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Sharon Hargus and Keren Rice (eds)
Athabaskan Prosody

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This book is dedicated to Michael Krauss,
in honor of his important work and lifelong commitment
to Athabaskan linguistics,
including Athabaskan prosody.

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INTRODUCTION

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1. *Goals of this volume*

This volume grows out a workshop on prosody in Athabaskan languages that took place in June 2000 in Moricetown, British Columbia, Canada. The workshop was timely: tone has long been a topic of central concern in the Athabaskan literature, and research on stress in Athabaskan languages was just beginning to come into its own when the workshop was planned. The workshop brought together both seasoned and junior scholars with the goal of coming to an understanding of some of the major issues surrounding prosody in languages of the family. Some of the articles in this volume were presented in earlier forms at the workshop, while others were written specifically for this volume. In addition, two seminal articles in the field, Krauss 1979 and Kingston 1985, have been included in this volume, one in largely original form (Krauss) and one greatly revised (Kingston). These two articles help to provide phonological and phonetic perspectives on Athabaskan tonogenesis, and introduce many of the issues that have continued to be of interest since then.

Our major goal in this introduction is to provide a survey of the literature on Athabaskan prosody. We begin with some background on the Athabaskan language family, background that we believe to be necessary to understand almost all of the articles in the book (section 2). For those already familiar with Athabaskan languages, this section can be skipped, but for those who are venturing into this family for the first time, this section is likely to be helpful. Following this, we survey the literature on prosody in Athabaskan languages, looking first at tone (section 3), then at stress (section 4), and then the interaction between the two (section 5).

2. *Background on Athabaskan languages*

2.1 *The family*

It has been recognized since the early 19th century that the languages of this family form a single genetic group (see Krauss 1973). The Athabaskan family, together with the languages Eyak and Tlingit, forms a larger group currently known as Athabaskan-Eyak-Tlingit (Leer 1999).[1]

The Athabaskan languages are traditionally divided into three groups based partly on geography, partly on historical changes. Starting in the southwest of the United States, we find languages of the Apachean (sometimes called Southern Athabaskan) group including Navajo, the best described of the Athabaskan languages, as well as Kiowa Apache (more recently called Plains Apache), Jicarilla, Lipan, Chiricahua, Mescalero, and Western Apache (with dialects Tonto, Cibecue, San Carlos, White Mountain). The Pacific Coast group includes languages that are, or were, spoken on the Pacific coast in two geographically and linguistically motivated groupings: Oregon and northern California. These include Hupa and the Mattole-Bear River-Lassik-Nongatl-Sinkyone-Wailaki-Kato continuum (California group); Upper Umpqua and the Tutuni-Chasta Costa-Coquille-Galice-Applegate-Chetco-Tolowa continuum (Oregon group). Finally, the largest grouping of languages is the geographical grouping Northern Athabaskan, spoken from the province of Manitoba, Canada, across the northern parts of the western Canadian provinces and south of the tree line in the Canadian Northwest and Yukon territories and the American state of Alaska. These languages include the following, in alphabetical order (alternative names and dialect names are in parentheses): Ahtna, Babine-Witsuwit'en (dialect Witsuwit'en), Beaver, Dakelh (Carrier, dialects Nak'azdli, Lheidli), Chilcotin, Dene Sųłiné (Chipewyan, Dene Soun'liné), Dena'ina (Tanaina), Dogrib, Gwich'in (Kutchin), Deg Xinag (Deg Hit'an, Ingalik), Han, Holikachuk, Kaska, Koyukon, Nicola, Lower Tanana (Tanana, dialect Minto), Northern Tutchone, Tsuut'ina (Sarcee), Sekani (dialects McLeod Lake and Fort Ware), Slave (dialects South Slavey, Mountain, Bearlake, Hare), Southern Tutchone, Tagish, Tahltan, Tanacross, Tsetsaut, Upper Kuskokwim, and Upper Tanana. Two or three dialects of a language which was spoken around the mouth of the Columbia River, Kwalhioqua-Tlatskanai, show affinities with both the northern group and the

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[1] Athabaskan-Eyak-Tlingit has also been called Na-Dene (Sapir 1915). However, because 'Na-Dene' has also sometimes included Haida, which is not generally considered to be a related language, we adopt Leer's term Athabaskan-Eyak-Tlingit.

Pacific Coast group (Krauss 1976). We do not attempt further classification in this article; see Krauss 1973, Krauss and Golla 1981, Goddard 1996, Mithun 1999, and some of the articles in this volume (Krauss, Kingston), for further discussion.

While the integrity of the Athabaskan languages as a single genetic unit has long been understood, the reconstruction of the proto-language has been a point of some debate in the literature. Leer 1979, in his ground-breaking work on the phonology and morphology of Proto-Athabaskan verb stems, distinguishes between two different levels of reconstruction, Proto-Athabaskan (PA) and an earlier, internally reconstructed stage, Pre-Proto-Athabaskan (PPA). Within a generative approach to grammar, PPA can best be conceptualized as the underlying or input representation of the reconstructed language, and PA, the phonetic forms of the reconstructed language.

2.2 *Athabaskan morphology*

Athabaskan languages are well known for their complex morphological structures. In this section, we provide an overview of the structure of nouns and verbs, as their morphological structure is of issue in almost every article in the volume, and it is extremely difficult to understand prosody in these languages without having some understanding of the morphology.

2.2.1 *Nouns.* The core part of a noun is the stem.[2] Nouns stems tend to be monosyllabic, although some bisyllabic noun stems are also found.

A possessive construction is found in the languages of this family. This construction is marked by a possessor that precedes the noun stem and, for many nouns in many languages, a possessive suffix, a reflex of **-(e)ʔ* (see Leer this volume, on this reconstruction).[3] Not all possessed nouns are marked with a possessive suffix. In a number of the tonal languages (see §3), two different suffix forms are found for some nouns, one a marked tone vowel (reflex of **-eʔ*) and one simply a marked tone (reflex of **-ʔ*). An example from

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[2] Note that the terms 'stem' and 'root' are not interchangeable in Athabaskan linguistics. The 'root' is the morphologically most basic form. Stems may be formed from roots via suffixation, which is much more common with verbs than nouns. In general in the articles here, the term stem is used. In nouns, this is a non-possessed form; in verbs it is the root plus suffixes marking tense/aspect/mode.

[3] Hereafter, references to reconstructions are abbreviated as follows: L79 = Leer 1979; K79 = Krauss 1979, this volume; KL = Krauss and Leer 1981; L87 = Leer 1987; L00a = Leer 2000a; L00b = Leer 2000b; Ltv = Leer this volume.

South Slavey is given in (1). The hyphen before the stem is a standard device used in the Athabaskan literature to indicate that this form of the stem is dependent, requiring either a nominal or pronominal possessor. (Languages of the family differ in whether a pronominal possessor is required or not for possessed nouns.)[4]

(1) South Slavey

tu	"water"
-túʔ	"water (inalienable)"
-tuéʔ	"water (alienable)"

The other common structure into which nouns enter is compounding. The most common compounding structure involves two nouns. Perhaps of most interest is that the nouns of the compounds can enter into two types of relationships with each other, as evidenced by the phonology. In one case, the two nouns each have independent forms, as in the forms from Navajo in (2a). In the other case, the second noun has a dependent form, as can be seen by the presence of the possessive suffix (voicing of the stem final fricative (2b)) and the voicing of the stem-initial fricative (2b, c).

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[4] We use the orthography for the language under discussion unless otherwise indicated, and we comment on orthography only where such comments will be helpful in sorting out prosodic issues. We have retranscribed a few symbols to standardize within the context of this article (for instance, we consistently use the symbol [ʔ] for a glottal stop). In general, consonants have their usual values in Athabaskan linguistics: symbols such as [b d dz g] represent voiceless unaspirated stops and affricates and [t ts k] are voiceless aspirated stops and affricates. The laterals are generally considered to be fricatives based on phonological patterning. Stops and affricates are usually grouped together based on inventory, distribution, and phonological patterning, and the term 'stop' is used to include both manners of articulation. The acute accent represents high tone; a grave accent is used to mark low tone. As is customary in Athabaskan linguistics, we generally mark only one tone in a tonal language, the unmarked one (see 3.2, for details), unless otherwise indicated.
Sources of data are cited except for Sekani, Slave, and Witsuwit'en, where we draw on our own fieldwork.

