*A Survey of Tibeto-Burman phonological phenomena.*

Jonathan Evans, Academia Sinica
jonathan@sinica.edu.tw

The earliest proponents of the language family known as Tibeto-Burman (TB) or Trans-Himalayan noted lexical relationships between Tibetan and Burmese, alongside other languages of Northeast India and the Tibetan plateau (Klaproth 1923; Körös 1834). Karlgren (1931) noted that Proto-Tibeto-Burman (PTB) needed to be reconstructed as a unit of comparison with Chinese, rather than directly comparing Tibetan and Chinese. The first comprehensive reconstruction of PTB phonology and lexicon was Benedict and Matisoff (1972), updated in Matisoff (2003). Taking Matisoff (2003) as the reference point, the reconstructed consonants and vowels of PTB are presented in Table 1, with some transcriptions updated to current IPA conventions.

Table 1. Reconstructed consonants and monophthong vowels of Proto-Tibeto-Burman (Matisoff 2003).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| p, b | t, d | | | k, g | | i | | u |
| m | n | | ɲ | ŋ | | e | | o |
| | s, z | ʃ, ʒ | | | h | | a | |
| | ts, dz | tʃ, dʒ | | | | | | |
| w | l | r | j | | | | | |

The distribution of reconstructed vowels in PTB is highly uneven; *a is "the only monophthong of high frequency" (Matisoff 2003:159). The mid vowels *e, *o are not well attested, a phenomenon in many extant TB languages, including the Sal languages, Qiang, and others. For example, Genetti reports that "there is some disagreement as to whether the Kathmandu dialect [of Newari] has a distinct phoneme /o/ (1990: 70)." PTB vowel-glide sequences, consisting of non-close vowels (*ə, *e, *o, *a), followed by *j or *w are better attested than plain monophthongs other than *a. This summary is a simplification; for details, cf. Matisoff 2003 (159, ff).

Syllable structure of PTB is reconstructed as in (1). Opinions differ as to whether PTB had tone or not (arguments for early tone in Bradley this volume). Initial consonant clusters consisted of stops, affricates, fricatives or nasals in C1 position followed by (*j, *w, *l, *r) in G position (1).

(1) Syllable Canon of PTB (Matisoff 2003:59)

| | | | | T | | | |
|---|---|---|---|---|---|---|---|
| (P2) | (P1) | C1 | (G) | V | (ː) | (Cf) | (s, n, t) |

P2 and P1 are prefixal consonants. Some prefixes have identifiable semantics, such as *s- for causative verbs, animals, and body parts. The prefix *m- appears to have expressed inner directedness; e.g., detransitivization of verbs, inalienable possession of nouns, etc. Although (1) is written as if it were a single syllable, some prefixed morphemes must have had emergent vowels between the consonants; e.g, *b-r-gjat ~ *b-g-rjat 'eight'. (Matisoff 2003:87, ff).

PTB codas included voiceless stops (*-p, *-t, *-k), nasals (*-m, *-n, *-ŋ), liquids (*-l, *-r, *-j, *-w), and *-s. Root-final *s (*g-rus 'bone') is not the same as suffixal *-s, which is attested crosslinguistically as a nominalizer, among other functions. For example, Written Tibetan has the pair *skyab* 'protect', *skyabs* 'protection' (Beyer 1992). Likewise, in Ronghong Qiang we find /dzə/ 'eat', /dzəs/ 'grain' (LaPolla and Huang 2003:43; both examples from Matisoff 2003).

Across time and space, many changes have occurred within the PTB phonological system, leading to significant phonological diversity across the family. Nevertheless, three changes are especially common. First, although PTB is reconstructed with only a two-way laryngeal contrast, many sub-families display a three-way contrast in voicing. As will be shown below, a few languages even show a four-way distinction. Support for a two-way distinction comes from *inter alia* Old Tibetan, in which aspiration of voiceless stops was subphonemic (Hill 2010); there are, however, some counterexamples to this claim.

A second common change is syllable canon reduction. The complexities of the PTB proto-syllable are readily seen in Written Tibetan and Rgyalrongic languages. However, reduced syllable canons are common across most extant Tibeto-Burman languages. For example, toneless dialects of Dimasa have a syllable canon as in (2).

(2) Haflong Dimasa syllable canon (Evans and Langthasa, 2023)

(C2) (C1) V (G) (Cf)

Third, and beyond the scope of the present chapter, would be the development of tones (tonogenesis) and of laryngeal states such as breathiness/murmur and creakiness (registrogenesis). Tonogenesis is addressed in (Chapter xref).

The following sections examine typologically unusual segmental phonological phenomena found among Tibeto-Burman languages. The discussion is divided between consonant and vowel phenomena. An effort has been made to survey all available phonological information. Many Tibeto-Burman languages are not represented here, simply because their consonant and vowel phonemes are typologically normal.

## 2. Typologically unusual consonant phenomena.

The atypical consonant properties attested across Tibeto-Burman are organized here by manners of articulation, secondary articulations, and rare consonant phonemes.

### 2.1 Manners of consonant articulation

Uncommon manners of articulation that are found in some Tibeto-Burman languages include implosives, voiceless sonorants and murmur.

Implosive consonants are attested in languages of Africa south of the Sahara, and in languages of Southeast Asia. The WALS database notes their existence in Tai-Kadai and Austro-Asiatic languages, but not in Tibeto-Burman (Maddieson 2013). However, within the Tibeto-Burman family, implosive stops are found in the Karen, Kiranti, and Kuki-Chin groups. Tai-Kadai and Austro-Asiatic implosives are inherited from their respective proto-languages. However, Tibeto-Burman implosives are innovative (Solnit 1992).

Pre-glottalized *ʔb- and *ʔd- have been reconstructed for Proto-Karen (Luangthongkum 2019), leading to implosives in some varieties of Pwo and in Central Karen (Kauffman 1993). An example of the phonological status of implosive stops in Western Pwo Karen may be found in the Kyonbyaw dialect. This dialect contrasts /ɓ, b, p, pʰ/ and /ɗ, t, tʰ/. Near-minimal pairs for the implosive bilabial are provided in (3).

(3) Implosive /ɓ/ contrasts in Kyonbyaw Western Pwo Karen (Kato 1995)

| | | | |
|---|---|---|---|
| /ɓá/ | 'to worship' | /bá~báθì/ | 1:PL:OBJ |
| /ɓà/ | 'to be right' | | |
| /ɓɤ́/ | 'quicklime' | /bɤ̀/ | the inside |

Proto-Western Kiranti is reconstructed with a pre-glottalized phoneme, either *ʔb- (Michailovsky 1994) or *ʔw- (Opgenort 2004). Implosive /ɓ/ is still found across Western Kiranti dialects, where Wambule has both /ɓ, ɗ/ (4).

(4) Contrast among /ɓ, b, ɗ, d/ in Wambule (Opgenort 2004).

| | | | |
|---|---|---|---|
| /bwalcam/ | 'buzz' (v.) | /ɓwalcam/ | 'mix, blend' |
| /bamme/ | '3pl sat' | /ɓamme/ | '3pl ate' |
| /dakcam/ | 'like' | /ɗakcam/ | 'chew' |
| /ɖi/ | 'liver' | /ɗi/ | 'name' |

In some cases, implosives can be traced to Proto-Western Kiranti *ʔw-, coming ultimately from *kw-. However, in many Western Kiranti words, the origin of implosive articulation is not yet clear (Opgenort 2004).

Daai Chin, a Southern Kuki-Chin language has implosive [ɓ, ɗ], which contrast with voiceless and voiceless aspirated stops, but not with voiced. Due to the lack of contrast with a voiced series, So-Hartmann (2008: 49) marks them phonologically as /b, d/ (5).

(5) Daai Chin implosives (So-Hartmann 2008:50).

| | | | | | |
|---|---|---|---|---|---|
| [pu] | 'father-in-law' | [pʰu] | 'boil over' | [ɓu] | 'cover' |
| [tɔ] | 'agree' | [tʰɔʔ] | 'to pack' | [ɗɔ] | 'good' |

In many instances Daai Chin implosives [ɓ, ɗ] are reflexes of PTB *b, *d, and the Kuki-Chin cognates have plain /b, d/. For this reason, and due to the abovementioned lack of contrast, Mortensen (2021) argues that implosives are a Daai Chin innovation through "VOT enhancement", rather than being an older feature. Likewise, Lam Thang (2001) does not posit Proto-Kuki-Chin implosives. On the other hand, VanBik (2009:59) argues for *ɓ, *ɗ in the phonology of Proto-Kuki-Chin. Like Daai Chin, the S. Loloish language Louma Uishui has allophonic [ɓ, ɗ, ɠ] (Lew 2014).

To summarize, implosive /ɓ, ɗ/ descend from *preglottalized consonants in some Karen and Western Kiranti languages. However, in Western Kiranti, the origin of implosion is not clear in all cases. In Southern Chin, linguists agree on the existence of [ɓ, ɗ], but disagree over the phonemic status of implosion, and also disagree about the phenomenon's time depth.

