

A Phonological Study of Selected Central Mountain Languages: Part I  
From Primordial Proto-Central-Mountain to Classical Noyahtowa

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The following abbreviations and diacritics will be used throughout:

PCM Proto-Central-Mountain

HIh HIholamelo

Q Qapakwonaq

N Noyahtowa

C any consonant

V any vowel

˘ mid-length vowel

: long vowel

Short vowels are unmarked

ˉ mid-pitched vowel

ˊ high-pitched vowel

Low-pitched vowels are unmarked

S short vowel syllable

M mid-length vowel syllable

L long vowel syllable

HP high-pitched vowel syllable

MP mid-pitched vowel syllable

LP low-pitched vowel syllable

F\_V front vowel

C\_V central vowel

B\_V back vowel

R rounded

U unrounded

( ) optional

{ } phoneme set

C<sup>ʔ</sup> glottalized

C<sup>h</sup> aspirated

<sup>h</sup>C preaspirated

<sup>n</sup>C prenasalized

C<sup>y</sup> palatalized

C<sup>w</sup> labialized

+ voiced

- voiceless

The following standard orthography will be used throughout, and the language or stage in which each phoneme first appeared is shown by color on the charts below:

Primordial PCM (original phoneme)

Late PCM

Hlh

Q

Hlh & Q (both independently)

N

## Consonants:

	<b>Bilabial</b>	<b>Interdental</b>	<b>Dental</b>	<b>Palatal</b>	<b>Velar</b>	<b>Glottal</b>
<b>Stop</b>	- p p <sup>ʔ</sup> p <sup>h</sup> p <sup>w</sup> p <sup>y</sup> p <sup>yw</sup>		- <sup>(h)</sup> t t <sup>ʔ</sup> t <sup>h</sup> t <sup>y</sup> t <sup>hy</sup> t <sup>w</sup> t <sup>yw</sup>		- <sup>(h)</sup> k k <sup>ʔ</sup> k <sup>h</sup> k <sup>w</sup> k <sup>y</sup> k <sup>yw</sup> g <sup>y</sup> (+)	
<b>Nasal</b>	+ m m <sup>ʔ</sup> m <sup>w</sup> m <sup>y</sup> m <sup>yw</sup>		+ n n <sup>ʔ</sup> n <sup>y</sup> n <sup>w</sup> n <sup>yw</sup>	+ ñ		
<b>Long Nasal</b>	+ <u>m</u>		+ <u>n</u> <u>n<sup>y</sup></u>			
<b>Syllabic Nasal</b>	+ m̩ m̩ <sup>y</sup> m̩ <sup>w</sup> m̩ <sup>yw</sup>		+ n̩ n̩ <sup>y</sup> n̩ <sup>w</sup> n̩ <sup>yw</sup>			
<b>Fricative</b>	- f f <sup>y</sup> v(+)	- <sup>(h)</sup> θ	- <sup>(h)</sup> s s <sup>ʔ</sup> s <sup>y</sup>	- <sup>(h)</sup> š š <sup>ʔ</sup>	- x	- h h <sup>y</sup>
<b>Semivowel</b>	+ w			+ y		
<b>Syllabic Semivowel</b>	+ w̩			+ y̩		
<b>Affricate</b>			- c	- <sup>(h)</sup> č	- ħ	
<b>Lateral Approximant</b>			+ l n <sub>l</sub>	+ λ n <sub>λ</sub>	+ L n <sub>L</sub>	
<b>Lateral Fricative</b>			- <sup>(h)</sup> ɬ			
<b>Lateral Affricate</b>			- <sup>(h)</sup> ɬ̩			

## Vowels:

	Front	Central	Back
High	U i R ü	R ʌ	R u  R ʊ
Mid	U e	U ə	R o
Low	U æ	U ɐ	U a

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### General principles for applying the changes:

All sound changes should be applied in the order given; this is not meant to suggest that the changes necessarily occurred as discrete chronological steps (e.g., some changes were simultaneous, and some were active over a longer period than others), but rather the sound change rules are formulated and ordered to produce the proper forms. Each change or group of related changes is assigned a unique number. Changes are applied to individual morphemes, unless otherwise stated. Changes designated as "word-final" should be applied to all morphemes capable of closing a word (e.g., pronominal finals), but only when they actually do close a word; and changes designated as "word-initial" should be applied to all morphemes capable of opening a word (e.g., initials), but only when they actually do open a word. Word-final and word-initial changes invariably result in allomorphy among the morphemes subject to them; the allomorph that reflects a word-final or word-initial change appears only when the morpheme actually opens or closes a word; when it does not, the unchanged or alternate allomorph is used. All other changes resulting in allomorphy are covered by sandhi rules. Analogical leveling erases allomorphy in some cases; and some morphemes, especially pronominal finals,

undergo reforming during the phonological history, so that their forms are not always predictable. Furthermore, vowel length or pitch can change irregularly in some cases in order to disambiguate homophones.

