Stop and affricate features in Athabaskan (in general) and Deg Xinag (in particular)

Sharon Hargus
University of Washington

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Vancouver BC

Yukon R., Grayling, Alaska
Proto-Athabaskan consonants

*t  *th  *t’
*tl  *tl’h  *tl’  *l  *l
*ts  *ts’h  *ts’  *z  *s
*ʧ  *ʧ’h  *ʧ’  *ʒ  *ʃ
*ʦ  *ʦ’h  *ʦ’
*ç  *ç’h  *ç’  *ç
*q  *q’h  *q’  *ʁ  *χ
*m  *n  *ŋ’
*w  *j

after Leer 2005: 284

More inventories

- **Upper Tanana** (Minoura 1994)

### Obstruents

**Stops/Affricates**
- Plains: (ʦ)
- Aspirated: t
- Glottalized: t'

**Fricatives**
- Fortes: t ʈ θ s ʂ x h
- Lenes: t ʈ θ s š y (ʃ) x

**Sonorants**
- Voiced: m n l ă y
- Voiceless: ĥw [h]

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Minoura, Nobukatsu. 1994. 'A Comparative Phonology of the Upper Tanana Athabaskan dialects.' In *Languages of the North Pacific Rim*, ed. by Osahito Miyaoka. Sapporo, Japan: Department of Linguistics, Hokkaido University. 159-196.
Dëne Sųliné (Cook 2004)

<table>
<thead>
<tr>
<th>Stops and Affricates</th>
<th>Plain</th>
<th>b</th>
<th>d</th>
<th>dl</th>
<th>ḃdh/dɔ</th>
<th>dz</th>
<th>j/dž</th>
<th>g</th>
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<tbody>
<tr>
<td>Affricates</td>
<td>Aspirated</td>
<td>t</td>
<td>tf</td>
<td>tth/tθ</td>
<td>ts</td>
<td>ch/č</td>
<td>k</td>
<td></td>
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<tr>
<td>Glottalized</td>
<td>t’</td>
<td>tf’</td>
<td>tth’/tθ’</td>
<td>ts’</td>
<td>ch’/č’</td>
<td>k’</td>
<td>?</td>
<td></td>
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<tr>
<td>Fricatives/Continuants</td>
<td>Voiceless</td>
<td>l</td>
<td>th/θ</td>
<td>s</td>
<td>sh/š</td>
<td>x</td>
<td>h</td>
<td></td>
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<tr>
<td>Continuants</td>
<td>Voiced</td>
<td>w</td>
<td>(r)</td>
<td>l</td>
<td>dh/ð</td>
<td>z</td>
<td>y</td>
<td>gh/ɣ</td>
</tr>
<tr>
<td>Sonorants</td>
<td>Nasal</td>
<td>m</td>
<td>n</td>
<td></td>
<td></td>
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</table>

Navajo (Young and Morgan 1980, McDonough 1990)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Stops</td>
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<tr>
<td>unasp</td>
<td>b</td>
<td>d</td>
<td>g, g'</td>
<td></td>
</tr>
<tr>
<td>aspirat</td>
<td></td>
<td>t'</td>
<td>k, k'</td>
<td></td>
</tr>
<tr>
<td>glottal</td>
<td></td>
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<td></td>
<td>/'/'</td>
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<tr>
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<td>+voi</td>
<td></td>
<td></td>
<td>gh, gh'</td>
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<tr>
<td>-voi</td>
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<td>z, zh</td>
<td>h, h'</td>
<td>h</td>
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<td>+voi</td>
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<td>-voi</td>
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<td>(\rangle)</td>
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<td></td>
</tr>
<tr>
<td>Affricates</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unasp</td>
<td></td>
<td></td>
<td>dz, j, dl</td>
<td></td>
</tr>
<tr>
<td>aspir</td>
<td></td>
<td></td>
<td>ts', ch', t(\rangle)</td>
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</tr>
<tr>
<td>glottal</td>
<td></td>
<td></td>
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<td>t</td>
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<td>Nasals</td>
<td>m</td>
<td>n</td>
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<tr>
<td>Semi-vowels</td>
<td>w</td>
<td>y</td>
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</tbody>
</table>