(2) Navajo

a. tsésǫ? "glass, window pane, window" YMM: 961[5]
tsé "rock" + sǫ? "star"

b. tsiiyéél "hairknot" YMM: 610
tsii- "head" + -yéél "burden, possessed form" (cf. héét "burden")

c. tsézéi "gravel" YMM: 739
tsé "rock" + séí "sand, crumbs, crumbled fragments" YMM: 466

Structurally, the compounds of the type in (2a) pattern more like two independent words, while those like (2b)-(2c) are more like single words. More formally, these might be analyzed as two Prosodic Words (Pwd) (2a) versus a single Pwd (2b,c).

2.2.2 *Verbs*. The verb consists of a stem and a series of prefixes, where the stem is composed of a root plus a suffix; see note 3. In many Athabaskan languages, both suffixes and clitics are found. The suffixes by and large indicate tense, aspect, and/or mode. Some of the verbal suffixes and clitics reconstructed for Proto-Athabaskan are **-ç* momentaneous imperfective, **-ŋ* perfective, **-ʔ* durative perfective and optative, **-ɬ* progressive/future, **-k^y* customary, and **=he* negative (L79, Ltv, L00a).

For our purposes, only the gross structure of the verb is important; see Morice 1932 on Dakelh, Li 1946 on Dene Sųłiné, Golla 1970 on Hupa, Tenenbaum 1978 on Dena'ina, Kari 1979 on Ahtna, Young and Morgan 1987 (hereafter, YM) on Navajo, Hargus 1988, Hargus in preparation on Sekani, Randoja 1990 on Beaver, Rice 1989a on Slave, Tuttle 1998 on Lower Tanana, Holton 2000 on Tanacross, or Hargus (to appear) on Witsuwit'en, among other sources, for detailed descriptions of verb morphology in individual languages.

The prefixes in an Athabaskan language are typically divided into two major groups, disjunct and conjunct (Li 1946). Conjunct prefixes immediately precede the verb stem, and typically mark categories such as subject, object, and aspect. Disjunct prefixes are further from the verb stem. In terms of semantics, the disjunct prefixes typically indicate concepts such as quantification, direction, location, manner, and relation. The example in (3) shows a Witsuwit'en verb with both disjunct ('D') and conjunct ('C') prefixes. The stem is the final syllable, consisting of root *ʔa* + suffix *-y*.

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[5] YMM = Young and Morgan 1992.

(3) Witsuwit'en

hayinʔay	"he/she brought it (compact object) up"			
ha-	*y-*	*+ in-*	*ʔa*	*-y*
"up, out" (D)	3sO (C)	perfective (C)	"handle compact"	perfective(stem)

2.3 *Phonological domains*

The morphology of a typical Athabaskan language distinguishes stems from affixes, and the phonology does so as well. In this section we summarize some of the major phonological characteristics of the different morpheme types.

Proto-Athabaskan stems are reconstructed as having two vowel types, full (V) and reduced (v).[6] Stems, generally monosyllabic, can have the form CV or CVC, but if the stem vowel is reduced, only CvC is possible as a stem shape (Leer 1979), a bimoraic minimality requirement (see McCarthy and Prince 1986, on this term). Daughter languages vary in their reflexes of the full/reduced distinction and stem minimality requirement. Some languages, such as Sekani (Hargus 1988), are conservative, preserving basically the same full/reduced distinction and stem minimality requirement that Leer reconstructs for Proto-Athabaskan. In other languages (e.g., Ahtna, Kari 1990), the full/reduced vowel classes have been analyzed as long vs. short but the stem minimality requirement still holds. In still other languages, e.g. Slave (Rice 1989a, Rice 1990), the distinction between full and reduced vowels is neutralized and there is no stem heavy syllable requirement: in Slave, there are only place and height-defined subclasses of vowels, without quantity distinctions within a stem.

Stems can generally begin with the full inventory of consonants, or close to it, and can contain any vowel of the inventory. In addition, in the tonal Athabaskan languages, stems contrast (on the surface) for tone; see 3.2, for discussion. The stem was the original domain of place agreement between sibilant consonants (Krauss 1964). Some of the languages still limit sibilant harmony to stems (e.g. Sekani, Hargus in preparation), while other languages have extended sibilant harmony to prefixes in different ways (e.g., Tahltan, Shaw 1991; Doig Beaver, Story 1989a; Navajo, Kari 1976, McDonough 1991).

Turning to prefixes, in most Athabaskan languages, the verb stem is obligatorily preceded by a prefix. This is sometimes viewed as a consequence of a prosodic constraint (e.g. Randoja 1990, Causley 1994) and sometimes as a

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[6] Because restrictions on the forms of stems and roots are similar, we use the term stem here.

consequence of the morphology; see Hoijer (1971), Rice (1989a), McDonough (1990b), and Hargus and Tuttle (1997), for variations on this latter hypothesis. Conjunct prefixes in verbs, possessive prefixes in nouns, and pronominal objects of postpositions are phonologically rather different from stems. Most conjunct prefixes are reconstructed as *C(ə) (the vowel is sometimes treated as epenthetic; see especially Hargus and Tuttle (1997), for detailed discussion on the source and content of the vowel). While some conjunct prefixes bear marked tone in the tonal languages, this contrast is not nearly so robust in these prefixes as it is in the stems and in the disjunct prefixes. Conjunct prefixes in verbs, pronominal possessors in nouns, and pronominal objects in postpositions also generally begin with a smaller range of consonants than do the stems. See Rice (this volume), for some discussion of the differences between inventories found in stems and conjunct prefixes.

Disjunct prefixes fall somewhere between the stems and the conjunct prefixes in terms of their phonotactics. In most languages disjunct prefixes exhibit the full range of vowel and consonant contrasts, and tone is contrastive within the disjunct prefixes to the same extent that it is within the stems. However, the disjunct prefixes may exhibit some properties of affixes as well. There are disjunct prefixes which are historically and/or synchronically related to a free stem morpheme. Some such disjunct prefixes have phonologically simpler or shorter shapes than the related free morpheme. For example, in the Witsuwit'en example in (4), the prefix *ze-* lacks the coda consonant of the free stem morpheme *-zeq*:

(4) Witsuwit'en

-zeq			"(inside) mouth"		
nət'ay	**ze**nigəltl'əz		"I popped a berry in my mouth"		
ze-	+ n-	+ i-	+ g-	+l-	+tl'əz
"mouth"	round object	conjugation	1sS	valence	"toss compact object"

Disjunct morphemes in Ahtna tend to have reduced vowels. This can be seen most clearly with incorporates, where the vowel of the incorporate often has a reduced vowel even though the stem has a long vowel (Kari 1990: 37).

(5) Ahtna

tsaa (Kari, 1990: 367)	"cache"
tsets da**tsa**dinitsiy (Kari, 1990: 368)	"he brought in a pile, armload of wood"
-en**tsiis** (Kari, 1990: 390)	"nose"
neken**tsis**kalyae (Kari 1990: 391)	"they walk around in a circle with their noses to the ground"

The stem-affix distinction is important in many of the articles. We now move to a survey of tone in the Athabaskan family.

3. *Tone*

3.1 *Tonogenesis*

It has long been known that some Athabaskan languages are tonal, and some are not. A pattern that has puzzled linguists working on the tonal languages is one that is sometimes referred to as tonal flip-flop: high tone morphemes in some languages are clearly cognates of low tone morphemes in other languages, and vice versa. This can be seen in a comparison of forms from two of the northern languages, Sekani and Slave. (Here we transcribe tone on all syllables.)

(6) Low-marked vs. high-marked language

Sekani (Ft. Ware)	Slave	
tú	tù	"water"
tsaʔ	tsáʔ	"beaver"

The work of Krauss (1964, 1979, this volume) on Athabaskan tone is seminal in providing an explanation for the different tonal cognates. Krauss 1979, this volume gives a good sense of the frustration around the work on tone that preceded his article. Krauss proposed a new way of looking at tone, namely that tone should not be reconstructed for Proto-Athabaskan. Rather, he proposed the reconstruction of 'constriction', a property of glottalization that developed into tone in some languages. Further, Krauss showed that, to oversimplify, in some languages this feature developed into high tone, in some it developed into low tone, and in others it was largely lost. Krauss (1979, this volume) created a flurry of research activity within the tone languages, and his

work led to substantial gathering of additional data, even between the 1978 version (which was widely distributed) and the 1979 version of the article included here. Krauss's work is largely historically focused, but much of the research that grew out of it identified various synchronic issues. Before turning to these, we examine the second major issue in tonogenesis. While Krauss's hypothesis that tone developed from an early stage of constriction is very satisfying in many ways, it relies on an assumption that this property could be the source of both high tone and low tone.

