dahua Village, which splits all four proto-tone categories into high and low reflexes. Examples of these renumbered according to the above schema are:
As one can see from Figure 3 and 4 the Voiced-Low Principle has operated in paradigmatic fashion and caused even-numbered tones to be lower than odd-numbered counterparts (with the possible exception of Tone 2 in Dahua).

The syllable structure of Pa-hng, as mentioned above, has undergone considerable erosion. The nasals have been absorbed by the vowels preceding them at most locations and stop consonants have disappeared in Tone 7 and 8 and have left in their places a tightness of voice at the end of the syllable with creak (slow glottal closure) and a lowering and backing of vowels in these tones. I have indicated this feature in Figure 3.

3. **Initials.** The initials of Pa-hng are considerably more interesting than its tones. First of all consider the inventory of its sounds in Figure 5.
p  ph  m  mh  f  w
pj  phj  mj  mhj

l  lh  l  lh
s

lj  lhj  lhj

c  j
k  kh  nh
x
kw  khw
q  qh
qw  qhw

p  qa³³ pu⁵³ ljå⁵³  leopard  py²²  flower
ph  kha⁵⁵ phu¹¹  hold hand, to
pj  qa³³ pjo¹¹  house, home  pja²⁴  tree, five
phj  phjo²⁴  whistle, to  phji⁵³  daughter
m  ma⁴¹  thickly matted  ma¹¹  dig, to
mh  mhè²⁴  scold, to (slight aspiration only)
mj  mjè²²  person  pa¹¹ mju²²  Kam nationality

mhj  qo³³ mhjo⁴⁴  nose (slight aspiration only)
w  wy²⁴ xy²⁴  seek, to  wa²⁴  two
f  fy²⁴  light in weight  fy⁴¹  dip water, to
t  ta⁴¹  bite, to  ty²⁴ lu²⁴  table
to¹¹  long  te¹¹  wait, to
th  thu⁵⁵  read, to
tj (these may all have changed to pj)

ñ  ña²²  good  ña⁵³  weave, to
ñh  ?a³³ ñhè³⁴  lungs  ñhe²⁴  day
  (slight aspiration only)
l  la⁴¹  bury, to  la¹¹  short
lh  qa³³ he²⁴  day (slight aspiration only)
lj  lji²²  paddy  lja¹¹  oar
lhj  l(h)jü¹²²  cool  qa³³l(h)jä⁵³  dog  (slight aspiration only)
	
l  ℓu⁵⁵  iron

lh  ?a³³'ha⁴⁵  moon  [r¹³'he⁴⁴  rope  (slight aspiration only)

lhj  lhjo²⁴  big (slight aspiration only)

ts  ?a³³fu⁵⁵tsö¹¹  coffin

s  [r²²sv⁴⁴y¹¹  sleeve  qa¹¹şö¹¹  bone

gä²⁴  invite, to

tc  ?a³³'tca¹¹  sister, older  tcö⁴⁴  chopsticks

tch  ty⁵³'tchi⁴⁴  wall

n  nö¹¹'qha¹¹  vomit, to  ?a³³nö²²  dam

nh  nha¹¹  heavy  nhi³⁵  clear

nhi¹¹  stir fry, to (water)

c  ca¹¹  fly, to

j  je⁵³  lightning, to  ja¹¹  want, to

k  ke⁵⁵  street  kã²²  talk, to

kw  kwa¹¹  intelligent  kwö²⁴  white

kwy²⁴  demon

khw  [r³³khwà⁵⁵lji²²  paddy wall  khwi⁵⁵  poor

η  ny⁵⁵  carry on pole, to  na²²  meat

ne⁵⁵  like, to

nh  nhe¹¹  blood (slight aspiration only)

x  xo³⁵  talk, to  a³³xö¹¹  cave

xw (found in other locations, but not in Laobao)

q  qa³³şö¹¹  bone

qh  qhö⁵⁵  cough  nö¹¹'qha¹¹  vomit, to

pa¹¹qhe²⁴  Han

qw  qwa⁵⁵şö⁴⁴  rabbit

qhw (no examples yet)

Figure 5: The initials of Guangxi Sanjiang Laobao Pa-hng
The dental series //tʰ n ηh// are retroflexed in Laobao. The palatalized series loses this retroflex character.