# Features for classes of Athabaskan consonants

Rice 1994

<table>
<thead>
<tr>
<th></th>
<th>[spread glottis]</th>
<th>[constricted glottis]</th>
<th>[voiced]</th>
</tr>
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<tbody>
<tr>
<td>t, ts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tʰ, tsʰ</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>t’, ts’</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>z</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Voiceless unaspirated stops pattern with voiceless fricatives

- D-Effect Rule (Slave et al. version)

\[
\begin{align*}
D + \emptyset & \rightarrow t' \\
D + \text{fricative} & \rightarrow \text{plain stop (of same place of articulation)} \\
\quad & \text{e.g. } D + S \rightarrow dz \\
\quad & D + š \rightarrow j \\
\quad & D + x \rightarrow g \\
\quad & D + l \rightarrow dl \\
d + C & \rightarrow C
\end{align*}
\]

The resultant stop is voiceless unaspirated, as expected, since both underlying fricatives and plain stops have no laryngeal features.
- **Stem-finals**
  - contrasts

<table>
<thead>
<tr>
<th>syllable-initial</th>
<th>syllable-final</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>plain</td>
</tr>
<tr>
<td>fricatives</td>
<td>aspirated</td>
</tr>
<tr>
<td>voiced</td>
<td>voiceless</td>
</tr>
<tr>
<td></td>
<td>voiced</td>
</tr>
<tr>
<td></td>
<td>voiceless</td>
</tr>
</tbody>
</table>

- **alternations (Koyukon)**

<table>
<thead>
<tr>
<th>stem form</th>
<th>imperfective</th>
<th>perfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>/-ʔcdl/</td>
<td>-ʔcf</td>
<td>-ʔcdl</td>
</tr>
<tr>
<td>/-bædz/</td>
<td>-bæs</td>
<td>-bædz</td>
</tr>
<tr>
<td>/-log/</td>
<td>-lɔx</td>
<td>-log</td>
</tr>
<tr>
<td>/-lud/</td>
<td>-lud</td>
<td>-lud</td>
</tr>
</tbody>
</table>

‘chew’
‘cook by boiling’
‘die’ PL SUBJECT
‘scrape’

word-final stops/affricates spirantize (Leer 1979)

suffixed with reflex of *-ŋ perfective, protects from spirantization

Hare: “Aspirated affricates generally spirantise to voiceless fricatives... Some speakers use affricates in some words.” (Rice 1994: 129, 144)

<table>
<thead>
<tr>
<th>Hare</th>
<th>Bearlake</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ts → s</td>
<td>[s]á</td>
<td>[ts]á</td>
</tr>
<tr>
<td></td>
<td>-[s]í</td>
<td>-[ts]í</td>
</tr>
<tr>
<td>tɬ → t</td>
<td>[ɬ]ɛ</td>
<td>[tɬ]ɛ</td>
</tr>
<tr>
<td></td>
<td>-[tɬ]a</td>
<td>-[tɬ]a</td>
</tr>
<tr>
<td>č → š</td>
<td>[ʃ]o</td>
<td>[č]o</td>
</tr>
<tr>
<td></td>
<td>-[ʃ]u</td>
<td>-[č]u</td>
</tr>
</tbody>
</table>

Aspirated stops are unaffected, as in (48):

<table>
<thead>
<tr>
<th>(48)</th>
<th>[k]ō</th>
<th>[k]ō</th>
<th>‘fire’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[t]u</td>
<td>[t]u</td>
<td>‘water’</td>
</tr>
</tbody>
</table>
Summary

- Distributional evidence for some classes of Ath consonants
  - stops + affricates (Koy verb stem-final alternations)
  - voiceless unaspirated stops/affricates + voiceless fricatives (DER, Koy verb stem-final alternations)
  - affricates + fricatives (Hare)
McDonough and Wood 2008:446