Voiceless sonorants are rare in the world's languages, and "the presence of non-voiced sonorants in a language implies the presence of voiced ones" (Botma 2011). Among the 3,020 phonological inventories in the PHOIBLE database (Moran and McCloy 2019), 75 (2.5%) have /m̥/. The remaining voiceless consonants attested in Tibeto-Burman languages are represented in the PHOIBLE database as follows (including variant transcriptions): /l̥/ (73, 2.4%), /n̥/ (61, 2.0%), /ŋ̊/ (48, 1.6%), /ɲ̊/ (41, 1.4%), /ʍ/ (40, 1.3%), /r̥/ (36, 1.2%), /j̊/ (29, 1.0%). This list does not include voiceless sonorants with secondary articulation, such as palatalization, which are also rare. The present discussion combines the symbols /ɬ, l̥/ under /l̥/, as there are no grammars in PHOIBLE that contrast these two sounds.

Unlike typical voiceless consonants, voiceless sonorants typically begin voiceless and end voiced, which has led to controversy in the feature representation. One solution is to assign these sounds the [spread glottis] feature, typically used to indicate aspiration (Botma 2011). However, a [spread glottis] specification could lead to feature specification ambiguity with murmured (breathy) sounds. The transition from voiceless to voiced has also been analyzed as pre-aspiration (Wang 2016). Rarely, languages are documented with no voiced component during its voiceless sonorants. Two such Tibeto-Burman examples are Xumi (Chirkova et al. 2013) and Angami (Blankenship 1994).

Within the Tibeto-Burman family, the seven voiceless sonorants of Angami /m̥, n̥, ɲ̊, l̥, r̥, j̊, ʍ/ (Blankenship 1994) and Mongsen Ao and Chepang /m̥, n̥, ŋ̊, l̥, r̥, j̊, ʍ/ (Coupe 2017; Hale 1973:30-31, Caughley 1990) appear to set the record for extant Tibeto-Burman languages. Burmese, Lotha, Central Khams Tibetan, and Pattani occupy the next place with six voiceless sonorants in each grammar (Table 2). In agreement with the articulatory property mentioned above, Watkins (2001) observes that these sounds in Burmese start voiceless and end voiced; e.g., [m̥m]. The contrastive nature of Burmese voiceless sonorants is demonstrated in (6).

(6) Voiceless sonorants in Standard Burmese (Watkins 2001, tones not given)

| | | | |
|---|---|---|---|
| /m̥a/ | 'to order' | /ma/ | 'hard |
| /n̥a/ | 'nose' | /na/ | 'to be ill' |
| /ɲ̊a/ | 'to be considerate' | /ɲa/ | 'right-hand side' |
| /ŋ̊a/ | 'I' | /ŋa/ | 'borrow' |
| /l̥e/ | 'boat' | /la/ | 'to come' |
| /ʍɛʔ/ | 'to hide' | /wa/ | 'cotton' |

In many cases, voiceless sonorants in Burmese and other Proto-Tibeto-Burman languages can be traced back to earlier *s- or *ʔ- clusters (Matisoff 2003:37-39). An example is 'snot', where PTB *s-nap became Written Tibetan *snabs*, Written Burmese *hnaut* and Lushai *hnap*, Jinghua Pumi [n̥a[13]]. Likewise, Proto-Ao *a.n̥a from PTB *s-naːy 'near'; *(a-)n̥ak from PTB *s-maːk 'son-in'law'.

Chirkova and Handel (2022) observe that numerous Tibeto-Burman languages in Southwest China and Myanmar contrast voiceless sonorants, making this region a geographic hotspot for the feature. In many cases, voiceless nasals are inherited from earlier meso-languages, such as Proto-Lolo-Burmese, Proto-Karen, and (controversially) Proto-Kuki-Chin (Van Bik 2009:59). Proto-Karen is posited to have had seven such sounds /*m̥, *n̥, *ɲ̊, *ŋ̊, *l̥, *ʍ, *r̥/ (Luangthongkum 2019), although extant Karen languages have fewer. For example, Geba (Eastern Bwe Karen) has four voiceless sonorants /m̥, n̥, l̥, ʍ/ (Shee 2008). Table 2 summarizes the subgroup-wise distribution of voiceless sonorants in Tibeto-Burman.

Table 2 voiceless sonorant phonemes in Tibeto-Burman.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Central Khams Tibetan | m̥, n̥, ɲ̊, ŋ̊, l̥, r̥ | Olson 1974 |
| | Batang Tibetan; Khams Dege | m̥, n̥, ɲ̊, ŋ̊, l̥ | Batang: Jumian 1989; Dege: Sun et al 1991 |
| | Amdo; Tshangla; Lhasa; Balti | l̥ | Amdo: J. Sun 1986; Tshangla: Andvik 1993; Lhasa: Sun et al. 1991 (149-156); Balti: Rangan 1975 |
| | Ladakhi; Manang; Jirel, Sherpa; Kanauri | l̥, r̥ | Ladakhi: Koshal 1976; Manang: Nagano 1984. Jirel, Sherpa: Hale 1973; Kanauri: D. D. Sharma 1988; |
| | Spiti | r̥ | S. R. Sharma 1979 |
| | Cuona; Kurtöp | l̥ | Sun et al. 1991 (168-173); Hyslop 2008 |
| | Dzongkha | n̥, l̥, r̥ | Watters 2018 |
| Western Kiranti | Hayu | l̥ | Michailovsky 2017 (few words) |
| | Puma | m̥, n̥ | Michailovsky 2017, N. P. Sharma 2014. Might be /m$^{ɦ}$, n$^{ɦ}$/ |
| Kiranti/ Dhimalish | Dhimal | m̥, n̥, l̥, ʍ, r̥ | King 1994 |
| Newaric | Kathmandu Newar | m̥, n̥, l̥ | Superset of Hale 1973, Genetti 2017 |
| TGTM | Tamang (Sahugaon) | ʍ, r̥ | Hale 1973; Mazaudon 1994 |
| | Tamang (Taglung) | ʍ | Mazaudon 1994 |
| | Thakali (3 dial) | l̥, r̥̊ | Mazaudon 1994 (pages 16-29 of Vol 2) |
| | Manang (Gyaru, Prakaa) | l̥, r̥ | Gyaru: Nagano 1984; Prakaa: Hoshi 1984 |
| Central Himalayan 'Magaric' | Chepang | m̥, n̥, ŋ̊, l̥, r̥, j̊, ʍ | Hale 1973:30-31, Caughley 1990 |
| West Himalayan | Pattani | m̥, n̥, ɲ̊, l̥, r̥, ʍ | Sharma SR 1991b |
| Rgyalrongic | Zhuokeji Jiarong | ʍ, l̥ | Lin 1993, Sun et al 1991 |
| Qiangic (controversial) | Northern Qiang (Mawo) | l̥, r̥ | Sun et al. 1991 |
| | Xumi | m̥, n̥ | Chirkova et al 2019 |
| | Proto-Ersu, Lizu, Duoxu | *m̥, *n̥, *ŋ̊ | Chirkova & Handel, 2022 |
| | Queyu | m̥, n̥, ɲ̊, ŋ̊, l̥ | Sun et al. 1991 (223-226) |

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Qiangic | Pumi (Jinghua); Shixing A | m̥, n̥, l̥ | Pumi: Sun et al. 1991 (192-196); Shixing: Chirkova 2009 |
| | Pumi (Taoba) | m̥, n̥, ȵ̊, ŋ̊, l̥ | Sun et al. 1991 (pages 196-200) |
| | Daofu, Ersu, Guiqiong, Namuyi, Shixing B; Mianchi Qiang; Ronghong; Lüsu | l̥ | Daofu: Sun et al. 1991 (210-218); Ersu: *ibid.* 231-235; Namuyi: *ibid.*236-239; Shixing: *ibid.* 240-244. Mianchi: Evans 2001, p44 (only one word); Ronghong: LaPolla & Huang 2003, p21; Lüsu: Dai et al 1991 |
| Naic | Eastern Naxi | l̥ | Sun et al. 1991 (268-270) |
| Burmese-Ngwi: Burmish | Standard Burmese | m̥, n̥, ɲ̊, ŋ̊, l̥, ʍ | Watkins 2001 |
| | Achang (Lianghe, Longchuan dialects) | m̥, n̥, ɲ̊, ŋ̊, l̥ | Dai (1985), Dai and Cui (1985) |
| Burmese-Ngwi: Loloish | Nusu [Bijiang] | m̥, n̥, ȵ̊, ŋ̊, l̥ | Sun et al. 1991: 297-302 |
| | Phunoi | m̥, n̥, ɲ̊, l̥, j̊ | Bradley 1979 |
| | Bisu | m̥, n̥, ɲ̊, ŋ̊, l̥ | Beaudouin 1988 |
| | Dafang; Yi Mile; Ahi, Hani; Luquan, Lüsu; Nasu, Nesu, Noesu; Nyi; Yi | l̥ | Dafang: Sun et al. 1991 (258-261); Mile: *ibid.* (258-261); Ahi: Yüan 1953; Hani: Sun et al. 1991 (276-278); Luquan: Matisoff 1979. Lüsu: Dai et al 1991. Nasu, Nesu, Noesu: Chen 1986. Nyi: Wu et al, 1984. Yi: Sun et al. 1991: 258-261 |
| | Yi (Xide); Nosu | m̥, n̥, l̥ | Yi: Sun et al. 1991 (245-248); Nosu: Chen 1986 |
| Karenic | Proto-Karen | *m̥, *n̥, *ɲ̊, *ŋ̊, *l̥, *ʍ, *r̥ | Luangthongkum (2019) |
| | Geba | m̥, n̥, l̥, ʍ | Shee 2008. |
| Nungish | Nung | m̥, n̥, ȵ̊, ŋ̊, l̥ | Sun et al. 1991: 331-336 |
| Ao [Central Naga] | (Proto-)Central Naga | *m̥, *n̥, *ŋ̊, *l̥, *r̥, *j̊, *ʍ | Bruhn 2014 |
| | Mongsen Ao | m̥, n̥, ŋ̊, l̥, r̥, j̊, ʍ | Coupe 2017 |
| | Lotha | m̥, n̥, ŋ̊, l̥, r̥, j̊ | Bruhn 2014 |