Kingston (1985) took on the challenge of offering a phonetic account of tonogenesis. Kingston (this volume), a revision of Kingston 1985, sets out three goals in his article. First he proposes an explanation for asymmetries in the development of constriction that Leer 1979 identified between Pre-Proto-Athabaskan (PPA) and Proto-Athabaskan (PA). These developments are summarized in (7) below.

(7) Reflexes of (Pre-)Proto-Athabaskan rhymes

PPA	PA	High-marked language	Low-marked language
VV	VV	V̀V̀	V́V́
VV?	V?	V́?	V̀?
vR	vR	v̀R	v́R
vR'	v'R'	v́R'	v̀R'
VVR	VVR	V̀VR	V́VR
VVR'	VV'R'	V́VR'	V̀VR'
vT	vT	v̀T	v́T
vT'	v'T'	v́T[7]	v̀T
VVT-R	VVT	V̀VT	V́VT
VVT(-T/S)	VVS	V̀VS	V́VS
VVT'-R	VVT'	V̀VT	V́VT
VVT'(-T/S)	VV'S	V́VS	V̀VS
VV'T(')-R	V'T(')	V́VT	V̀VT
VV'T(')(-T/S)	VV'S	V́VS	V̀VS

Note that T represents a stop/affricate, S a fricative, and R a sonorant, VV a full vowel, and v a reduced vowel. Following Athabaskanist convention, we also use V to represent a vowel which has the quality of a full vowel but short

[7] Nearly all of the languages in which tone has evolved have lost syllable final glottalization from ejectives.

duration. V' represents a constricted vowel. (V followed by *ʔ* is also reconstructed to be a constricted vowel.) T', R' represent glottalized consonants, ejective in the case of T'. (Proto-Athabaskan did not have ejective fricatives.) Rhymes consisting of full vowels followed by stops/affricates had one of two possible reflexes. When the rhyme was unsuffixed or followed by an obstruent suffix, the stop/affricate was replaced by a homorganic fricative. Otherwise, the stop was retained. See Leer 1979 and Kingston this volume, for more information.

As mentioned above, this is the first of Kingston's goals: to explain certain asymmetries in the developments in (7), among them, why there is a difference between the development of tone from constriction depending on vowel weight, and why stops, fricatives, and sonorants pattern differently. This first step provides a general overview of where constriction in PA developed into tone and where it did not. The second goal is to account for the actual form that constriction takes in the various daughter languages. As indicated in (7), constriction sometimes develops into a high tone and sometimes into a low tone. Kingston accounts for how the effect of constriction can arise from two different types of articulatory mechanisms, and shows how the two different patterns are both natural phonetic developments. This is an important contribution to the understanding of tonogenesis in that it takes a phonologically elegant proposal and shows that it is plausible phonetically.

Kingston argues that the phonetic differences between two different types of constriction account for the deeper splits between high-marked and low-marked languages. However, in some cases, the split between high and low tone is known to have affected languages of relatively shallow time-depth, in some cases even dialects of the same language. For instance, the Doig River and Blueberry dialects of Beaver are high-marked (Story 1989a, Miller 2003), but the Halfway River dialect is low-marked (Randoja 1990). Kingston's final goal is to account for how these more shallow splits might have arisen. He proposes two possible accounts. One possibility is that the articulatory account can be maintained: final glottal stops which had been articulated in one way came to be articulated in the other, leading to a reversal of tone. One problem with this idea is that not all languages retained glottal stops following marked tone vowels, but instead the glottal stop was replaced by the tone. The other account that Kingston suggests is phonetic as well. He suggests that if the target of tone was towards the end of the syllable, as is known to occur in several unrelated languages, the tone could have been misperceived as being on the following syllable. Specifically, he proposes that tone values could be reversed under the following conditions: (1) tonal targets were coordinated

with the onset of the following syllable rather than the offset of the preceding one and therefore were not reached when the F0 contour was cut off by vowel reduction; (2) listeners misperceived the target on the stem vowel for the tone of the prefix; and (3) listeners sort morphemes into abstract lexical classes contrasting for tone rather than by their F0 value. The details of this analysis remain to be worked out, but this is the first attempt to sort out how the recent tone reversals could have occurred, basing the analysis in misperception.

Krauss's model of Athabaskan tonogensis has given rise to numerous synchronic studies; see, for instance, Alderete (this volume), de Reuse (this volume, to appear), Hargus (1988), Holton (2000, this volume), Leer (1999), McDonough (1999), Pike (1986), Rice (1989a), Story (1989a, 1989b), and Tuttle (1998). As indicated in these references, some of the articles in this volume examine the development of tones in individual languages. In a study of Western Apache noun stems, de Reuse (this volume) shows that the tonal developments in this language are like those in Navajo —PA constricted full vowels become low toned, PA non-constricted vowels become high-toned, and all PA reduced vowels have low tone. See 3.2 for further details, and also de Reuse (to appear) for a companion article on tonal developments in Western Apache verb stems. Alderete (this volume) also deals with tone, examining its further developments in Tahltan. He argues that Tahltan is best classified as a low-marked language, just as Krauss (1979, this volume) and Nater (1989) had done. However, in his acoustic study, tone does not appear to be very salient, and in some cases vowel length replaces the marked tone; see further discussion in section 3.5. Holton (2000, this volume) also provides a detailed examination of the reflexes of constriction in Tanacross, as discussed in more detail in 3.2.

Next we examine the major issues that have been addressed in the synchronic phonology of tone.

3.2 *Markedness issues*

The term 'markedness' is used in two different ways in the Athabaskan literature with respect to tone. First is the historical use of the term: how did constriction develop in the daughter languages? This perspective allows the languages to be divided into three basic groups, low-marked, high-marked, and nontonal. The development of a form with constriction is shown in (8) for a language of each type; here two tones are written for each of the tonal languages, as are final predictable glottal stops.

(8) *ča? "beaver" (K79)

low-marked	high-marked	toneless
Sekani	Slave	Witsuwit'en
tsà?	*tsá?*	*tsa*

According to this use of the term, 'marked' simply tells us something about historical developments.

The term markedness is used in another way in the Athabaskan literature, referring to the synchronic presence or absence of tone as a lexical property of the language. Again, we compare the two languages Sekani and Slave, showing that the historical definition of markedness and synchronic patterning of tone yield similar results in these two languages. First, in both of these languages, only one tone is referred to by the phonology. This tone is the marked one based on the historical development of Sekani as a low-marked language and Slave as a high-marked language. (Accordingly, the unmarked tone is not transcribed in these languages.) In Sekani, word-final glottal stop is inserted following a low-toned vowel for words of many (but not all) lexical categories. In Slave, on the other hand, word final glottal stop is inserted following a high-toned vowel. In (9), a single marked-tone vowel morpheme from each language is presented in two prosodic contexts. When word final, this morpheme appears with epenthetic glottal stop, whereas when word internal, glottal stop is absent.

(9) Slave -/tθí/ "head" [tθíʔ]
cf. [k'e**tθí**eču] "she turns her head"

Sekani (Ft. Ware) -/tsì/ "head" -[tsìʔ]
cf. [tɪ**tsì**sìɣniʔǫ]
"she criticized me"
(lit. "she put my head in the water")

Under conditions of prefix vowel deletion, L remains in Sekani, while H remains in Slave.

(10)

Sekani	ì-ah-čut	àhčut	"take it (you pl.)"
	ì-in-h-čut	ìnhčut	"take it (you sg.)"
Slave	í-ah-ču	áhču	"take it (you pl.)"
	í-n-h-ču	íhču	"take it (you sg.)"

The morphology similarly refers to L in Sekani and to H in Slave. First, in both languages the possessed noun suffix used with vowel-final roots generally consists solely of a tone, L in Sekani and H in Slave.

(11)

	unpossessed	*possessed*	
Slave	ǰíye	-ǰíyéʔ (-ǰíye-´)	"berry"
Sekani	ǰɪ̀ǰe	-ǰɪ̀ǰèʔ (-ǰɪ̀ǰe-`)	"berry"

Second, an allomorph of the **s-* and **n-* (L79) conjugation verbal conjunct prefixes has the form L in Sekani, and H in Slave (Rice and Hargus 1989). The durative perfective and optative suffixes are also purely tonal, consisting of -L in Sekani (Hargus 1988) and -H in Slave (Rice 1989a).