The revised Athabaskan inventory

<table>
<thead>
<tr>
<th></th>
<th>Bi-labial</th>
<th>Alveolar</th>
<th>Alveo-palatal</th>
<th>Velar</th>
<th>Labiovelar</th>
<th>Glottal</th>
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</thead>
<tbody>
<tr>
<td>Simplex stops</td>
<td>p</td>
<td>t</td>
<td></td>
<td>k</td>
<td></td>
<td>ñ</td>
</tr>
<tr>
<td>Affricates</td>
<td></td>
<td>tx</td>
<td></td>
<td>kx</td>
<td>kw</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ts tsʰ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>tʃ tʃʰ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ejectives</td>
<td></td>
<td>tʼ</td>
<td></td>
<td>kʼ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>tsʼ</td>
<td></td>
<td>tʃʼ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>s z</td>
<td>f ʒ</td>
<td></td>
<td>y x</td>
<td></td>
<td>(h)</td>
</tr>
</tbody>
</table>

"a sample Athabaskan inventory as we see it...this is likely a more accurate representation of the phonemic contrasts in the Athabaskan languages. In this inventory, there are no aspirated plain stops."

“simplex” vs. “complex stops”

- “the unaspirated plosives (/p t k q/) are simplex segments, whereas the aspirated and ejective stops (/tʰ t’/ and /kʰ k’/) pattern together and form the class of complex segments with affricates.”
  (McDonough and Wood 2008: 428)

Why?

- “aspirated stops are phonemic affricates in Athabaskan, and…these affricates share with ejectives and plain aspirated stops the feature of having long release periods”: 
“Fig. 5. A bar graph indicating the median duration in milliseconds of the release portions of the plain stop series in the language in the study.” (p. 436); i.e. /th t' t/ etc.
Speaker- rather than linguist-designed word lists

- “We did not control for position in word or morpheme category (stem versus prefix)…Using wordlists constructed by the consultants resulted in uneven distributions of the segments in the languages across the study”.

- “We are choosing to report median values here, rather than average, because of the nature of the data in the study.” (434)

Small number of speakers per language

- 3 Dëne Sųliné speakers from 2 dialects
- 1 Dogrib speaker
- 3 North Slavey speakers
- 2 Chilcotin speakers
Aspirated stops as affricates

“The t and k phonemes are phonemic as well as phonetic heterorganic affricates /tx/ and /kx/. However, it may not be the case that t and k phonemes are affricates in every Athabaskan language.”

Known counter-examples: Hupa, W. Apache

Due to contact? “The production of an Athabaskan phoneme t as an aspirated stop...may well represent a shift away from an Athabaskan type system towards an English type system. Such a change may be due to a reduced speech community and/or contact with English speaking populations and educational practices.”
“classic” Athabaskan ejectives

- “Complex ejectives are of the classic Athabaskan type, containing a characteristic period of silence after the oral and before the glottal release.”  (p. 445)
- “strong [long VOT] or complex ejectives...These are the classic Athabaskan ejectives.’ (p. 443)

Known counter-examples: “weak” (short VOT) ejectives in Witsuwit’en (Wright, Hargus and Davis 2002) and Carrier (Bird 2002)

Questions about McDonough–Wood model

1. Are affricate-like voiceless aspirated stops distributed across different branches of the family?
2. Do aspirated affricates pattern with aspirated stops and/or unaspirated affricates (all “complex segments”) ? How is aspiration realized in affricates?
3. Are long VOT ejectives found in all branches of Ath?
Classifications of Athabaskan Languages

Goddard 1996


Test aspects of McDonough-Wood model against new phonetic data, Deg Xinag stops and affricates

Integration of Deg Xinag findings with those from other Ath languages
Deg Xinag (ing)

a.k.a. Ingalik, Deg Hit’an

Central AK-Yukon branch (Goddard-Rice classification), Alaska branch (Leer classification)

# Consonant inventory

## Syllable-initial consonants:

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>pʰ</th>
<th>t</th>
<th>tʰ</th>
<th>t’</th>
<th>k</th>
<th>kʰ</th>
<th>k’</th>
<th>q</th>
<th>qʰ</th>
<th>q’</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>tθ</td>
<td>tθʰ</td>
<td>tθ’</td>
<td>ts</td>
<td>tsʰ</td>
<td>ts’</td>
<td>ʃ</td>
<td>ʃʰ</td>
<td>ʃ’</td>
<td>ʔ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tɬ</td>
<td>tɬʰ</td>
<td>tɬ’</td>
<td>v</td>
<td>θ ̄</td>
<td>ŋ</td>
<td>n</td>
<td>j</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>n</td>
<td>j</td>
<td></td>
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## Syllable-final consonants:

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<th></th>
<th>p</th>
<th>d</th>
<th>t</th>
<th>g</th>
<th>k</th>
<th>G</th>
<th>q</th>
<th>?</th>
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<tr>
<td>dʃ tθ</td>
<td>dz ts</td>
<td>dz ts’</td>
<td>ʃ</td>
<td>ʃʰ</td>
<td>χ</td>
<td>k</td>
<td></td>
<td></td>
</tr>
<tr>
<td>θ ̄</td>
<td>s z</td>
<td>s z’</td>
<td>f</td>
<td>f’</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dl tɬ</td>
<td>dl tɬ’</td>
<td>v</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ɬ</td>
<td>ɬ’</td>
<td>m m’</td>
<td>n</td>
<td>n’</td>
<td>j j’</td>
<td>j’</td>
<td>η</td>
</tr>
</tbody>
</table>

**Syllable-initial consonants:**
- p (pʰ)
- t (tʰ, t’)
- k (kʰ, k’)
- q (qʰ, q’)
- ?

**Syllable-final consonants:**
- p
- d
- t
- g
- k
- G
- q
- ?
Are not affricates

- e.g. [tʰən] “ice”

“production...as an aspirated stop...may well represent a shift away from an Athabaskan type system towards an English type system...may be due to a reduced speech community and/or contact with English speaking populations and educational practices.”

First contact of Deg Xinag was with Russian, ca. 1835 (smallpox did reduce community) (VanStone 1979)

the aspiration “contrast appears in the offset of the medial phase, at the release of the fricated part of the articulation as a transition into the vowel. It is an audible quality of these sounds.” (McDonough and Wood 2008: 446)

- Aspiration contrast in DX affricates
  - [t̪ʃ]  [t̪ʃʰ], more narrowly [t̪ːʃ]

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![Waveform and spectrogram for [t̪ʃ] and [t̪ʃʰ]](image-url)
A phonetic study of the laryngeal contrast among Deg Xinag stops/affricates

- What are effects of Manner, Laryngeal contrast on (each measure)?
  - 2 manners (stops vs. affricates)
- What are effects of Place, Laryngeal contrast on (each measure)
  - for stops?
  - for affricates?

<table>
<thead>
<tr>
<th></th>
<th>interdent</th>
<th>alv</th>
<th>alv sib</th>
<th>alv lat</th>
<th>retro sib</th>
<th>pal-alv</th>
<th>velar</th>
<th>uvular</th>
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<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>affr</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Word list recorded with 8 speakers (results for 7 here)
  - postvocalic
  - stem-initial (stressed)

- Measures
  - Consonantal
    - closure duration (Hogan 1976)
    - VOT (Hogan 1976)
  - Vocalic (following V)
    - f0 perturbation (Warner 1996)
    - jitter perturbation (Wright, Hargus and Davis 2002)
    - rise time (energy at $V_{30} - V_{ons}$, $V_{mid} - V_{30}$)

Results

- inferential statistics
  - repeated measures ANOVA, each speaker’s mean as dependent variable
- post hoc test: Bonferroni/Dunn
- f0 results handled differently:
previous voice quality study (Hargus 2011)
- effect of final [n’] on pitch perturbation of preceding V

f0 results, this study
- factorial ANOVA for each speaker

Hargus, Sharon. 2011, under review. 'Deg Xinag Final Laryngealized Consonants and Voice Quality.' In Laryngeal Features of Native American Languages: Brill.
Effects of Manner, Laryngeal on...