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| | Sangtam, Yimchungrü | r̥ | Bruhn 2014 |
| SW Naga | Mzieme, Ntenyi | ʍ | Marrison 1967 |
| Angami-Pochuri | Khezha; Khonoma | m̥, n̥, l̥, r̥ | Khezha: Yabu 1994; Khonoma: Marrison 1967 |
| | Angami | m̥, n̥, ɲ̊, l̥, r̥, j̊, ʍ | Blankenship et al. 1994 |
| | Khezha | m̥, n̥, l̥, r̥, ʍ | Yabu 1994 |
| | Chokri | m̥, n̥, ɲ̊, l̥, r̥ | Nienu 1990 |
| | Sema | m̥, n̥, ɲ̊, l̥ | Marrison 1967 |
| Kuki-Chin | (Proto-)Kuki-Chin | *m̥, *n̥, *ŋ̊, *l̥, *r̥, *j̊ | VanBik (2009:59), Zakaria (2021) |
| | Mizo (Lushai) | m̥, n̥, ŋ̊, l̥, r̥ | Lorrain 1940 |
| | Kom Rem | m̥, n̥, ŋ̊, l̥, r̥ | Toba and Kom (1991) |
| | Falam (Laizo) | m̥, n̥, ŋ̊, l̥, r̥ | Osburne 1975 |
| | Lakher [Mara] | m̥, n̥, l̥, r̥ | Lorrain 1951 |
| | Paang | l̥, r̥ | Löffler 1985 (borrowed from Lushai |
| | Thado | m̥, n̥, ŋ̊, l̥ | Krishan 1980, Thirumalai 1972 (only /l̥/) |
| | Meluri | ʍ, r̥ | Marrison 1967 |
| Kaman-Meyor | Geman; Miji | l̥ | Sun et al. 1991 (342-346); Simon 1979 |
| Tawrã-Idu | Darang | m̥, n̥, ŋ̊, l̥ | Sun et al. 1991(337-341) (In China, not Tawrã in India) |
| Tani | Damu | m̥, l̥, ŋ̊ | J. Sun 1993 |
| Unclassified | Jinuo [Youle] | m̥, n̥, ɲ̊, ŋ̊, l̥ | Gai 1986 |

Several patterns emerge from Table 2. First, voiceless sonorants occur in about eighty-five grammars of extant Tibeto-Burman languages. WALS and the Ethnologue databases each list about 400 Tibeto-Burman languages, which suggests that about 21% of Tibeto-Burman languages could have this typologically rare feature, compared to less than 3% of the world's languages, as sampled by PHOIBLE. Second, it can be seen that if a TB language has only one voiceless sonorant, it is almost always /l̥/: Spiti, Sangtam and Yimchungrü, have just /r̥/; Mzieme, Ntenyi, and Tamang have just /ʍ/. Although both UPSID and the PHOIBLE databases show /m̥/ as marginally more common than /l̥/, no Tibeto-Burman languages display /m̥/ as the only voiceless sonorant. Almost all languages with exactly two voiceless sonorants have either /l̥, r̥/ (Paang, Mawo Qiang, Thakali, Ladakhi, Manang, Jirel, Sherpa) or /m̥, n̥/ (Xumi, Puma). Exceptions include Zhuokeji Jiarong /ʍ, l̥/ and Meluri /ʍ, r̥/. Every Tibeto-Burman language with voiceless nasals has at least /m̥, n̥/, with the exception of just /n̥/ in Dzongkha. If there are three voiceless nasals, then the language has /ŋ̊/, with the exception of Phunoi and the Central Naga languages Angami,

Chokri and Sema, which all have /n̥/. According to the grammars cited in Table 2, the number of voiceless sonorant phonemes per language may be summarized as in Table 3. Although these sounds are rare (PHOIBLE, UPSID), most of the extant Tibeto-Burman languages with voiceless sonorants have two or more of them (54/85 = 64%).

Table 3. Number of voiceless sonorant phonemes in extant Tibeto-Burman grammars.

| Phonemes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Grammars | 31 | 16 | 7 | 7 | 17 | 4 | 3 |

Many extant voiceless sonorants derive from *s- clusters, as in Burmese, Mianchi Qiang (/l̥ə ‘moon’ < PTB *s-la), and Proto-Ersu/Lizu/Duoxu (Chirkova & Handel 2022). In many other groups, the origin of voiceless sonorants remains to be discovered.

Like voiceless sonorants, murmured (breathy) consonants are also rare in the world’s languages; they are most common in Indo-Aryan languages, where they descend from the proto-language. Not surprisingly, Tibeto-Burman languages with murmured consonants are located in the Indo-sphere, specifically Nepal, Bhutan, and adjacent areas of India. Kiranti is the subgroup with the most languages (at least four) having murmured consonants (Table 4). Neither Michailovsky (2017) nor Jacques (2017) reconstruct murmur in Proto-Kiranti. For the Puma language, Michailovsky (2017) points out that “sources differ on the value of Puma *mh* ([m̤] or [mʱ]), *nh*.” The Puma sounds were provisionally listed above with voiceless consonants, due to the presence of /m̤, n̤/ in other Tibeto-Burman languages. The Kiranti language Sampang/Sangpang also has exactly two murmured consonants /mʱ, ŋʱ/; perhaps these are better analyzed as [m̤, n̤], nevertheless, they are listed in Table 4.

Table 4. Murmured consonants in Tibeto-Burman languages

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Dzonghha | bʱ, dʱ, ɖʱ, gʱ, bdʒʱ, dʒʱ, zʱ, ʒʱ | Watters 2018 |
| Eastern Kiranti | Bantawa | bʱ, dʱ | Rai 1985 |
| Western Kiranti | Khaling | bʱ, dʱ, ɟʱ, gʱ | Hale 1973: 27-28 |
| | Chamling | mʱ, nʱ, lʱ, rʱ | Rare sounds. Michailovsky (2017) |
| | Sampang/ Sangpang | mʱ, ŋʱ | Rare sounds. Michailovsky (2017) |
| Kiranti/ Dhimalish | Dhimal | bʱ, dʱ, ɟʱ, gʱ, wʱ, lʱ, rʱ | King (2008) |
| Newaric | Kathmandu Newar | bʱ, dʱ, ɟʱ, gʱ, mʱ, nʱ, lʱ, rʱ, wʱ, jʱ | superset of Malla 1985, Genetti 1990, Hale 1973:28-30 |
| Central Himalayan | E. Chepang A | bʱ, dʱ, ɟʱ, gʱ | Caughley 1990 |
| | E. Chepang B | bʱ, dʱ, ɟʱ, gʱ, mʱ, nʱ, ŋʱ, wʱ, jʱ | Hale 1973:30-31 |

Table 4 shows that the number of murmured phonemes ranges from two (Bantawa, Sangphang/Sampang) to ten in Kathmandu Newar. The median number of contrasts is four, and seven out of nine languages (78%) have at least four murmured consonants. Sangpang/Sampang and Chamling have only murmured sonorants; all of the other languages have at least four murmured stops, which are usually /bʱ, dʱ, ɟʱ, gʱ/. Dzongkha stops /bʱ, dʱ, ɖʱ, gʱ/ present the lone exception.

Every language in Table 4 has a murmured labial consonant; only Sangpang/Sampang lacks an alveolar murmured consonant. Dzongkha and Chepang have both voiceless sonorants and murmured consonants.

The Tamangic language Chantyal has been described as though nearly all consonants contrast modal and murmured phonation, including voiceless stops /pʱ, tʱ/, etc. (Noonan 2008). A seemingly simpler analysis would be to posit murmur as a vowel quality, as other Tamangic languages have been described (Mazaudon 2012).

**2.2 Secondary articulations of consonants.**
Secondary articulations are additional constrictions or modifications of airflow, apart from primary place and manner specifications. Less common secondary articulations of consonants which are found in the Tibeto-Burman family include glottalization, prenasalization, epiglottalization, and labialization. Common secondary articulations such as palatalization are also attested, but are not discussed here.