The feature [aspiration] in Pa-hng carries a high functional load. As is clear from Figure 5, stops and sonorants come in unaspirated and aspirated forms. Unlike in Eastern Guizhou Miao, fricatives do not distinguish for aspiration. It is important to note that aspiration in Pa-hng does not mean that a period of voicelessness follows the release of a stop before the voicing of the vowel begins. In Pa-hng there is strongly increased airflow presumably from a spread glottis that may or may not be vibrating. One of the best ways to document this difference is a comparison of the airflow between aspirated and unaspirated initial consonants.\textsuperscript{10}

Figure 6: Airflow recording of Laobao Pa-hng na\textsuperscript{53} 'to weave'
Figure 7: Airflow recording of Laobao Pa-hng र्हि 'to stir fry'

It is very evident from Figure 7 that voicing is going on during the period of increased airflow.

4. Finals. Pa-hng has a very distinctive inventory of finals. They are even by Hmongic standards simple in structure. For example, nasal codas are typically not present. Original nasals at the end of the syllable have been absorbed by the nuclear vowel in front of them to form nasalized vowels. Most finals consist of simple nuclear vowel nuclei or a syllabic nasals. There are, for instance, four vowel heights, three degrees of backness, and no distinction for vowel length. These are illustrated in the Figure 8 below.

\[
\begin{array}{cccccccc}
\text{i} & \text{ε} & \text{a} & \text{ɔ} & \text{ɔ} & \text{o} & \text{ʊ} & \text{ɤ} \\
\text{ḭ} & \text{ɛ} & \text{ɛ̉} & \text{ã} & \text{ɔ̈} & \text{ɔ̈} & \text{ʊ̈} & \text{ŋ̌} \\
\text{m} & \text{n} & \text{ň} & \text{ŋ̌} & \\
\end{array}
\]

- ड ना
- ड ना
- ड पे
- ड रे

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<th>ड रे</th>
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<tbody>
<tr>
<td>good</td>
<td>to weave</td>
<td>to bite</td>
<td>have, exist</td>
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The vowel //i// is centralized and approaches [i] as in 
[pi²⁴] 'to know' except following palatalized initials as in [pji²⁴] 
'body hair'.

5. **Pa-hng lectal variation and its phonological development.** Pa-hng has figured prominently in the history of Hmong-Mien languages. In the following I present a wide spectrum of data (about 100 minimally contrasting roots) at about 7 locations (see Map), using Laobao as the standard of comparison. I have chosen Laobao for this role for at least two reasons: (1) Laobao Pa-hng is the variety for which I have collected the most data and (2) Lao Pa-hng preserves a number of features not found in Rongshui Pa-hng. Locations investigated:
1  Liangzhai  良 {
2  Baiyun  白雲
3  Dalang  大浪
4  Xiangfen  香粉
5  Gunbei  島
6  Ganbei  洞
7  Dongtou  同穗

5.1. Initials.

5.1.1 Uvulars and velars. One of the characteristics of the Proto-Hmongic velar and uvular stop series. In Gaoji Gongjiang (Wenjie) Pa-hng some of the original velars are preserved, whereas others from original velars merge with the uvulars. In Figure 9 below I have compared contemporary reflexes of *k and *q at four locations. Lines surround forms that today show uvular initials and the page break divides original velars and uvulars.

<table>
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<tr>
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<tbody>
<tr>
<td>*k needle</td>
<td>kā̂^35 (1)</td>
<td>taî^33kanj^13</td>
<td>kanj^35</td>
</tr>
<tr>
<td>ten pair</td>
<td>k̓hū^32 (8)</td>
<td>ku^32</td>
<td>ku^11</td>
</tr>
<tr>
<td>insect</td>
<td>qŷ^35 (1)</td>
<td>qai^13</td>
<td>qe^24</td>
</tr>
<tr>
<td>road</td>
<td>qo^11</td>
<td>qo^21</td>
<td>qo^11</td>
</tr>
<tr>
<td>horn</td>
<td>q̓s ^35 (1)</td>
<td>qanj^13</td>
<td>qā^24</td>
</tr>
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\begin{center}
\begin{tabular}{l|l|l|l}
Wenjie & Gundong & Laobao & Shunhua \\
(Mao et al 1982) & (Zhang et al 1985) & & (Li 1985) \\
\hline
*q\l/ & q\l/ & q\l/ & q\l/ \\
star & q\l/ & q\l/ & q\l/ \\
excrement qa & qa & qa & qa \\
old & qo (5) & qo & qo \\
hole & qh\l/ & qhon\l/ & qhon\l/ \\
meat & nq\l/\l/ & ne & nai & nai \\
\hline
*ql/ & qo & kw\l/ & qo \\
white & & kw\l/ & \\
black & kuan & kw\l/ & qan\l/ \\
yellow & khwy & kua\l/ & kui \\
\end{tabular}
\end{center}