While the relation between historical and synchronic markedness is relatively straightforward in Sekani and Slave, this is not always the case with other languages. In his article for this volume, Holton demonstrates that while Tanacross can be considered a H-marked language historically, both H and L function actively in the synchronic phonology of the language. This can be seen in several ways. First, Tanacross allows stem-internal contour tones, as in (12).

(12) Tanacross contour tones

xɣ̌:θ	"raft"	< PA *χəŋə's (KL81)
mâ:ʁ	"shore"	< PA *wa:n'(ɣ)e: "edge" (KL81)

Second, contour tones arise as a result of suffixation. In the possessive construction, both the tone of the stem and the tone of the possessive suffix (H) are found.

(13) Tanacross contour tones

č'òχ	"quill"
š-č'ǒʁʔ	"my quill"

Likewise, falling tones can arise as a result of suffixation of a L tone. In (14), the L tone in the form containing the relative clause is the Tanacross reflex of **-i:* (Ltv), the non-human relativizing suffix.

(14) Tanacross contour tones

ɬu:g ekt'é:θ	"I fry the fish"
ɬu:g ekt'ê:ð	"the fish which I fry"

It is instructive to compare Tanacross with the Slave dialect of Hare, where suffix tones can also occur on stems. However, in Hare contour tones do not

develop, unlike Tanacross. In (15)a, the tone of the possessive suffix is realized on the stem vowel, without the creation of a contour tone. In (15)b, which has the same historical source as the second Tanacross form in (12) (with a falling tone), there is also no contour tone in Hare:

(15) Hare (Slave)

a.	tu	"water"	
	-túʔ	"water (psd.)"	*-tuʔ (L87)
b.	ba	"shore"	*waːnʼ(ɣ)eː "edge" (KL81)
	yáhba túéʔ	"ocean"	

In *yáhba túéʔ* "ocean", the high tone of the stem /bá/ is realized on the vowel of the prestem morpheme (which generally has the form *yah* "beyond") rather than on the stem itself. See Rice 1989a, Rice this volume, for more detail.

Holton 2002 surveys a number of other northern Athabaskan languages, showing that tests such as the form of the possessive suffix function to identify one tone as synchronically marked and the other as unmarked in some of the languages (Upper Tanana, Han, Gwich'in), while in others both high and low tone play an active role synchronically (Northern Tutchone, Southern Tutchone), with patterning similar to that of Tanacross.

The Apachean languages show a different pattern of lexical tone marking. These languages, like Ahtna, are ones in which the full/reduced vowel contrast has become a long/short contrast. In this group, the reflexes of constriction are more complex than in other Athabaskan languages, with lexical category also playing a role. Leer 1987 provides a description of historical developments in Navajo. Our summary in (16) leaves out some details. As a result of these developments, in synchronic Navajo tone is partly predictable from syllable weight: tone is generally high in short vowel open syllable stems, and low in short vowel closed stems, regardless of whether its source was historically constricted or not.[8]

[8] There are exceptions to the generalization that in open syllable short vowel stems the tone is high: *ni* "you" (sg.) (YMM: 930), *-ni* "during" (YMM: 431), *-ni* "taste, have a taste" (YMM: 431), *-li* "be suspicious of" (YMM: 373). We thank Jeff Leer for helpful discussion around the developments in Navajo and other Apachean languages.

(16) Navajo historical phonology (YMM: 803-804)

	PA	Navajo	example[9]
obstruent closed	*V:	VV	*weːšˢ(r) "knife" > béézˇ
	*V':	VV	*daː'z "be heavy" > -daaz
	*v, *v'	V	*yɑ(χ)s "snow" > yas
non-obstruent closed	*V:	V́	*tuː "water" > tó
	*V?	V? (in verb stems)	*-?a? "send" (pf.) > -?a?
		VV? (in noun stems)	*ča? "beaver" > čaa?
	*vN	VN	*wən "fill up" > bin
	*vN'	Ṿ?	*qʊ'n' "fire" > kǫ?
	*V:N	V́	*-qaː-ŋ "handle contained" > -ką́
	*V:N'	V́V́? (verb stems)	*-q'aːn' "burn" > -k'ą́ą?
		ṾṾ? (noun stems)	*-neːn' "face" > -nįį?

In the tonal languages considered so far, one source of evidence for tonal markedness came from the form of the possessive suffix. In Navajo, it initially seems that a tonal form of the possessive suffix occurs on short-vowel, open tone stems, as in the possessed form of 'water', *-to?* (< **tu-?*). This form makes it appear that the possessive suffix is a L tone followed by a glottal stop, as in Sekani (cf. (11) above), since this tone occurs only in the possessed form. However, this tonal form of the suffix would be required only for short open syllables. In short closed stems and long vowel stems, no tonal change occurs in the possessed form, although other changes can occur, as in (17).

(17) Navajo possessed forms

a. *long vowel high tone closed stems*

héézł	"bundle"	-yéél	"bundle (psd.)"	YMM: 962
béézš	"knife"	-béézˇ	"knife (psd.)"	YMM: 962
ɬį́į́?	"dog"	-lį́į́?	"dog (psd.)"	YMM: 394

[9] Note that we follow the orthographic convention of Navajo and transcribe only high tone. Vowels unmarked for tone have low tone.

b. *long vowel low tone closed stems*

ǰeeh	"gum, pitch"	-ǰeeh	"gum (psd.)"	YMM: 980
saad	"word, speech, language"	-zaad	"word, speech, language (psd.)"	YMM: 991
yoo?	"bead"	-yo?	"bead (psd.)"	YMM: 1006

c. *short vowel closed stems (predictable low tone)*

č'ah	"hat"	-č'ah	"hat (psd.)"	YMM: 98, 962

The forms in (17) show that, with the exception of short vowel open stems (*tó, -to?* "water"), tones do not change in possessed forms. This suggests that the low tone in the possessed form of words like "water" is simply a consequence of the stem shape: the stem is short and closed, and thus bears low tone. It is the glottal stop that marks possession in this case, and not the tone.

Further, in a language like Sekani, if an open syllable stem has a low tone vowel, it will generally end in a glottal stop and vice versa. With long vowel stems in Navajo, such patterns are not found. In stems, if the vowel is long and the syllable is closed with a glottal stop, the tone can be low (18a) or it can be high (18b).

(18) Navajo glottal closed stems

a. *with low tone vowel*

ts'aa?	"basket, pod, shell, box, bed"	YMM: 1003
noo?	"storage pit"	YMM: 991

b. *with high tone vowel*

ɬóó?	"fish"	YMM: 987
dlǫǫ?	"prairie dog"	YMM: 976

The phonology and morphology of stems in the Apachean languages, here exemplified by Navajo, thus do not appear to offer the kinds of clues towards markedness found in many of the other languages: in short vowel stems, tone is predictable, and in long vowel stems, we have not found the kinds of asymmetries present in languages such as Sekani and Slave that would allow one to determine if one tone is phonologically unmarked and the other marked. In prefixes, on the other hand, asymmetries can be found. In disjunct prefixes, a prefix may bear either high tone (e.g., *yá-* "into air" YM: 56g, *č'í-* "out horizontally" YM: 46g) or low tone (e.g., *ya-* "vertical, upward/ downward" YM:56g, *ha-* "up vertically, up out" YM: 48g). When one of these prefixes

combines with the prefix *ná-* "iterative", the concatenation has a long vowel with high tone (e.g., *č'í-* + *ná-* is realized as *č'éé-* YM: 58g; *ha-* + *na-* is realized as *háá-* YM: 58). The retention of the high tone suggests that high tone might be marked in the disjunct prefixes.[10]

Finally, in the conjunct prefixes, it is usually assumed that the low tone is a default tone, with high tone marked lexically (see Kari 1976, McDonough 1999, for discussion). As evidence for this analysis, Kari formulates a tone assimilation rule by which a low tone conjunct vowel assimilates to a preceding high tone. McDonough 1999 reanalyzes this as a coarticulatory effect rather than a phonological rule. In addition, one of the allomorphs of the second person singular subject is simply a high tone.

Some of the other Apachean languages provide evidence for the synchronic markedness of low tone in stems. In Western Apache, as discussed by de Reuse (this volume, to appear), there are three phonetic tones, low, mid, and high. The mid and high tones are in complementary distribution, with mid tone on long vowels and high tone on short vowels. Here the fact that the low tone is constant and the non-low tone variable in its realization depending upon the environment is an indication of the markedness of the low tone.

3.3 *Other tonal processes*

In this section we summarize some of the other tonal processes found in the tonal Athabaskan languages.