Maddieson (2013) describes 3 types of glottalized consonant: ejectives (not found in Tibeto-Burman languages to my knowledge), implosives (classified above under manner, due to the ingressive airstream), and 'glottalized resonants'. This last category seems to be what are referred to as glottalized or preglottalized consonants in Tibeto-Burman grammars. They are attested in less than 3% of grammars in PHOIBLE. While ejectives are produced with larynx raising, and implosives with larynx lowering, glottalized resonants are accompanied by neither movement. Table 5 presents attested (pre-)glottalized consonants of Tibeto-Burman. Note that for some languages (Maru, Zaiwa), there is controversy as to the presence of glottalized consonants. Nung has both glottalized consonants and glottalized vowels: /bɪˀ, ŋ̍ˀ, ɳ̍ˀ, m̩ˀ, ŋ̩ˀ, ɲˀ, iˀ, ɛˀ, ɑˀ, ɯˀ, uˀ, oˀ, ɔˀ/.

Table 5. Glottalized consonants in Tibeto-Burman.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Tibetan ('Bumyag Amdo) | ʔt, ʔk, ʔts, ʔtʃ, ʔtʂ, ʔm, ʔn, ʔɲ, ʔŋ | Sun & Lin 2023 |
| Central Himalayan ['Magaric'] | Chepang (Eastern/ Maiserang) | mˀ, wˀ, nˀ, lˀ, rˀ, ŋˀ, jˀ | Caughley 1990; Caughley 1972 |
| Burmish | Maru | pˀ, mˀ, pˀʲ, mˀʲ, tˀ, nˀ, lˀ, nˀʲ, tsˀ, cˀ, kˀ, ŋˀ, kˀʲ | Burling 1967 (not found in Sawada 2018) |
| | Zaiwa | pˀ, mˀ, pˀʲ, mˀʲ, tˀ, nˀ, lˀ, nˀʲ, tsˀ, cˀ, kˀʲ, kˀ, ŋˀ | Burling 1967 (but not found in Wannemacher 1994, Lustig 2010) |
| | Zaiwa (Sadon) | mˀ, nˀ, n̆ˀ, ŋˀ | Yabu 1982 |
| Burmese-Ngwi: N. Loloish | Lalo (Weishan) | vˀ, mˀ, nˀ, lˀ | Björverud 1994 |

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| | Nusu (Bijiang/ Central) | mˀ, nˀ, ɳˀ, lˀ | Sun and Liu 1986; Sun et al. 1991 |
| Burmese-Ngwi: S. Loloish | Mo-ang | vˀ, mˀ, mˀʲ, lˀ, nˀ, lˀʲ, nˀʲ, zˀ, ɳˀ, ɳˀʲ, ŋˀ | Wu 1993 |
| Karenic | Bwe Karen (Blimaw) | bˀ, dˀ | Henderson 1997 |
| | Bwe Karen (Chitabu) | mˀ, wˀ, nˀ, lˀ, rˀ, jˀ, pˀw, pˀl, kˀɣ, kˀw, kˀl | Weidert 1987 |
| Jingpho-Asakian | Jingpho | mˀ, wˀ, nˀ, lˀ, rˀ, ŋˀ, jˀ | Kurabe 2017 |
| Nungish | Nung | bɹˀ, ɳˀ, ɳˀ, m̩ˀ, ŋˀ | Sun et al. 1991 |
| | Trung (Dulonghe) | mˀ, nˀ, ŋˀ | Sun Hongkai 1982; Sun et al. 1991 |
| Bodo-Garo | Atong | mˀ, nˀ, ɾˀ, ŋˀ | Burling 1959. Van Bruegel (2008) treats glottalization as prosodic. |
| | Bodo | mˀ, nˀ, ɾˀ, ŋˀ | Burling 1959 |
| | Garo | mˀ, nˀ, ŋˀ, rˀ | Burling 1961 |
| S. Naga | Rongmei (Songbu) | mˀ, nˀ, ŋˀ | Marrison 1967 |
| SW Naga | Liangmei | mˀ, nˀ, ŋˀ | Marrison 1967 |
| Kuki-Chin | Bawm | mˀ, nˀ, lˀ, rˀ, ŋˀ | Schwerli 1979 |
| | Laizo | wˀ, lˀ, rˀ, jˀ | Osburne 1975 |
| | Lushai | lˀ, rˀ | Lorrain 1940 |
| | Thado | mˀ, nˀ, ŋˀ | Krishan 1980 |
| | Tiddim | lˀ, wˀ; bˀ, dˀ | Henderson 1965 |

Glottalized voiced consonants are found in all Tibeto-Burman languages with glottalized sounds. Maru, Zaiwa, and Bwe Karen are also listed as having glottalized voiceless consonants. As in other phonological topics, the discretion of the linguist plays a role in these analyses. For example, more recent studies on Maru and Zaiwa do not describe glottalized sounds. Likewise, Pekon (2007) says that in Ayan Karen, glottalization is a speaker-level trait; some speakers glottalize, others do not. Within Lolo-Burmese, "the most frequent sources of both glottalized and voiceless nasals are proto-nasals prefixed by *s- or *ʔ-." (Matisoff 2003:37).

Prenasalization occurs when a nasal consonant is produced at the same place of articulation as the subsequent oral stop or affricate (or fricatives in Lotha and Mzieme). This process has been documented in multiple subgroups of Tibeto-Burman (Table 6). Also, prenasalization is to be distinguished from nasal-initial clusters, such as Ersu /nba$^{\text{ɪ}55}$/ 'urine'. Analytical preferences play a role in how these complex sounds are analyzed.

Table 6. Prenasalized consonants in Tibeto-Burman. Representation of prenasalization has been normalized to /ⁿC/.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Baima (Luotongba) | ⁿb, ⁿd, ⁿdz, ⁿdʑ, ⁿdʐ, ⁿdʒ, ⁿg | Sun Hongkai 1991 |
| | Tibetan (Amdo: Bla-brang) | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Sun et al. 1991 |
| | Tibetan (Amdo: Zeku) | ⁿpʰ, ⁿb, ⁿtʰ, ⁿd, ⁿtsʰ, ⁿdz, ⁿtʂʰ, ⁿdʐ, ⁿcɕʰ, ⁿɟj, ⁿtɕʰ, ⁿdʑ, ⁿkʰ, ⁿg | Sun et al. 1991 |
| | Tibetan (Amdo: ‘Bumyag) | ⁿd, ⁿg, ⁿtʃʰ, ⁿdz, ⁿdʒ, ⁿdʐ | Sun & Lin 2023 |
| | Tibetan (Batang) | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Dai 1989 |
| | Tibetan (Khams: Dege) | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Sun et al. 1991 |
| Qiangic | Ersu (Ganluo) | ⁿpʰ, ⁿtʰ, ⁿtsʰ, ⁿtʂʰ, ⁿtʃʰ, ⁿtɕʰ, ⁿkʰ, ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʒ, ⁿdʑ | Sun et al. 1991 |
| | Guiqiong | ⁿp, ⁿt, ⁿts, ⁿtʂ, ⁿtʃ, ⁿtɕ, ⁿk, ⁿpʰ, ⁿtʰ, ⁿtsʰ, ⁿtʂʰ, ⁿtʃʰ, ⁿtɕʰ, ⁿkʰ, ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʒ, ⁿdʑ, ⁿg | Sun et al. 1991; Sun Hongkai 1991 |
| | Lüsu | ⁿpʰ, ⁿb, ⁿtʰ, ⁿd, ⁿtʃ, ⁿdz, ⁿtʂʰ, ⁿdʐ, ⁿdʑ, ⁿkʰ, ⁿg, ⁿbʑ, ⁿpʰʐ, ⁿbʐ | Dai et al. 1991 |
| | Muya | ⁿpʰ, ⁿb, ⁿtʰ, ⁿd, ⁿtʃ, ⁿdz, ⁿtʂʰ, ⁿdʐ, ⁿtɕʰ, ⁿdʑ, ⁿkʰ, ⁿg, ⁿqʰ, ⁿɢ | Sun et al. 1991; Sun Hongkai 1991 |
| | Zhaba | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Sun et al. 1991 |
| Qiangic (controversial) | Namuyi | ⁿpʰ, ⁿb, ⁿtʰ, ⁿd, ⁿʐ, ⁿtʃ, ⁿdz, ⁿtʂʰ, ⁿdʐ, ⁿtɕʰ, ⁿdʑ, ⁿkʰ, ⁿg, ⁿqʰ, ⁿɢ | Sun et al. 1991; Sun Hongkai 1991 |
| | Shixing | ⁿb, ⁿd, ⁿdʐ, ⁿdʑ, ⁿg, ⁿɢ | Sun et al. 1991; Sun Hongkai 1991 |
| Naxi | Naxi (Western/ Lijiang) | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Sun et al. 1991; He and Jiang 1985 |
| Burmese-Ngwi: N. Loloish | Luquan | ⁿpʰ, ⁿtʰ, ⁿtsʰ, ⁿʈʰ, ⁿtʂ, ⁿtɕʰ, ⁿkʰ, ⁿkʰʷ | Matisoff 1979 (normalized from Ma 1948) |
| | Nasu | ⁿbʰ, ⁿdʰ, ⁿdzʰ, ⁿɖʰ, ⁿdʐʰ, ⁿdʑʰ, ⁿgʰ | Chen 1986 |
| | Noesu | ⁿb, ⁿd, ⁿdz, ⁿɖ, ⁿdʐ, ⁿdʑ, ⁿg | Chen 1986 |
| | Nosu | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ⁿg | Chen 1986 |
| | Yi (Dafang) | ⁿb, ⁿd, ⁿdz, ⁿɖ, ⁿdʑ, ⁿg | Sun et al. 1991; Chen et al. 1985 |