Figure 9: Variation of Pa-hng velars and uvulars

On the basis of this data it appears that uvulars are preserved and, in fact, even expand in the areas north of the Rongjiang River with the isolated village at Wenjie having preserved uvulars mostly strongly (even in nasals). At Tongle, which is north of the river, my time for data elicitation was so brief I didn't record any of the above examples. A few items in this location have contrasting //k q//: n\l/\l/ qa 'to vomit'; qa\l/son\l/ 'bone'; kh\l/ 'to put or place; kwe\l/ 'intelligent'; ?a\l/\l/ku\l/ 'story'; kwe\l/ 'demon'; khwa\l/\l/\l/ 'paddy wall'. In some areas to the north of the river at Shunhua, for example, there is less departure from the original division between the two stop positions. In Rongshui Pa-hng, the uvulars are rare or are missing altogether, at least among younger speakers at all location except in Dalang, where we found a few cases. The rule then seems to be that southern Pa-hng (Rongshui and less so Laobao) merges uvulars with original velars, whereas in northern Pa-hng (Gundong, Shunhua, Tongle, and especially at Wenjie) uvulars are still present and seem even to have absorbed some vocabulary with original velars.

5.1.2 Palatalized labials and dentals. One change very evident at various locations among the Pa-hng is the correspondence of palatalized labials in some locations to palatalized dentals in others, i.e. pj <-> tj; phj <-> thj; mj <-> nj,
and mhj <-> nhj. This kind of change is found in Kam, in Chinese and also in Italian and Slavic, cf. Edmondson 1989, and Ohala 1979. The change from labials to dentals dominates, though there may be some cases of change in the opposite direction. Neither Zhang, Xu, and Li (1985) nor Li (1985) lists palatalized or labialized initials among the inventory of initials. Instead they opt for a more complex set of rhymes that includes an i-element and a u-element as onset. However, the phonological behavior of these sounds argues for regarding them as palatalization and labialization of initial consonants and not vocalic differences. Therefore, Gundong and Shunhua should have the palatalized labial series //pj pjh mj mjh// and //tj lh lj h ljh//. Similarly, the labialized initials might be assumed, i.e. //kw kwh xw qw qwh//. The net result is a kind of "sluicing" in which the change has gone in opposite directions resulting in the western and northern areas having more dentals and the eastern and southern forms having developed labials.

5.2.1. Reflexes of original prenasalized voiced stop initials. In Rongshui many locations preserve original prenasalized voiced stop initials and these locations also evidence significance amounts of breathy voice quality in initials. This feature is especially prominent in even number tone categories. Deng (1983) and Streeker (1989) have suggested that the voiced initials of Proto-Hmong-Mien were aspirated. Thus, following Chang Kun and Wang Fushi they assume that there was a three-way opposition among voiceless unaspirated, voiceless aspirated, and voiced initials:

*\(t\)  *\(nt\)  *\(?n\)
*\(th\)  *\(nth\)  *\(n\) (or *\(nh\))
*\(d\)  *\(nd\)  *\(n\)

whereby the last series was phonetically [dfi ndfi nfi].
For the moment I am ignoring the difference between voiceless aspiration and breathy voice.
Much more study is warranted, of course, but these results confirm Strecker's view that original voiced, prenasalized voiced, and nasal initials in Hmong-Mien—those that led to low register tones—were accompanied by a strong breathy component. Breathiness is preserved longest in continuant initials, nasals and laterals in Pa-hng just as I found in the Kam, cf. Edmondson (1990b). This pitch lowering element certainly would have abetted the development of low tones.

5.2 Finals with nasal absorption and coda weakening. Nasal consonants tend first to nasalize vowels in their environments and then the nasal consonants are fully absorbed. Li (1985) indicates that both //-/n -ŋ// are found in the Pa-hng Shunhua Gaoniang, whereas Zhang Jiming, Xu Zhishun, and Li Juwei (1985) found that in Guizhou Province Liping County Gundong, which is very close to the Guangxi border only //-/ŋ// existed. Our data showed that at Tongle there is still a velar nasal //-/ŋ// just as in Gundong. However, at Xishan Dahua (Chang Kun 1947), Laobao and at all locations in Guangxi Rongshui the nasals had been absorbed by the vowels that preceded them. The following implication pattern of absorption emerges in which southern forms show the most advanced state:

| Shunhua, Gundong | ̄v  | -ŋ | -n |
| Tongle          | ̄v  | -ŋ |
| Dahua, Rongshui, Wenjie | ̄v  |
6. Conclusion. The preceding exposition has tried to focus on the special features of Pa-hng and to sketch their phonological evolution showing the step-by-step progression still manifest in the local varieties of Pa-hng.