3.3.1 *Stem-domain phonology.* A process in a few tonal languages is one by which the stem and suffix vowels come to share tone, with the stem vowel assimilating to the tone of the suffix. This can be seen in the forms from the Hare dialect of Slave in (19) and in the Gwich'in forms in (20) (Leer 1996):

(19) Slave (low tone not transcribed)

low-toned stem, high-toned suffix

ts'a(h)	"hat"	-ts'ádé?	"hat (psd.)"

high-toned stem, low-toned suffix

dzé?	"gum"	´-dzege	"be gummy"

[10] Across the family, the iterative prefix is often unusual in its patterning. It has the reflex of the unmarked tone in the language, but patterns phonologically as if its historically unmarked tone is lexically marked, even in languages like Sekani and Slave which otherwise pattern as if only one tone, the historically marked tone, were present lexically. See 3.3.3.

In these suffixed stems from Slave, the two syllables share the same tone. (Note that the high tone of the stem "gum, be gummy" is maintained, but is located on the prestem vowel. See Rice 1989a and Rice this volume, for discussion.) In low-marked Gwich'in (20), replacement of the stem tone by the suffix tone must be considered a strictly historical process in forms such as "berries" in (20), because suffixes have been lost by regular processes which are detailed in Leer 1996.

(20) Gwich'in (high tone not transcribed)[11]

historically unconstricted stem, constricted suffix

ʔaih < *ʔaːxʸ "snowshoe" -ʔàiːʔ < *-ʔaːy-eʔ "snowshoe (psd.)"

historically constricted stem, unconstricted suffix

ǰak <*gəkʼ-eː "berries"

Krauss (1979, this volume) reports that a number of languages exhibit the pattern seen in (19)-(20). Some of them (other Slave dialects, Dogrib) are misreported, as later fieldwork showed. Perhaps the majority of the tonal languages in which the vocalic form of suffixes is retained do not exhibit tonal assimilation within the domain of the stem + suffix. For example, in Sekani, as shown in (21), low tone stems are found before high (unmarked) tone suffixes and vice versa. As with Slave, there are many disyllabic stems in Sekani ending in [e] which can be shown to consist of root + *-e* suffix. Although this suffix does not have a meaning, it has an effect on the form of the diminutive suffix in Ft. Ware. With roots ending in *-e*, the *-a* rather than *-azi* allomorph of the diminutive suffix must be used. The *-azi* allomorph occurs with vowel final roots. See Hargus (this volume), for more information.

(21) Sekani

high-toned stem, low-toned suffix

tseɬ	"axe"	-tseɬèʔ	"axe (psd.)"

low-toned stem, high-toned suffix

gǫ̀ze	"pine"	cf. gǫ̀za	"pine tree (dim.)"

[11] These forms are representative of all but the Arctic Red River dialect of Gwich'in. See Leer 1996, for more information.

Yet some lexical items in Sekani with unexpected tonal developments suggest that there may have been sporadic assimilation of the stem to the suffix tone in a few lexical items. In the words in (22)a., low tone has unexpectedly developed on a stem syllable that is reconstructed without constriction in PA. In both cases in (22)a., the stem syllable is followed by a low tone suffix. Similarly, the stem syllables in (22)b. have failed to develop low tone from constriction in Sekani. These stems were historically followed by unconstricted syllables in PA:

(22)

a.	*assimilation to marked tone of suffix*
*sa:g^{y}e? "(of) old" (L00b)	ts'ā̀dzè? "old"
*χαy "small roots" (K79)	-ɣə̀yè?
b.	*assimilation to unmarked tone of suffix*
*wa:n'-(ɣ)e: "edge" (KL81)	-mah
*čə'ye: "grandfather" (K79)	-tse
*-k^{y}ə'tl'e: "younger brother" (K79)	-čɪdle
*qə'm'e: "house" (K79)	kǫh

In the preceding, three types of languages are recognized, those in which the stem and suffix share the same tone, with the suffix tone taking precedent (Slave, some lexical items in Sekani); those in which stem and suffix each retain their lexical tone (most of Sekani); and those in which the vocalic portion of the suffix is lost but its tone retained, supplanting that of the stem (Gwich'in). Tanacross (Holton this volume) represents a variation of the pattern seen in Gwich'in. In (12) through (14), we saw that vowels have been lost from suffixes but their tones kept, and both stem and suffix tone is realized on the stem vowel. The Tanacross/Gwich'in pattern is also found in at least some environments in Upper Tanana, Han, Northern Tutchone, and Southern Tutchone (Holton 2002).

Interestingly, Ahtna (Kari 1990: 23-24), a non-tonal language, exhibits a somewhat similar effect to that found in the Hare dialect of Slave. In this

language, stems can end in consonants, and both plain and glottalized stops are found. However, when the possessive suffix, with a final glottal stop, is added, the underlyingly stem-final glottal stop deglottalizes, as illustrated in (23).

(23) Ahtna

stem	*possessed form*		
gets'	-gedzeʔ -/gets'-eʔ/	"mittens"	Kari: 37
k'aʔ	-k'aaʔ -/k'aʔ-eʔ/	"gun"	Kari: 37

However, when a vowel-final suffix is added, the glottalization is maintained in most dialects, as seen in the verb stems in (24).

(24) Ahtna

stem	*suffixed form*	
-ts'uuts'	gigi nanats'uuts'-i	"become deflated/dry shriveled berries [deflated berries]" Kari: 417
-tl'ets'	sidatl'ets'-i	"be blue-green, dark in color/mallard [that which is blue-headed]" Kari: 361

Just as in the Hare dialect of Slave where the stem can have only one tone, in Ahtna, setting aside morpheme-initial consonants, a stem can have only one final glottal stop.

3.3.2 *Prefix-domain processes.* In many languages, various processes affect prefix tones as well. We mentioned in 3.1 that one of the sources of evidence for tonal markedness are tonal morphemes, and that the **s-* and **n-* conjugation morphemes exhibit tonal effects in many languages. In (25), forms from Sekani and Slave illustrate the tonal effect of *n-* conjugation and *s-* conjugation. The verb stem is separated from the prefixes by a hyphen, and the tone of interest is the one on the syllable before the stem.

(25) Tonal effects of conjugation markers: Sekani and Slave (Rice and Hargus 1989)

conjugation	Sekani (McLeod L. dialect)	Slave (Hare dialect)
n-	yidàdę̀-leh "s/he carries pl. wooden objects inside" 275	ríradę́-dlu "s/he drags in wooden object in one trip" 275
s-	tl'o̧dès-łeh "s/he puts rocks in circle" 279	táréh-šu "s/he drives object ashore" 279

3.3.3 *Interactions between prefixes.* Some languages exhibit unusual patterning of the iterative prefix (also called customary, reversative). In Dene Sųłiné and Slave, the vowel of this prefix is often deleted when another prefix precedes, and the preceding vowel is nasalized and takes on the low tone of the iterative, as in (26).

(26)

a. Dene Sųłiné *xá-* "out" (Li 1946:417)

xálʔoih "water rushes out"
xá- "out" + *na-* iterative
xąlʔóih "water rushes out (customarily) as if it were boiling"

b. Slave *ná-* continuative (Rice 1989a: 675)

ná-tla "s/he goes"
ná- continuative + *na-* iterative
nǫ-tle "s/he goes customarily"

Similar patterning is found in other languages as well.

(27) Navajo *di-* "fire"

didiš-ǰeeh	"I build a fire"	YM87: 314d
di- "fire" + *ná-* reversionary		
déédíš-ǰah	"I repeatedly build a fire"	YM87: 58g

(28) Sekani *tà-* "uphill"

tàsəsya	"I walked uphill"
tà "uphill" + *na-* iterative	
tànasəsǰa ~ tansəsǰa	"I walked back uphill"

In Tanacross, Holton (this volume) illustrates a process that he calls *na-* absorption. Like the processes illustrated in (26) – (28), the tone of the iterative remains. However, in Tanacross the vowel of the preceding disjunct prefix is lengthened and a falling tone results.

(29) Tanacross *xá-* "up" (Holton this volume)

xá- "up" + *nà-* iterative
dɛts'ɛn xâːnɛt'ax "the duck is flying around"

Not all tonal languages retain the tone of the iterative. In Kaska (Moore 2001) the iterative has two forms, *ne-* and *n-*, with the reduced form occurring after another prefix. It has no effect on the tone of that prefix, as in (30).

(30) Kaska *né-* plural + *n-* iterative

néngaajen	"they (pl.) sang again"

However, unlike the iterative prefix, *né-* plural retains its tone when its vowel is deleted.