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| | Yi (Xide) | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ᵑg | Sun et al. 1991; Chen et al. 1985 |
| Burmese-Ngwi: S. Loloish | Mo-ang | ⁿb, ⁿbʲ, ⁿd, ⁿdʲ, | Wu 1993 |
| | Sangkong | ⁿb, ⁿbʲ, ⁿd, ᵑg | Y. Li 1991 |
| Ao [Central Naga] | Lotha | ⁿp, ⁿpʰ, ⁿb, ⁿt, ⁿtʰ, ⁿs, ⁿz, ⁿdr, ⁿl, ⁿc, ⁿʃ, ᵑk, ᵑkʰ | Marrison 1967 |
| | Sema | ⁿp, ⁿt, ⁿl | Marrison 1967 |
| E. Naga | Ntenyi | ⁿp, ⁿpʰ, ⁿt, ⁿtʰ, ᵑk, ᵑkʰ | Marrison 1967 |
| | Rengma | ⁿp, ⁿpʰ, ⁿb, ⁿpf, ⁿt, ⁿtʰ, ⁿd, ⁿdr, ᵑk, ᵑkʰ, ᵑgʷ | Marrison 1967 |
| S. Naga | Rongmei (Songbu) | ⁿp, ⁿpʰ, ⁿb, ⁿt, ⁿtʰ, ⁿd, ⁿc, ᵑk, ᵑkʰ, ᵑg | Marrison 1967 |
| SW Naga | Liangmei | ⁿp, ⁿpʰ, ⁿb, ⁿt, ⁿtʰ, ⁿd, ᵑk, ᵑkʰ, ᵑg | Marrison 1967 |
| | Mzieme | ⁿp, ⁿb, ⁿd, ⁿts, ⁿz, ᵑg, ᵑk | Marrison 1967 |
| | Zeme | ⁿp, ⁿb, ⁿt, ⁿd, ⁿs, ⁿz, ⁿr, ⁿc, ᵑk, ᵑg, | Marrison 1967 |
| Kuki-Chin | Khoirao | ⁿp, ⁿpʰ, ⁿt, ⁿtʰ, ⁿl, ⁿr, ⁿc, ᵑk, ᵑkʰ | Marrison 1967[1] |
| Kaman-Meyor | Geman | ⁿpʰ, ⁿtʰ, ⁿtsʰ, ⁿtɕʰ, ᵑkʰ | Sun et al. 1991; Sun et al. 1980 |
| Tawrã-Idu | Idu | ⁿb, ⁿd, ⁿdz, ⁿdʐ, ⁿdʑ, ᵑg, ⁿbɪ, ᵑgɪ | Sun et al. 1991 |

Although prenasalization is a rare phenomenon cross linguistically, about 30 languages are attested above with this secondary articulation. Table 6 shows that all such languages have prenasalized stops; most have prenasalized affricates (except Mo-ang, Sangkong).

Labialized consonants are attested across a range of Tibeto-Burman languages (Table 7). Outside of Bodic, Tibeto-Burman inventories of labialized sounds include only velar stops, nasals, and the occasional fricative (Loloish). On the other hand, the Tibetic language Gser-Rdo has fourteen prenasalized obstruents across seven places of articulation (J. Sun 2023). Jiang, Li & Sun (2013) analyzed Tawrã as having both labialized and palatalized initials. However, Evans & Manyu (2021) prefer an analysis of /Cw-, Cj-/ clusters, which function analogously to /Cɪ-, Cl-/. Writing these sounds as sequences rather than unitary phonemes reduces the consonant inventory by seventeen segments, and fits the typology of non-Bodic labialization seen in Table 7. The presence of competing analyses in Tawrã highlights one of the challenges of comparative phonology in this area of the world: many languages have only been analyzed by one linguist, so it may not be known if there are competing analyses that might more elegantly account for speaker behavior.

Table 7. Labialized consonant phonemes in Tibeto-Burman.

[1] Some of the languages cited in this source also indicate the presence of /mm, nn, ɲɲ, ŋŋ/. These are not included here as examples of prenasalization.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Kanauri | tʷ, tʰʷ, cʰʷ, kʷ, skʷ, kʰʷ, gʷ | D. D. Sharma 1988 |
| | Tibetan (Amdo: Zeku) | pkʷ, ptʂʷ, mkʰʷ, mgʷ, wgʷ | Sun et al. 1991 |
| | Tibetan (Amdo: ‘Bumyag) | ʷd, ʷg, ʷts, ʷtʃ, ʷtʂ, ʷdʒ, ʷdz̩, ʷx, ʷχ, ʷz, ʷʒ, ʷr, ʷr̥, ʷl, ʷj | Sun & Lin 2023 |
| | Tibetan (Gser-Rdo) | ⁿpʰ, ⁿtʰ, ⁿtsʰ, ⁿtʂʰ, ⁿtʃʰ, ⁿcʰ, ⁿkʰ, ⁿb, ⁿd, ⁿdz, ⁿdz̩, ⁿdʒ, ⁿɟ, ⁿg | J. Sun 2023 |
| Tamangic | Manange | pʷ, pʰʷ, kʷ, kʰʷ, mʷ, ŋʷ | Hildebrandt & Bond 2017 |
| Qiangic | Southern Qiang (Taoping) | ŋ̩ʷ | Sun Hongkai 1981; Sun et al. 1991 |
| Burmese-Ngwi: N. Loloish | Luquan | kʷ, kʰʷ, ŋkʰʷ, xʷ, ɣʷ, ŋʷ | Ma 1948 |
| Burmese-Ngwi: C. Loloish | Ahi | kʷ, kʰʷ, gʷ, xʷ, ŋʷ | Yüan 1953 |
| | Lisu (Central) | kʷ, kʰʷ, gʷ, ŋʷ | Burling 1967 |
| | Nyi | kʷ, kʰʷ, xʷ | Matisoff 1979 (normalized from Ma 1951) |
| Burmese-Ngwi: S. Loloish | Phunoi | kʷ, kʰʷ | Ferlus 1990 |
| Kuki-Chin | Meluri | kʷ, kʰʷ | Marrison 1967 |
| Kuki-Chin-Naga | Angami (Khonoma) | kʷ, gʷ | Marrison 1967 |
| E. Naga | Ntenyi | kʷ, kʰʷ, gʷ, nʰʷ | Marrison 1967 |
| | Rengma | kʷ, gʷ, ŋgʷ | Marrison 1967 |

In ‘Bumyag (Amdo Tibetan), labialization of the initial consonant can surface in various ways; hence /ʷtʂẽ/ ‘chest’ can be pronounced as [ptʂẽ] ~ [ɸtʂẽ] ~ [wtʂẽ] ~ [tʂwẽ] ~ [ptʂwẽ] (Sun & Lin 2023).

Epiglottalization is a rare secondary articulation. Among Tibetic varieties it has only been reported in Baima (Chirkova, Antolík, Amelot 2023). Epiglottalization is contrastive in the high-falling tone, and not in the other two tones. Consonants that can be epiglottalized are oral stops, affricates and fricatives; prenasalized obstruents, nasals, laterals, and palatal approximants (ibid); cf. Table 8.

Table 8. Subset of epiglottalized consonant contrasts in Baima (Chirkova et al. 2023)

| | | | | | |
|---|---|---|---|---|---|
| ᵐbˤ | ᵐbˤů | ‘to fly’ | ᵐb | ᵐbû | ‘insect |
| mˤ | mˤê | ‘feces; fertilizer’ | m | mē | ‘to plough (PFV/IMP)’ |
| nˤ | nˤâ | ‘pus’ | n | nâ | ‘forest’ |
| ᶮdʑˤ | ᶮdʑˤâ | ‘to be cold’ | ᶮdʑ | ᶮdʑê | ‘to win’ |
| ɲˤ | ɲˤê | ‘to find’ | ɲ | ɲê | ‘fire’ |

| | | | | | |
|---|---|---|---|---|---|
| jˤ | jˤyə̂ | ‘to be lax’ | j | jyə̂ | ‘to yawn’ |

It has been claimed that “harsh register” sounds are epiglottalized (Moisik, Czaykowska-Higgins, Esling 2012). If this analysis is correct, then Akha has epiglottalized vowels (cf Trigo 1991).

Pre-aspiration is rare across the world’s languages. In some cases, it might be better treated phonologically as a cluster, with /h/ as the first consonant. Wang (2016) claims pre-aspirated voiced nasals for some Amdo dialects. However, given that /h/ often surfaces as a voiceless articulation of its subsequent sound, I suggest that these are voiceless nasals, which have already been attested in various Tibetic dialects (Table 2). Zhongu Tibetan has distinctive pre-aspiration on the phonemes /ʰp, ʰt, ʰts, ʰtʃ, ʰk/: /kɔ/ ‘cowhide’ vs /ʰkɔ/ ‘be thirsty’; /tsʁ/ ‘rust’ vs /ʰtsʁ/ ‘grass; /pi/ ‘wool’ vs /pəʰpi/ ‘brother’ (J. Sun 2003). A similar set of pre-aspirated sounds are attested for the Qiangic Ersu language /ʰp, ʰt, ʰts, ʰtʂ, ʰtʃ, ʰtɕ, ʰk, ʰps/ (H Sun et al. 1991).