- **Closure duration**
  - Lar: va < vu

- **VOT**
  - Manner: affr > stop
  - Lar: vu < ej < va
- jitter perturbation

- Lar: ej > va, ej > vu
Typical energy profiles

more convex
more concave
- **Energy**
  - **30 ms. – onset**
  - **midpoint – 30 ms.**
    - Lar: ej > va, ej > vu
- f0 perturbation

  (ED) Lar: ej < vu < va

- pitch raiser (RD)
  - Lar: ej > vu, va
  - Manner: affr > stops

- equivocal (JD)
  - Manner: affr > stops
  - Lar x Manner, p = .0262
Effects of Place, Laryngeal contrast for each manner

- **Closure duration**
  - stops
    - Place: alv < vel
    - Laryngeal: ej < va, ej < vu
  - affricates
    - Place: pal < inter-dent, pal < lat
VOT

- stops
  - Place: alv < vel, alv < uvu
  - Lar: vu < ej < va
  - Place x Lar, p < .0001

- affricates
  - Place: alv sib > inter-dent, alv sib > lat, alv sib > retro, pal > lat
  - Lar: vu < ej < va
- Jitter perturbation
  - stops
    - Lar: ej > va, ej > vu
  - affricates
    - Lar: ej > va, ej > vu
- Energy, 30 ms. – onset
  - stops
    - Place: alv < vel, alv < uvu
    - Place x Lar: p = .0146
  - affricates
    - Place: lat < inter-dent
- Energy, midpoint - 30 ms.
  - stops
    - Lar: ej > vu, ej > va
    - Place x Lar: p = .0005
  - affricates
    - Lar: : ej > vu, ej > va
    - Place: inter-dent > pal, lat > pal
- **f0 perturbation**
  - *pitch lowerers (AJ, ED, HM).*
    - stops
      - Lar: \( \text{ej} < \text{vu} < \text{va} \)
      - Place: \( \text{alv} < \text{uvu}, \text{vel} \)
  - affricates
    - Lar: \( \text{ej} < \text{vu} < \text{va} \)
- **pitch raiser (RD)**
  - stops
    - Lar: ej > va

- affricates
  - Lar: ej > va, vu
- pitch equivocators (JD, LH, PA)
  - stops
    - Lar: ej < vu
    - Place: uvu < alv, vel
  - affricates
Comparison with Witsuwit’en

- **Witsuwit’en laryngeal contrasts**
  - 1 manner (stops)
  - 2 places (alveolar, uvular)
  - 3 positions (initial, post-vocalic, post-s)

- **Deg Xinag laryngeal contrasts**
  - 2 manners (stops, affricates)
  - 3 stop places, 5 affricate places (releases)
  - 1 position (post-vocalic)

Witsuwit’en vs. Deg Xinag

- **Similarities**
  - Ejectives have intermediate VOT, most jitter perturbation, slowest rise time
  - 3 types of f0 perturbation after ejectives: lowering, raising, “flat”/“equivocal”
  - Place effects:
    - dorsals have longer VOT and closure duration (Wit: uvular; DX: velar) as expected (Cho and Ladefoged 1999)
    - faster rise time (why?)

- **Differences — nothing major or obvious!**

1. Are Athabaskan languages with affricate-like realizations of voiceless aspirated stops distributed across different branches of the family?

- A few so far. But not all:
  - not Deg Xinag (Alaska branch (Leer’s clf))
  - not Witsuwit’en (B.C. branch)
2. Do aspirated affricates pattern with aspirated stops and/or unaspirated affricates?
   - VOT?

   ▪ aspirated affricates > aspirated stops > voiceless unaspirated affricates > unaspirated stops
3. Are long VOT ejectives found in all branches of Ath?

- Found in
  - Southerly Outlying branch
    - Hupa (Gordon 1995)
    - Navajo (McDonough and Ladefoged 1993)
  - Eastern branch
    - Dëne Sųliné (Hogan 1976)
    - (apparently) N. Slavey, Dogrib (McDonough and Wood 2008)

- Not found in
  - Alaska branch: Deg Xinag
  - British Columbia branch: Witsuwit’en and Carrier
  - Southerly Outlying branch: W. Apache (Gordon et al. 2001)

Conclusions

- ‘the revised Athabaskan inventory’ of McDonough and Wood 2008 is not supported by detailed phonetic evidence from Deg Xinag
- f0 perturbation effects from glottalic consonants in 2 non-tonal Athabaskan languages a microcosm of familial tonogenesis
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Some of the Deg Xinag speakers

Phillip Arrow
Raymond Dutchman
Lucy Hamilton
Edna Deacon
James Dementi