(31) Kaska *de-* + *né-* plural

degetl'ụh	"they both are setting (a snare)"
déngetl'ụh	"they all are setting (a snare)"

Kaska not only shows tonal stability effects in prefixes, as above, but also has tone spread from one prefix to the next (Moore 2001). In (32) we illustrate rightward tone assimilation in Kaska, triggered by the high tone prefixes *né-/yé-* plural subject. In (32), this prefix spreads its tone onto *ge-* third person plural subject.

(32) Kaska (Moore 2001)

egetsets	"they both are eating"
négétsets	"they (pl.) are eating"

Moore (2001) remarks that this spreading occurs only in imperfective and optative forms, and not in perfective or future forms, so that it is not purely phonologically determined.

3.3.4 *Prefix-stem interactions.* Several different types of processes are illustrated in this section, all of which involve rightwards movement onto a stem or leftward movement from a stem onto a verbal prefix.

Cook 1989 discusses some interesting tonal processes in Chilcotin. In the presence of the first person duo-plural subject prefix, which carries a lexical high tone, the marked tone in Chilcotin, the tone of the following stem may change. This can be seen by comparing first person duo-plural subject forms with third person subject forms, where the lexical tone of the stem is present in the third person forms. In (33)a, the stem assimilates to the H tone of the preceding H prefix through progressive spread of the prefix tone. In (33)b, the H stem dissimilates from the H tone of the prefix, losing its tone.

(33) Chilcotin (Cook 1989: 184) (the stem follows the hyphen)

a. *low tone stem, high tone prefix (1.DU.PL subject)*
ní-bín "we swam"
cf. ni-mbin "s/he swam"

b. *high tone stem, high tone prefix (1.DU.PL subject)*
není-qa "we sew"
cf. nene-qá "s/he sews"

Although not illustrated in (33), the *s-* and *n-* conjugation prefixes also cause tonal assimilation and dissimilation. Cook notes that instead of outright tonal dissimilation, the tone reversal seen in (33)b. may be realized as a contour tone, as seen in the first person duo-plural form in (34):

(34) Chilcotin (Cook 1989: 184)
nítsên "we are bad"
cf. nen-tsén "he is bad"

Other prefixes which trigger progressive H spread in Chilcotin are *ná-* continuative and *ná-* customary. In (35), the continuative prefix *ná-* and the stem are lexically high. The high tone on the syllable [ǰú] in the first form is due, Cook argues, to the progressive spreading of a high tone.

(35) Chilcotin *ná-* continuative
náǰú-bí "they will swim around" (Cook 1989: 188)
cf. ǰètù-bí "they can swim"

A customary form, marked by *ná-* in Chilcotin, is illustrated in (36)a. In this example, the stem has unmarked (L) tone, and the progressive tone spread rule affects both the prefix [ǰe] and the stem [biš]. Cook shows that this spreading to the stem is somewhat variable if the stem is not adjacent to the H that triggers the spreading. Note that spreading does not occur in (36)b. He suggests that segmental characteristics of the stem may affect spreading (e.g., whether it ends in a nasal or not, the quality of the stem vowel, the type of consonant that begins the stem).

(36) Chilcotin *ná-* customary
a. náǰé-bíš "they customarily swim"
cf. b. ǰètè-bìš "they started to swim"

Cook summarizes by identifying "three major phonological processes that obscure the surface pitch contrast: two types of tone reversal/perturbation, forward high spreading/assimilation, and allotonic variation conditioned by syllable types. Interactions of these three processes account for most irregular pitch levels observed on the phonetic surface" (Cook 1989: 191).

De Reuse (this volume) reports a tonal process in Apache by which the high tone of a prefix shifts onto a stem.

(37) San Carlos Apache

ns-cō:s	"I bring it (a flat flexible object)"
ńɬcō:s > nɬcó:s	"you (sg.) bring it (a flat flexible object)"

Recall that in San Carlos Apache, mid tone is one of the surface manifestations of the unmarked tone; thus here a prefix high tone is shifting onto an unmarked tone stem. This is somewhat different from Chilcotin, where tones spread rather than shift onto stems.

Tanacross also exhibits a progressive tone spreading process, as Holton (this volume) discusses. In (38)a, high tone spreads rightward from a stem onto the next word:

(38) Tanacross (Holton this volume)

a. ɬóx nɛ́k?ę̀h
   fish hook 1sg. see
   "I see the fish hooks"

cf. b. sè:y nɛ̀k?ę̀h
   knife 1sg. see
   "I see the knives"

Stems can also block tonal spread in Tanacross. High tone spread of the sort shown in (38)a. is blocked if the following stem syllable has a high tone. In (39)a., the tone of the postposition *?éɬ* "with" spreads H to the prefix of the following word, while in (39)b. this spreading is blocked because the stem bears a high tone.

(39) Tanacross (Holton this volume)

a. u-?éɬ ðíh-dah
   3s-with 1sg. stay
   "I am staying with him"

b. u-ʔéɬ ɣih-dáʔ
3s-with 1sg. stayed
"I stayed with him"

3.4 *Dakelh tone*

Having looked at some of the tonal processes which occur in several of the Athabaskan languages, we are now ready to turn one of the most complex systems, Dakelh.

Dakelh tone is described in Story 1989b,[12] who builds on her own earlier work on Dakelh prosody (Story 1984), and especially on the work of Pike 1986. Story (1984:24) had suggested that Dakelh lacked stem tone, but Pike, who worked intensively with one speaker of the Nak'azdli (Fort St. James) dialect, identified tonal contrasts among words which in some cases can be traced to differences in stem tone. We begin this section with a review of Story's work, and then turn to some more recent studies.

Underlyingly, there appears to be a contrast between H and toneless morphemes in Dakelh. As Story 1989b:106 notes, many morphemes with lexically specified H are "reflexes of forms which...contain a constricted vowel in their reconstructed form" (e.g. /ɬéz/ "dust" < **ɬe'ːš* "clay" (L87)), whereas words which lack H "are reflexes of forms which do not contain a constricted vowel in their reconstructed forms" (e.g. /deɬ/ "crane" < **deːɬ* (KL81)). Dakelh is therefore a historically and synchronically high-marked language. However, the distribution of H vs. toneless morphemes does not always align perfectly with the reconstruction of constriction.[13] The lexical representations of some loans into Dakelh have H tone (e.g. *suniyá* "money" < Cree *soniyaw*; *lisél* "salt" < French *le sel*; *saldán* < *soldier*, *ǰéyo* "bull moose" < McLeod L. Sekani *ǰeyǫèʔ*), but some do not (*məsdus* "cow" < Chinook Jargon *moos-moos* "buffalo; horned cattle", *ligok* "chicken" < French *les coqs* or Chinook Jargon *le-cock*). It should be noted too that McDonough 1990a reanalyzes the data provided by Pike/Story in terms of an underlying contrast between accented

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[12] For the most part, Story 1989b simply interprets the data in the single-speaker study of Pike 1986, providing some orientation of Dakelh within the historical linguistic study of Athabaskan tone. However, Story 1989b also adds some data recorded with another speaker at an earlier date, and notes some differences between the two speakers.

[13] For example, the following words have a lexically specified H tone in Dakelh, but are reconstructed without constriction: /də́be/ "goat" < **də-weː* "mountain sheep" (KL81), /bésk'i/ "seagull" < **weːǰ* (KL81), /tl'əɣə́s/ "snake" < **tl'əɣəšʕ* "eel, leech, snake" (KL81), /tsačón/ "cache" < **ča:*. Also, note that -/čəl/ "younger brother" is reconstructed with constriction (**–kʲə'tl'eː* (K79)), but is lexically toneless in Dakelh.

and accented, rather than tonal and toneless, morphemes. In her analysis, a HL tonal contour is aligned to the accented syllable.

A set of tone rules, posited by Pike and refined and clarified by Story, affect the realization of underlying tone. One rule posited by Story shifts the leftmost, lexically specified tone one syllable to the right:[14]

(40) *Tone Shift*
Leftmost H is realized one syllable to the right.