## 2.3 Rare consonants and contrasts

Across the language family, there are some examples of typologically unusual consonants and consonantal contrasts. Uvular consonants occur in 8% of the grammars in the PHOIBLE database (256 out of 3183). In order by frequency of attestation, they are /q/ (8.0%), /χ/ (6.7%), /qʰ/ (5.2%), /ʁ/ (4.9%), /ɢ/ (1.4%), /ʀ/ (0.6%), /ɴ/ (0.3%). Within the Tibeto-Burman family, uvular consonants are especially common in Qiangic languages. Table 9 shows that the frequency of occurrence of uvular consonants in Tibeto-Burman roughly follows the crosslinguistic tendencies attested in PHOIBLE. Out of the 18 grammars identified in Table 9, all but Hpun have /q/, and nearly all have /qʰ/. Uvular fricatives /χ/ (8) , /ʁ/ (7) and voiced uvular stop /ɢ/ (6) are about equally common in the sample. Three Naish or Qiangic languages have prenasalized uvular stops /ŋqʰ, ŋɢ/.

Table 9. Uvular consonants in Tibeto-Burman.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Balti | q, χ, ʁ | Rangan 1975 |
| Kiranti | Dhimal | q | King 1994 |
| Qiangic | Daofu | q, qʰ, χ, ʁ | Sun, et al. 1991:210, but only /q, qʰ/ in Dai 1989 |
| | Guiqiong; Lizu | q, qʰ | Sun et al. 1991 [ZMYYC] #17 (pages 227-230); Chirkova & Chen (2013a) |
| | Muya | q, qʰ, ŋqʰ, ɢ, ŋɢ, χ, ʁ | Sun et al. 1991 (pp 219-222) |
| Qiangic Naish | Namuyi | q, qʰ, ŋqʰ, ɢ, ŋɢ, χ, ʁ | Sun et al. 1991 (pp 236-239) |
| | Shixing | q, qʰ, ŋɢ, χ, ʁ | Sun et al. 1991 (240-244)[2] |
| | Pumi; Lower Xumi | q, qʰ, ɢ | Sun et al. 1991 (pp 192-196); Chirkova & Chen 2013b |
| | Northern Qiang (e.g., Mawo; Yadu) | q, qʰ, χ, ʁ | Sun et al. 1991 (pp 182-191); Dai 1989 |

[2] replace with Katia’s.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| | Southern Qiang (e.g,. Mianchi, Longxi; Puxi; Taoping) | q, qʰ, χ, ʁ | Evans 2001; Huang 2004; Sun et al. 1991. Sun also has /G/ in one form χGɑ²⁴¹ɕe³³ 'gnaw'. |
| | Upper Xumi | q, qʰ, χ, ʁ | Chirkova, Chen, Antolik 2013 |
| | Lizu | q, qʰ | Chirkova & Chen (2013a) |
| | Queyu | q, qʰ | Sun et al. 1991 (pp 223-226) |
| Bai | Bijiang Bai | q, qʰ, G | Xu and Zhao 1984 |
| Burmese-Ngwi: Loloish | Hpun (Northern Megyaw) | R | /R/ represents a back unrounded glide or a post-velar voiced fricative. Henderson 1986 |
| | Lahu; Sangkong | q, qʰ | Matisoff 1988, Chang 1986; Li 1991 |
| | Yi (Nyi) | q, qʰ, χ | Wu et al. 1984 |
| | Mo-Ang | q, qʰ, G, qʲ, qʲʰ, Gʲ | Wu 1993 |
| Ao [Central Naga] | Sema | q | Sreedhar 1976 |
| Kuki-Chin | Laizo | q, qʰ | Osburne 1975 |

Another rare sound is the interdental stop or affricate of Standard Burmese and Pwo Karen, which is typically transcribed /θ/. For Burmese, articulatory and acoustic evidence supports a stop analysis (Cooper et al 2012). In Pwo Karen, the similar sound is more affricated (Kato 1995).

**3. Typologically unusual vowel phenomena**.
Typologically unusual vowel phenomena found in the Tibeto-Burman family include laryngeal effects (e.g., creaky and murmured voicing), retractions (uvularization and pharyngealization) and fricative vowels.

Unusual vowel properties in Tibeto-Burman largely occur in subfamilies or geographic neighborhoods. The phonetic/phonological properties discussed in this section are what Ladefoged & Maddieson (1990:103) call the "minor features" of vowel quality. They organize minor features into four categories, which could be labeled nasalization, secondary tongue (-root) position, voice quality, and length/diphthongization. Nasalization and length/diphthongization are relatively common cross-linguistically; they are not discussed herein. For a thorough analysis of nasalization in a Tibeto-Burman language, cf. Edmondson, Esling & Li's (2020) analysis of Bai. Due to analytical tradition, glide-vowel and vowel-glide sequences are often transcribed as vowel-vowel sequences in Tibeto-Burman linguistics (*mea culpa*). This transcriptional approach can create the appearance of long vowel nuclei.

The discussion of vowel properties is organized by whether they relate to voicing, or if they involve secondary articulations. Vowels can be notoriously difficult to transcribe, and linguists differ in how certain sounds or features are analyzed. Most Tibeto-Burman languages have not been subjected to instrumental analysis, so the majority of analyses represented here are perceptually- and/or phonologically-based.

**3.1 Non-modal voicing of vowels.**
Non-modal laryngeal vowel properties found among Tibeto-Burman languages include breathy (murmured), creaky (glottalized), laryngealized (stiff) and voiceless vowels.

Breathy voicing occurs when the vocal folds have incomplete closure during voicing. The concomitant increase in airflow typically leads to a lowering and broadening of formants. Turbulent airflow reduces the intensity of harmonics, and high-frequency noise leads to a lower harmonic-to-noise ratio. Breathy consonants have been discussed in section 2.1; cf. Table 4. Breathy vowel phenomena are summarized in Table 10. Languages with breathy vowels are located in two geographic clusters, one in Myanmar/Yunnan, and one in the region of Tibet/Nepal.

Table 10. Breathy vowels in Tibeto-Burman.

| *Group* | *Language(s)* | *Properties* | *References* |
|---|---|---|---|
| Bodish | Lhasa; Kyirong, Dzongkha and many other varieties | low register tones | DeLancey 2017; Huber 2002; van Driem 1992 |
| Kiranti | Camling | Could be consonant or vowel feature | Ebert 2003 |
| Tamangic | Tamang, Gurung, Thakali, Manang; Nar-Phu | Contrast between breathy and modal tones | Mazaudon 2005; Noonan & Hildebrandt 2017 |
| Central Himalayan/ Magaric | Kham | Tone 1 + lax voice. | Watters 2009 |
| | Yanchok Magar | Verb suffixes can be breathy or modal | Hale 1973:19 |
| | Thakali | | |
| Bai | Jianchuan Bai | More noticeable in Jianchuan dialect than in Central dialect | Edmondson et al., 2021 |
| Burmese-Ngwi: Burmish | Standard Burmese | Sometimes called "heavy" tone; written with *visarga*, or -h. | Bradley 1982 |
| Burmese-Ngwi: Loloish | Qingyun Lalo | low level tone (Ts) is breathy | Yang, Stanford & Yang 2015 |
| Northern Naga | Proto- and extant Northern Naga | Proto-Northern Naga had breathy vowels that persist in some varieties | Van Dam, this volume. |
| Kuki-Chin | Paang | Low short breathy tone | Löffler 1985 |

Table 11 shows how breathy voicing in Burmese is one component in a complex of features that comprise the 'high' tone category.

Table 11. Tone properties in Standard Burmese (Watkins 1997 and other resources)

| *tone group* | *pitch* | *contour* | *phonation* | *duration* | *form* | *gloss* |
|---|---|---|---|---|---|---|
| low | low | level | modal | fairly long | /ka/ | 'to cover' |
| high | fairly high | fall | **breathy** | very long | /ka:/ | 'car' |

| | | | | | | |
|---|---|---|---|---|---|---|
| creaky | high | slight fall | creaky | short | /ka/ | 'to dance' |
| checked | very high | slight fall | tense, with -ʔ | very short | /kat/ [kɛʔ] | 'card'' |

In the Tamangic (TGTM) group, languages have four tones, resulting from a split in an earlier two tone system. Table 12 (Mazaudon, 2005; Noonan & Hildebrandt, 2017) shows that breathy phonation (in gray) is typical for low tones.

Table 12. Tamangic tones and breathy phonation (in gray).

| | Tamang | | | Thakali | | | Gurung | Manang | |
|---|---|---|---|---|---|---|---|---|---|
| tone | Ris. | Sahu | Taglung | Tukche | Marpha | Syang | Ghachok | Ngawal | Nar-Phu |
| 1. | 54 | 44 | 55/44 | 54 | 43 | 43 | 33 | 33 | 53 |
| 2. | 44 | 54 | 43 | 44/33 | 45 | 45 | 54 | 45 | 44 |
| 3. | 33/22 | 11 | 33/22 | 11 | 33/22 | 11 | 11 | 54 | 12 |
| 4. | 211 | 32 | 51 | 121 | 51 | 33/22 | 12 | 31 | 21/31 |

Some but not all TGTM languages, along with Kham (Watters, 2003) can be analyzed as having two tones combined with two phonations, yielding a four-way opposition.