First of all, there has been vast simplification of the (reconstructed) Proto-Miao's 131 initials and 29 codas in current Pa-hng. As for places of articulation, only five of the six original are retained: labial, dental, prepalatal, velar, and uvular, since the prepalatal, dental, and retroflex series merge to two. Moreover, I did not uncover any clustered initials, such as //pz pl pr// in Pa-hng, most of them having been weakened into secondary articulations, e.g. pj. By contrast, the prenasalization of voiceless, aspirated, and voiced stops and affricates is well-preserved. The absorption of nasal codas is in an advanced state, even more than in Western Hmong, except for vocabulary with nasal initials and nasal codas, which collapse to give syllabic nasal forms, cf. ɱm² 'Pa-hng' from *mroŋA².

Secondly, Pa-hng sound system is still rich in constraints between breathy/aspirated vs. plain sonorants //m n n / vs. //mhi nhi nhi lli// (also //li// vs. //lli//) and these forms are not listed in the proto-inventory by Wang Fushi. As is well known, the kind of Eastern Hmong centered in Kaili, Guizhou features a constraint between breathy/aspirated and plain fricatives. The aspirated fricatives correspond to plain fricatives, aspirated (prenasalized) affricates, voiceless nasals and have a tonogenetic association with the upper tone register, whereas the unaspirated fricatives are often Han loans or stem from unaspirated affricates (Wang 1985:107-20). Clearly, the breathy (aspirated) sonorants of Pa-hng do not share a common history with the aspirated fricatives of Eastern Hmong.

Notes

¹Support for this research was provided by the Committee for Scholarly Communication with the PRC and the National Endowment for the Humanities for the period Jan.-June 1990. It is hoped that this account will awaken interest in the Pa-hng language and be a partial repayment for the enthusiasm and forbearance displayed by my Pa-hng friends and helpers: Pan Shengwen, Sanjiang Tongle; Wan Rensheng, Wan Yuqing, and Tang Xiangcai, Sanjiang Laobao; Feng Wenji, Rongshui Liangzhai; Lan Rongxing, Baiyun; Chen Shiping and Chairman Pu, Rongshui Daliang; Feng Jinhua, Rongshui Xiangfen; Chen
Liannan, Rongshui Gunbei; Yang Fen, Rongshui Gandong; Ye Changzi, Dongtou. Although the Pa-hng are widely also known by the appellation Red Yao and locally as the Eight-Name Yao 八姓 T—the family names of the Laobao Pa-hng are: Wan ā, Chen 陳, Feng 風, Dai 代, Pu Pu 沛, Tang 湯, Li 李 and Yang 楊—their autonym is Pa-hng, which I propose as the future term of reference for this group.

²Like the Pa-hng of Guangxi Province the Pa-hng of Vietnam also use the designation Eight Name Miao or Yao. However, those listed by Fan Honggui et al 1986, including Fu, Deng, Dai, Hong, and Xin, are not identical with those family names in footnote 1.

³Tongle Jindai has a population as follows: Miao 102 households, Pa-hng 207 households, and Kam 9 households.

⁴In Laobao Bianlang there are 223 households, 1321 people of which about 70% are Pa-hng. Most of the remainder are Kam.

⁵This location seems to be identical with that described by Mao et (1982) under the name Wenjie. However, this name is not familiar to local officials today.

⁶The data for these plots was recorded on a Sony TCM 5000 Professional Quality Cassette Tape Recorder using a Atus ATR20 Unidirectional Microphone on high quality tape. Later, the data were digitized with CECIL (Edmondson 1990a) and stored on floppy disk medium of a DOS computer. A compositing program removed the idiosyncracies from five repetitions before computing mean values at each data point. The results were then plotted.

⁷It may be that the original stoppage of tones 7 has not disappeared entirely. In our data vocabulary in this tone category possesses some remnants of an original final stop coda in the form of a creaking of voice tending toward closure at the end of the syllable.

⁸The tone values plotted here for Laobao Pa-hng were found unchanged in Tongle, Liangzhai, Baiyun, Dalang, Xiangfen, Gandong, and Dongtou. At one location, Gunbei, tone 6 had a value of 35, instead of the expected 44.

⁹The root mju²² means 'to use shears to harvest glutinous
rice' and refers to a culturally distinctive practice among the Kam and other Kadai peoples of using a small shears attached to the finger in snipping off handfuls of the glutinous rice stalks at harvest. This tool is called in Kam tip⁹.

¹⁰These recordings were made with the Rothenburg Mask (Glottal Enterprises, Inc.), which is a plastic mask containing transducers measuring air pressure. The transducers in turn are connected to an amplifier and filter unit. The output from this hardware unit was digitized by the MacAdios 411 Hardware Unit (GW Instruments, Inc) connected to a Macintosh Computer (Apple Computer) and stored on floppy disk medium.

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