Tone Shift applies within the verb prefixes. The following forms, which contain the lexically H prefix *ná-* continuative, exemplify Tone Shift: /ná–sə–ya/ [nəsə́ya] "he went", /ná#ts'ə–z–dil/ [nəts'ə́zdil] "we went". Tone Shift also applies to some noun + enclitic combinations; e.g. /datsán/ "crow" + /čo/ "big" → /datsančó/ "raven". But compare /bús/ "cat" + /čo/ "big" → /busčo/ "cougar" with no tone shift (deletion of stem tone from /bús/ instead). Tone shift does not apply within polysyllabic, monomorphemic words: /ǰéyo/ [ǰéyo] "bull moose", /dákeɬ/ [dákeɬ] "Indian", /bésk'i/ [bésk'i] "seagull". Story also tentatively concludes that Tone Shift applies to noun compounds: /yə́n + tə + máiʔ/ [yəntə́maiʔ] "lowbush blueberry", /ts'é + ke/ [ts'eké] "woman" (cf. [ɬits'é] "bitch"). Dakelh Tone shift is somewhat reminiscent of the progressive tone assimilation rules discussed in 3.3.3, although it involves shifting rather than spreading of tone.

Just as the tonal assimilation in other languages is sensitive to different characteristics of stems (3.3), so too is Dakelh Tone Shift sensitive to different characteristics of stems. Tone Shift is blocked if the syllable to the right is already specified for H tone, as in /ná#s–íD–ʔaz/ [nə́sit'az] "we 2 went". Tone Shift also does not systematically apply across the verb prefix-stem boundary. To account for those cases in which Tone Shift does apply to verb stems, Story recognizes two types of verb stems, 'class X' (those which block the rightward movement of an underlying high tone) and 'class NX' (those which do not block rightward movement of an underlying high tone). She notes that these are historically and synchronically arbitrary classes, not reducible to H marking. Note the application of Tone Shift in the following third person singular forms before NX stems, which all contain the conjugation prefix /í(z)/–: /t–íz–ya/ [tizyá] "he/she left, went", /na–i–n–íz–ɬ–no/ [nainiɬnó] "he/she extinguished it", /ʔə–n–íz–dai/ [ʔənisdái] "he/she overate", /na–i–díz–ɬ–gih/ [naidiɬgíh] "he/she dried it", /yə–n–t–iz–ɬ–ʔi/ [yəntiɬʔí]

[14] Rule names are ours.

"he/she hid it". Compare the lack of Tone Shift (retention of H on the prefix syllable) in the following words, which contain class X stems: /t–íz–dlat/ [tízdlat] "he/she left by raft", /t–íz–ɬ–gai/ [tíɬgai] "he/she left running", /yə–t–íz–ɬ–no/ [yətíɬno] "he/she swallowed it", /ʔə–d–íz–gwət/ [ʔədízgwət] "he/she speared a tree". However, there are some predictable aspects to Tone Shift blockage by stems. For example, with certain prefix combinations, if the stem final consonant is voiceless, the stem is said to always block Tone Shift: [yə́zt'əs] "he cut it", [yə́zguh] "he grabbed it".[15] Compare Tone Shift with the vowel final stem in [yəɬgí] "he dried it" and with the voiced stem final consonant in [yəzdlíz] "he boiled it".[16,17]

Pike and Story also posit a tone rule of Tone Deletion:

(41) *Tone Deletion*
All H tones but the leftmost are deleted

Tone Deletion applies within the verb prefixes: /nə́#sə–íD–ʔaz/ [nə́sit'az] "we 2 went". We suggest that Tone Deletion also applies between words. Similarly, McDonough 1990a:57 proposes a rule spreading L tone that applies across words. Pike had identified two classes of words, L (those which lower the pitch of a following word) and NL (those which do not lower the pitch of a following word). Pike and Story sometimes transcribe the effect of an L class word on the following word with explicit grave accents marking low tone, but do not transcribe tone deletion within the verb with grave accents. By our analysis, Tone Deletion applies to noun + enclitic combinations (/ɬéz–íloh/ [ɬéz–iloh] "it's not dust"), numeral + noun (e.g. /ɬtak'ánt'i/ "7" + /bánək/ "Indian bread" [ɬtak'ánt'i bànək] "7 [pieces of] Indian bread"), and noun + noun compounds (e.g. /ʔó + k'ét/ [ók'et] "eddy"). Tone Deletion also applies within direct object noun + verb phrases (e.g. /tl'əɣ́s/ "snake" + /níłʔen/ "we 2

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[15] Some of the data presented in the article, for example [naidiɬgíh], appear to be counter-examples to this statement.

[16] These data raise the possibility that certain syllable-final laryngeal states might create a phonological L tone, which would block Tone Shift. Other effects of surrounding consonants on the realization of pitch are discussed below.

[17] Story notes a second type of perseverative tone in direct object + verb phrases: "in the second type of variant which occurs in the structure object noun + transitive verb, it is tentatively hypothesized that the variant consists of a high tone on the first syllable of the verb when the noun is diagrammatically of the form (CV)CV' (that is, carries high tone on the final syllable in its underlying form)..." pp. 113-114 (e.g. /datsán/ "crow" + /niɬʔen/ "he sees": [datsán níɬʔèn] "he sees the crow".

see": [tl'əɣə́s nìl?èn] "we 2 see the snake"; /tséldzu/ "comb" + /níl?en/ "we 2 see": [tséldzu nìl?èn] "we 2 see the comb"). However, as noted by Story, Tone Deletion does not always apply in the phrase direct object + verb.[18] Tone Deletion never affects subject nouns followed by direct objects, nor subject nouns followed by verbs.

Dakelh also exhibits Tonal Stability effects.

(42) *Tonal Stability*
CVCV́> CV́(C)

When the rightmost of two syllables has an underlying H tone, but must undergo some sort of 'reduction' (resulting in loss of the tone bearing unit), the H which was associated with the lost syllable shifts to the preceding syllable. For example, tonal stability can be seen in /nə́#ts'ə–ti–dəɬ/ [nə́ztidəɬ] "we'll go", where /nə́ + ts'ə/ → [nəts'ə́] (Tone shift) → [nə́z] (Tonal Stability). In some cases, Story must posit questionable synchronic reduction to explain the failure of Tone Shift to apply. For example, she notes the necessity of "positing an allomorph *ízə-* of the *s-* perfective prefix that occurs with conjunct derivational prefixes and that carries an underlying high tone" (p. 125) to explain why the H tone stays on the prefix syllable in 1s /tə–ízə–s–ya/ → (Tone Shift) təizə́sya → (with prefix reduction and Tonal Stability) [tísya] "I left, went". However, note that she must posit a different UR for this prefix to explain the 3s form /tə-íz-ya/ [tizyá] "he/she left, went", in which the tone shifts to the stem and does not remain on the prefix. (The stem "go" is class NX, allowing Tone Shift to apply across the verb prefix-stem boundary, as described above.) These tonal stability effects are reminiscent of those of other languages. As reviewed in 3.3, we found stability both within stems and in the retention of the tone of the iterative and other morphemes when their vowels were deleted.

Finally, words with no lexically specified H tone receive a phonetic H tone by default:

(43) *Default Tone*
H is assigned to the final syllable of toneless domains.

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[18] E.g. /nát'oh/ "grouse" + /ínč'i/ "you (sg.) shoot" [nát'oh ínč'i] "shoot a grouse!"; /yə́n/ "ground" + /níl?en/ "we 2 see" [yə́n níl'en] "we 2 see (some?) ground".

Default Tone accounts for the fact that "excluding words carrying low tone throughout...[the result of obligatory Tone Deletion between words], every (phonological) word carries one and only one high tone" (p. 125). The domain of Default Tone includes monomorphemic nouns (e.g. /xoh/ "goose" [xóh]; /dəčən/ [dəčə́n] "tree"; /dəne/ [dəné] "man") and noun + enclitic combinations (e.g. [xóh za] "only a goose"). Within these domains, only one H tone is inserted. Note that Default Tone does not apply to noun + enclitic combinations if the enclitic is specified H (e.g. [xoh–íloh] "it's not a goose"). Each word of a direct object + verb phrase constitutes a domain for Default Tone: e.g. /dəčən/ "tree" + /niɬʔen/ "he sees" → [dəčə́n niɬʔén] "he sees a tree". However, Tone Deletion blocks Default Tone within this domain. That is, a default tone is not inserted in a lexically toneless verb which follows a direct object noun with specified H. Instead, Tone Deletion applies: /datsán/ "crow" + /niɬʔen/ "he sees" → [datsán nìɬʔèn] "he sees the crow".