The descriptor "creaky voice" applies to a range of glottal phenomena that yield audible pops during phonation. Keating et al. (2015) describe six different types of articulation that yield creakiness. Notably, creak can occur during low-F0 phonation, such as in phrase-final position ("prototypical creak", ibid). However, creak can also occur during glottal tightness, such as that caused by anticipatory articulation of a word-final glottal stop ("tense/pressed voice creak", ibid). This latter type of creak has played an important role in Tibeto-Burman tonogenesis. The former is often an allophonic effect of a low pitch target, as in Mandarin Chinese tone 3 and the high-falling tone of Tawrã (Evans & Manyu 2021). In the Angami language Sumi, vowel nuclei with no onset can have creaky voice allophonically (Teo 2014). Allophonic creaky voice is not explored in this study.

Keating et al.'s (2015) "tense/pressed voice creak" appears to be the same articulation as the category "laryngealized," also known as stiff or pressed voice. During this kind of phonation, vocal folds are tensed. Laryngealized voicing is most commonly attested in Loloish languages, but occurs as far north as Qiangic (Table 13). A caveat relevant to creaky/laryngealized/tense voicing is that the denotation of the terms may not be consistent across authors.

Table 13. Laryngealized/creaky vowels in Tibeto-Burman.

| *Group* | *Language(s)* | *References* |
|---|---|---|
| Qiangic | Muya, Namuyi | Sun et al. 1991; Sun Hongkai 1991 (Note, Sun et al. 1991 also indicated creaky voice for a dialect of Ersu, but other sources do not) |
| Bai | Jianchuan | Dai 1989; Xu and Zhao 1984; Sun et al. 1991 |
| Burmese-Ngwi: Burmish | Lashi, Maru; Achang | Dai 1989; Dai and Cui 1985 |

| *Group* | *Language(s)* | *References* |
|---|---|---|
| Burmese-Ngwi: N. Loloish | Gasu; Lalo; Lisu; Lolopho; Nasu; Nesu; Nusu; Yi (Mile, Mojiang, Nanhua, Nanjian, Xide) | Wu 1994; Chen 1986, Björverud 1994; Bradley 2017; Dai 1989; Chen 1986; Chen 1986; Sun and Liu 1986; Sun et al. 1991 |
| Burmese-Ngwi: C. Loloish | Ahi; Nyi | Luo 1990, Sun and Liu 1986; Wu et al. 1984, Matisoff 1979 |
| Burmese-Ngwi: S. Loloish | Akha; Louma Uishi; Hani (Lüchun, Shuikui, Caiyuan Biyue); Mo-ang; Sangkong | Hansson 1989; Lew 2014; Li and Wang 1986; Wu 1993; Y. Li 1991 |
| Bodo-Garo | Kokborok | Tripura and Jurafsky 1988 |
| Nungish | Nung | Sun et al. 1991 |
| Kuki-Chin-Naga | Mongsen Ao | /a̰/ contrastive after labiovelar initials; Coupe (2017) |
| Tani | Damu | J. Sun 1993 |

Table 13 does not specify which vowels can be laryngealized, because for most languages, the feature can be applied to most if not all vowel phonemes. However, in Northern Lolosish languages, such as the varieties of Yi, it is common for only non-low vowels to laryngealize. Many languages with creaky/laryngealized voice also have breathy voice. Languages in Table 14 exhibit both phonemic creaky and breathy vowels.

Table 14. Creaky and breathy vowels in Tibeto-Burman.

| *Group* | *Language* | *Creaky* | *Breathy* | *References* |
|---|---|---|---|---|
| Central Himalayan/ Magaric | Chepang | creaky voice on rising tone | breathy voice on rising-falling tone | Pons (2022) |
| Burmese-Ngwi | Burmese | one creaky tone | one breathy tone | Watkins 1997 |
| | Red Lahu | Two creaky checked syllable tones | Allophonic breathiness | Jangjamras et al 2019 |
| Karenic | Sgaw | Occurs on some tones (Table 15) | Occurs on some tones (Table 15) | Sarvestani (2018), etc. |
| | Pwo | Sometimes on falling tones | Mid-level tones | Kato (2017) |

Sgaw Karen tones have been analyzed in the literature as having modal, creaky and breathy voicing. Based on acoustic analysis, Sarvestani (2018:80, 112) describes Sgaw Karen tones as in the left half of Table 15. Competing acoustic analyses only show agreement in the specification of phonation for Tones 4 and 6. Even within one language, and despite the application of acoustic analysis, the degree of phonatory diversity can be large.

Table 15. Tones of Sgaw Karen (Sarvestani 2018. Watkins (2001) and Fischer 2013 voice qualities)

| T | level | contour | Sarvestani 2018 | Watkins 2001 | Fischer 2013 |
|---|---|---|---|---|---|
| 1 | mid | level | modal | breathy | modal |
| 2 | high | falling | breathy | modal | creaky |
| 3 | low | falling | creaky | creaky | breathy |
| 4 | low | falling | creaky | creaky | creaky |
| 5 | high | falling | creaky | modal | creaky |
| 6 | low | falling | breathy | breathy | breathy |

Voiceless vowels are rarely phonemic (Gordon 1998, Ladefoged and Maddieson 1996: 315). However, they are attested as phonemic in the East Bodish Dakpa language (Hyslop & Tshering, 2010). Example (7) shows that high vowels [i, u] can be devoiced, and that they can occur after a voiced initial ('will.drink.1st'), lending credence to a phonemic analysis. Perhaps they are restricted to word-final position; this is not stated in the source.

7. Phonemic voiceless vowels in Dakpa

| | |
|---|---|
| *akpu̥* | 'crow' |
| *cipkethi̥ ~ cipketh* | 'eighteen' |
| *thoŋgju̥* | 'will.drink.1st' |
| *phuipu̥* | 'male' |

Voiceless high vowels occur allophonically in Hrusso (D'Souza 2018) on non-stressed syllables following a voiceless initial: [xúmtʂu̥] 'the Bichom river', [xu̥tʂú] 'tiger'. In Mianchi Qiang, nearly any vowel can be voiceless in word-final position, when occurring on a low tone and following a voiceless initial (Evans 2001: 48-52). Voiceless vowels appear to be phonemic, but marginally so (8).

8. Voiceless vowels in Mianchi Qiang

| | | | |
|---|---|---|---|
| ýN tɕʰì | 'luck' (b) | diá tɕʰi̥ | 'next year' |
| χà sɨ | 'recognize' | dá tʂʰɨ̥ | 'play' |

In Hrusso and Mianchi (and probably Dakpa), voiceless vowels are restricted to prosodically weak positions. Takpa and Hrusso limit voicelessness to high vowels. However, in Mianchi, non-high vowels can also be voiceless: /tiá tʰḁ/ 'pick up (basket)'.

**3.2 Atypical vowel features and secondary articulations.**

Beginning with the lower vocal tract upwards, various secondary articulations have been documented in Tibeto-Burman, especially in Qiangic languages: pharyngealization in Northern Horpa (Chiu & Sun 2020), ATR in Yadu Qiang/Rma (Evans & Huang 2007), and uvularization in Heishui Qiang/Rma (Evans et al. 2016) and Queyu (Zheng 2023). These three secondary articulations involve airflow alterations caused by movement of the back/root of the tongue.

In Northern Horpa, pharyngealization causes a range of changes in tongue configuration, depending on the plain (non-pharyngealized) tongue position for a given vowel. Perturbations include retraction, backing, and double bunching (Chiu & Sun 2020).

The [±ATR] feature plays a role in Yadu Qiang incomplete reduplication. Exact reduplication occurs both on verbs (/pʰi-'pʰi/ 'dig', /stə-'stə/ 'soak') and nouns (/χtu-'χtu/ 'turban', /gi-'gi/

‘claw’). However, Yadu also has ATR reversal reduplication, in which verbs and nouns display opposite feature value order (Table 16).

(Table 16) ATR reversal reduplication in Yadu Qiang (Evans & Huang 2007).

| | | | | | |
|---|---|---|---|---|---|
| [+ATR] [-ATR] | verbs | /ə-ɑ/ | stwə-'stwɑ | ‘shaking’ |
| [+ATR] [-ATR] | | /i-e/ | stwi-'stwe | ‘pulling (weeds)’ |
| [+ATR] [-ATR] | | /ə-e/ | dʐwə-'dʐwe | ‘robbing’ |
| [-ATR] [+ATR] | nouns | /ɑ-ə/ | tɑ-'tə | ‘father’ |
| [-ATR] [+ATR] | | /o-u/ | ʁo-'ʁu (-lɑ) | (village name) |
| [-ATR] [+ATR] | | /o-ə/ | dʐo-'dʐə | ‘armpit’ |

In Heishui Qiang, uvularization involves both vowel and consonant properties. Uvularized vowels each correspond to a plain vowel, although there can be plain vowels with no uvularized analog. For example, Yunlinsi dialect has (plain) /e/ with no corresponding uvularized vowel (9).