Finally, the phonetic realization of pitch is affected by neighboring consonants, or by intrinsic properties of syllable nuclei. (Recall from 3.3.4 that syllable initial and final consonants as well as vowels can affect the phonetic realization of pitch in Chilcotin.) (1) Certain consonants are pitch-raisers. This class, termed 'fortis' by Story, includes voiceless fricatives and voiceless aspirated stops and affricates (and presumably ejective stops and affricates). The non-pitch raising consonants in Dakelh are /ʔ/, voiced fricatives, sonorants, and voiceless unaspirated stops and affricates. (There is no pitch raising in vowel initial syllables.) (2) All other things being equal, syllables containing the vowel [i] are higher in pitch than those containing other vowels, ranked as follows: [i] > [u] (> [e, o]?). (3) Syllable-final /ʔ/ raises the pitch of the syllable. Other syllable-final consonants do not apparently affect pitch, except, as noted above, syllable-final laryngeal features determine in part whether or not a stem blocks Tone Shift. These subphonemic determinants of pitch are important because, as noted by Story 1989b, they have sometimes misled previously analysts, including Cook 1976 and Story 1984, into positing lexical tone in places where pitch is predictable, not distinctive.

More recently, Bird 2002, in a preliminary study of the Lheidli (Prince George) dialect, measured pitch, amplitude, and duration of the first and second vowels of two syllable words. She found consistent differences in pitch and amplitude between two classes of words, interpreted as stress differences. However, she did not take morphological factors into account, nor control for segmental differences between the syllables. Gessner 2003 also analyzes prosody (syllable structure, stress, tone) in the Lheidli dialect of Dakelh. She concludes that the Lheidli dialect has both stress and tone. Stress most clearly

falls on stems. Evidence for underlying tone in Lheidli does not come from minimal or near-minimal pairs but rather from patterns of tonal alternations when words or clitics are combined. Gessner concludes that the Lheidli dialect differs from the Nak'azdli dialect described by Story in that whereas HL and HH are the main tonal patterns for Nak'azdli disyllabic nouns, HL and LH are used in Lheidli.

The complexity of Dakelh tone thus has several sources. Phonetic H pitch may be underlying or derived. The location of phonetic H pitch may not correspond to its underlying location. Whether or not a morpheme contains underlying H tone may only be deduced from its effect on adjacent morphemes. Finally, in addition to the relatively large number of tone rules, the domains of application of the various rules differ.

3.5 *Tsuut'ina tone*

Tonogenesis in Tsuut'ina, and indeed the synchronic analysis of tone in that language, is complex, and has not been well understood. Sapir 1925 and Cook 1971 posited three level tones, on the basis of minimal sets such as that given in (44):

(44) Tsuut'ina

mɬ́	"moth"
mɬ̄	"snare"
mɬ̀	"sleep"

However, Cook 1984:11 wrote that while he transcribed three tones, he "always questioned the status of the mid tone." Krauss 1979, this volume classifies Tsuut'ina as a low-marked language. Recent work by Starlight, Leer, and Donovan 1998 bears out Tsuut'ina as a low-marked language, and we briefly summarize their overall analysis below, without going deeply into the synchronic tonal phonology.

Starlight, Leer, and Donovan 1998 propose that Tsuut'ina has four tones, which they notate low (à), mid (ā), mid-high (ă) and high (á). The mid-high tone seems to occur only in prestem position, where it can be seen as synchronically derived. They report the following set of reflexes:

(45) Tsuut'ina tonal development

PA	Tsuut'ina
unconstricted reduced vowels, unconstricted full vowels in open verb stems without suffix or enclitic	v̄, V̄
other unconstricted full vowels	V́
constricted vowels	V̀, v̀

Examples of this development in Tsuut'ina are summarized in (46), with Navajo added for comparison:

(46) Comparison between Tsuut'ina and Navajo

PA	Tsuut'ina	Navajo
*tu: "water" (L87)	tú	tó
*tse: "rock" (KL81)	tsá	tsé
*dəne: "person" (KL81)	dīná	dìné
*səda: "sg. animate sits" (L87)	sīdō	sìdá
*səɬk^{y}u':z "clothlike is" (L87)	sīstsùùz	sìɬtsòòz

The fact that tonogenesis in Tsuut'ina is dependent on vowel length, as well as rhymal glottalization, is obviously highly reminiscent of the Apachean languages, where, as discussed above, all reduced vowels developed low tone, as did PA constriction on full vowels only, but with non-constricted full vowels developing non-low tone. Krauss (1979, this volume) has suggested that Tsuut'ina and the Apachean languages may have formed a subgrouping within Athabaskan. Starlight et al. posit the historical scenario in (47). If this scenario is correct, then the mid tone in Western Apache described by de Reuse (this volume, to appear) is not in fact a conservative feature, retained from Tsuut'ina-Apachean, but a further innovation within Western Apache whereby some unconstricted full vowels (with high tone) either remain long, undergoing a tonal change to mid, or shorten, retaining high tone.

(47) Possible historical scenario

a. *PA ancestor to tonal languages*[19]	constricted vowels develop low tone
b. *Tsuut'ina-Apachean*	non-constricted reduced vowels develop mid tone; non-constricted full vowels develop high tone
c. *Apachean*	mid and low tone merged as low

In summary, Tsuut'ina tone is of interest for its multiple tone levels, and perhaps unique historical position, possibly forming a subgrouping with the Apachean languages. A more complete description of the tonal phonology of this language will be of great interest.

3.6 *Phonetics of tone*

While we have so far classified tonal systems as high-marked, low-marked, or high and low-marked synchronically, we have not examined the realization of the tones. The Western Apache dialects discussed by de Reuse (this volume) are interesting in that they can be viewed as sharing an underlying system with the rest of the Apachean group: as mentioned above, on full vowel stems, only low tone is present underlyingly. However, assuming shared lexical representations with respect to tone, phonetic implementation of the unmarked tone differs across the Apachean languages. In Navajo, Chiricahua Apache, and the Tonto dialect of Western Apache, the toneless vowel is always realized as high, while in San Carlos Apache, it can be either high or mid depending on the quantity of the vowel. Tuttle and de Reuse 2000 investigated the distinctiveness of the three pitch levels in Western Apache, finding that while the mid tone indeed on average exhibits a pitch which is intermediate between high and low tone, it was not significantly different from the low tone in their study.

Phonetic studies have also examined pitch and tonal ranges in a number of Athabaskan languages. As part of an ongoing study of the phonetics of Navajo, McDonough (1999) examines the acoustics of tone in Navajo through instrumental analysis. She shows that tone specification is very stable, with tonal contours sensitive to morphological information. Gessner this volume examines phonetic aspects of high and low tone in Dene Sųłiné, such as the

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[19] See Kingston (this volume).

range of high and low pitch, and finds that there is considerable variation within a single speaker, especially in the phonetic realization of high tone. Vowel height, the presence or absence of a preceding syllable, and the tone of the following syllable all play a role in determining the pitch of high tone in the speaker investigated.

Hargus, in work in preparation on Fort Ware Sekani (Kwadacha), finds that the pitch differences between H and L are similar to the pitch differences between high and low stems that Holton 2000 reports for Tanacross, but in Sekani, some speakers have much a wider pitch range than others. Miller 2003, in a five-speaker study of Beaver tone, likewise found great differences in span, ranging from 24-120 Hz. Tuttle (1998:140-147), in her work on Minto, shows that the pitch range in this language, where tone contrasts are sparse and disappearing, is very narrow.

Alderete (this volume) reports that the Tahltan speakers that he worked with show within and between individual variation, but in general historically marked tone stems are implemented as lower in pitch than historically unmarked tone stems. He also found that the difference between these pairs can be realized as greater length on the historically marked tone stems than the historically unmarked ones.

Holton 2000 observed qualitative differences between the voice quality of high and low stem vowels in Tanacross, indicating that high tone vowels, reflexes of PA constricted nuclei, are produced with creaky voice. Kingston 1985 (cf. Kingston this volume) had predicted that if PA constriction were creaky voice or tense voice, either form of laryngealization would result in an increase in the amplitude of higher frequency components of vowels, 'tilting up' the spectrum. Holton 2000 observed creaky voice as an accompaniment of high tone in Tanacross, and subjected these observations to quantitative analysis of one speaker. He measured the difference between the amplitude of the fundamental frequency of the vowel and the amplitude of the first formant, and found significant differences between the two for high tone, but not low tone, vowels. Holton pointed out that the creakiness associated with high tone in Tanacross could be either a conservative feature, remnant of PA constriction, or an independent development following tonogenesis. However, as he also points out, creaky voice is more often associated with low, rather than high, tone.

Finally, we note that some languages that lack phonological tone do nevertheless exhibit predictable pitch. In Tututni, for example (Golla 1976:222), syllables closed with a simple laryngeal or a cluster containing a