(9) Yunlinsi Qiang vowels (Evans et al. 2016)

| | | |
|---|---|---|
| i, iᵚ | | u, uᵚ |
| e | ə, əᵚ | |
| | a, aᵚ | |

Uvular consonants only occur with uvularized vowels, although labial and coronal consonants combine freely (10).

(10) Yunlinsi Qiang uvularized vowel phonotactics.

| /zi/ | /ziᵚ/ | /ze/ | /zə/ | /zəᵚ/ | /za/ | /ʁzaᵚ/ | /zu/ | /zuᵚ/ |
|---|---|---|---|---|---|---|---|---|
| exhausted | ladle | hit | field | leak | easy | collapse | wait | hail |
| * | * | /χe/ needle | * | /χəᵚ/ full of food | * | /χaᵚ/ yellow | * | /χuᵚ/ tiger |

Vowel harmony shows movement of the uvularized feature, which auditorily aids in the identification of plain/uvularized pairings (11).

(11) Yunlinsi Qiang uvularization harmony

| | | |
|---|---|---|
| /nu-/ + /la/ | /nu-'la/ | 'bring (in upstream direction)' |
| /nu-/ + /staᵚ/ | /nuᵚ-'staᵚ/ | 'pull out (in upstream direction)' |

Vowel harmony is a common feature of Qiangic languages (Chirkova 2021) that assists the analysis of vowel features, such as ATR and rhoticity in Yadu Qiang (Evans & Huang 2007).

The next set of articulatory effects on vowels, rhotacization and frication, involve oral articulators. Rhotacized vowels are found in Qiangic languages. In single-morpheme environments, these may be limited in distribution. For example, Yadu Qiang has only three rhotacized vowels in its lexicon; e.g., /phɨ˞phɨ˞/ ‘rip (v.)’, /qʰe˞/ ‘rice’, /gə˞/ ‘guard’. However, the 1pl suffix /-˞/ is not limited in the vowel to which it attaches (12).

(12) Rhotacization in Yadu Qiang (Evans & Huang 2007)

| | | | | | |
|---|---|---|---|---|---|
| /i/ | ɕtɕi | > | ɕtɕiˠ | ‘we push’ | |
| /y/ | tɕʰy | > | tɕʰyˠ | ‘we enclose’ | |
| /e/ | le | > | leˠ | ‘we live’ | |
| /a/ | χqa | > | χqeˠ | ‘we carry’ | /a-ˠ/ > [eˠ] |
| /u/ | pʰu | > | pʰuˠ | ‘we run/flee’ | |
| /ə/ | lə | > |ləˠ | ‘we plough’ | |
| /ɑ/ | dzɑ | > | dzɑˠ | ‘we chase’ | |

Ersu (Qiangic) rhotacized vowels are limited to two non-close vowels /aˠ, əˠ/ (Chirkova et al 2015).

Among Qiangic, Lolo-Burmese, and some neighboring languages (Baima, Naxi, Bai), many grammars display the super-high “apical” vowel [ɿ], which often exhibits friction near the alveolar region. As observed by Chirkova et al. 2015, it is usually analyzed as an allophone of /i/, and only follows a limited set of initials. However, Ersu fricative vowels /ʮ, ʐ̩/ and Bai /ʮ/ occur after a wide range of initial consonants, and may be considered phonemic. The vowel symbols [ɿ, ɻ], representing laminal and retroflex articulations, are not standard IPA symbols. In standard IPA terms they might be written as [ɨ, ɨˠ]; however, the apical vowel sounds often have friction, which is not indicated by the standard IPA symbols. Table 17 summarizes apical and fricative vowels in Tibeto-Burman.

Table 17. Apical and fricative vowels.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Bodish | Baima (Luotongba) | ɿ | Sun Hongkai 1991 |
| Qiangic | Daofu, Guiqiong, Shixing | ɿ | Sun et al. 1991 |
| | Ersu | ʮ, ʐ̩ | Chirkova et al. 2015 |
| Bai | Bai (Jianchuan) | ɿ, ʮ | Zhao 1990 ([v] is phonemic (Edmondson et al. 2021) |
| Naxi | Naxi (Eastern/ Yongning) | ɿ, v | Sun et al. 1991; He and Jiang 1985 |
| Burmish | Achang (Lianghe, Longchuan, Luxi); Bola, Lashi | ɿ | Dai and Cui 1985; Dai 1989 |
| N. Loloish | Gazhuo; Lolopho | ɿ, v | Dai et al. 1987; Dai 1989 |
| | Li, Nasu, Nosu; Yi (Dafang, Xide) | ɿ | Chen 1986; Chen et al. 1985 |
| | Yi (Nanjian) | ɿ, ʯ | Sun et al. 1991; Chen et al. 1985 |
| C. Loloish | Ahi; Lisu | ɿ | Chen 1986; Bradley 1994 |
| | Nyi | ɿ, ɻ | Wu et al. 1984; |
| | Nyi, Hani (Shuikui Haoni) | ɿ, ʮ | Ma 1951; Dai 1989 |
| S. Loloish | Hani (Caiyuan Biyue) | ɿ, ɻ, v | Sun et al. 1991; Li and Wang 1986 |
| | Sangkong | ɿ | Y. Li 1991; |
| Nungish | Nung | ɿ | Sun et al. 1991 |

Another set of non-vocalic realizations of vowels are syllabic consonants. In Tibeto-Burman these are usually nasal stops, although some Yi dialects have /l̩/ (Table 18).

Syllabic consonants occur when the accompanying vowel is elided, as shown by vowels in parentheses in some analyses.

Table 18. Syllabic sonorants.

| *Group* | *Language(s)* | *Sounds* | *References* |
|---|---|---|---|
| Qiangic | S. Qiang (Taoping) | m̩, ŋ̩$^{w}$ | Sun Hongkai 1981; Sun et al. 1991 |
| Bai | Jianchuan | m̩̩ | Xu and Zhao 1984; Sun et al. 1991 |
| Tujia | Tujia | n̩ | Tian et al. 1986 |
| N. Loloish | Lalo (Weishan) | n̩ | Björverud 1994 |
| | Yi (Dafang) | m̩(u), n̩(i) | Sun et al. 1991; Chen et al. 1985 |
| | Yi (Mojiang) | m̩(u), ŋ̩(u), n̩(i), l̩ | Sun et al. 1991 |
| | Yi (Nanjian) | m̩(u̱), n̩(ɿ), l̩(ɿ) | Sun et al. 1991; Chen et al. 1985 |
| | Yi (Xide) | m̩(u), m̩(u̱), n̩(ɿ) | Sun et al. 1991; Chen et al. 1985 |
| C. Loloish | Ahi | m̩ | Yüan 1953 |
| | Black Lahu | ŋ̩ (/mu/) | Matisoff 1988 |
| | Nyi | m̩, n̩, ŋ̩ | Ma 1951 |
| S. Loloish | Akha | m̩ | Hansson 1989 |
| Jingpho-Asakian | Jingpho (Enkun) | n̩ | Liu 1984 |
| Nungish | Nung | ˀm̩, ˀŋ̩ | Sun et al. 1991 |
| Unclassified | Jinuo (Buyuan) | m̩, n̩ | Gai 1986 |

## 4. Summary and Conclusion.

Tibeto-Burman languages display a wide range of typologically uncommon phonological phenomena. Although voiceless sonorants occur in only a few percent of the world's languages, 85 of the Tibeto-Burman grammars examined for this study displayed phonemic voiceless sonorants; most of these have two or more voiceless sonorant phonemes in their inventories. Another uncommon articulation, implosive stops are found phonemically in Karenic and Western Kiranti. Murmured consonants occur in some Tibeto-Burman languages of the Indo-Aryan sprachbund. These languages attest to the spread of typologically rare phonemes through contact.

Tibeto-Burman consonant inventories also attest to uncommon secondary articulations, such as glottalization, prenasalization, epiglottalization, and labialization. Of these, prenasalization is the most common, occurring in 33 grammars. Glottalization is almost as frequent, being described in 23 languages. Labialization is rather rare, although Bodish languages allow for large inventories of labialized sounds. Epiglottalization is attested in at least two TB languages (Baima, Akha).

In terms of vowel phenomena, Tibeto-Burman vowels can be breathy or creaky. In some Karenic and Lolo-Burmese languages, as well as Chepang, both creaky and breathy vowels

are phonemic. Voiceless vowels are found in prosodically weak position in a few languages; they are phonemic in Dakpa.

Rare secondary vowel articulations are also attested; they are rare in Tibeto-Burman languages as well. Examples include pharyngealization (Northern Horpa), advanced tongue root (Yadu Qiang) and uvularization (Heishui Qiang, Queyu). These three secondary articulations all involve movement of the tongue root or the back of the tongue.

Fricative vowels and syllabic sonorants are also found in Tibeto-Burman. Fricative/apical vowels are often allophones of /i/ after certain initials. However, Ersu /ɣ̩, ʐ̩/ and Bai /ʏ̩/ are phonemic fricative vowels. Syllabic sonorants are mainly found in Loloish languages, although not exclusively.

Tibeto-Burman languages, despite many being under-described, reveal remarkable phonological diversity and display a wealth of typologically uncommon phenomena. It is hoped that the current investigation and analysis will aid linguists in their evaluation of phonetic and phonological phenomena of more under-analyzed Tibeto-Burman languages.

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