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### Primordial PCM

The approximate time depth for Primordial PCM is 6500-7000 Solar years before Classical N. The span of time between linguogenesis and Primordial PCM cannot be determined exactly, but is thought to be less than a millennium.

The very earliest phonology for PCM that can be reconstructed is surprisingly simple: the unaspirated stops p,t,k; the nasals m,n; the fricatives s,š,h; and the vowels a,e,i,o,u, in short, mid and long quantities. The nasal consonants were voiced; the rest were voiceless, probably lenis. Short vowels were the most common; long vowels were fewer in number, and mid-length were the least frequent. The five-vowel system is typical of human language generally, save its distinguishing three lengths instead of the more usual two; however, as can be seen, even from the first the language family possessed an oddity that would be an enduring feature: the vowels do not make the most efficient use of vowel-space (e.g., one might expect a to be a central vowel, given the other members of the system; but it is instead a back vowel.) What lies behind this oddity cannot be said with certainty, but it has been suggested that the heightened senses (specifically, hearing) of men in ancient times might have played a role; it would have been far easier for them to live with an asymmetrical vowel system wherein the vowels were not maximally distinct (and it is interesting to note that the daughters of N, which date to the Second Earth, all have far more symmetrical vowel systems than any earlier language). This "primordial phonology" contained none of the stranger sounds that would later come to mark languages of the family; not even the palatalized or aspirated consonants were yet present.

The root was the foundation upon which all words were built, and together they formed the semantic core of the language; these roots were, semantically, oriented toward action, motion, process, relationship and quality. From them were built words to describe every act or thing that speakers wished to describe. The basic prime

root structure was CV(CV), but because of ancient vowel loss preceding this stage, prime roots of the forms CCV and CVC were present; ancient consonant loss also gave rise to some CVV and VCV forms. In roots with two vowels, there was often both a back and front vowel, a fact which aided early derivational ablaut. Morpheme-internal consonant clusters in roots (e.g., CVCCV, a common pattern seen in derived roots) were always due to insertion of derivational infixes. No root (prime or derived) was longer than two syllables. There was never more than one long or mid-length vowel in any given root; and in roots with a single vowel, the vowel was almost always short.

The word could begin or end with any single consonant or vowel. Clusters of any two qualitatively different vowels in hiatus were legal in all word positions save initially. Clusters of two consonants occurred word-medially; when a morpheme that began with a cluster opened a word, the cluster was simplified to a single consonant. The medial clusters were:

hh, hp, ht, hk, hm, hn, hs, hš, ph, pp, pt, pk, pm, pn, ps, pš, th, tp, tt, tk, tm, tn, ts, tš, kh, kp, kt, kk, km, kn, ks, kš, mh, mp, mt, mk, mm, mn, ms, mš, nh, np, nt, nk, nm, nn, ns, nš, sh, sp, st, sk, sm, sn, ss, sš, šh, šp, št, šk, šm, šn, šs, šš

In addition, four related clusters of three consonants occurred medially in a small number of words; they were:

hnm, hmn, nmh, mnh

Despite these, the language was generally averse to clusters of more than two consonants. Most or all of the clusters appear to be of fairly recent origin, given that they show few signs of change or simplification; they in large part likely came about due to the aforementioned ancient vowel loss, and to derivational infixing.

Primary stress was regular and tied closely to vowel length; but the patterns of it shifted during PCM's history. The old practice, retained until very late, was to place the primary stress invariably on the final syllable of a word. In the later and more complicated system, primary stress fell on the penult if that syllable had a long vowel; if the penult vowel was not long, then the first long vowel preceding the penult received the primary stress. If no long vowels were present in a word penultimately or pre-penultimately, the penult was stressed if it had a mid-length vowel; if it did not, then the first mid-length vowel preceding the penult received the primary stress. Words composed

entirely of short-vowel syllables penultimately and pre-penultimately were stressed on the penult, with the vowel of the penult being lengthened to long. Monosyllabic words received primary stress on their single syllable, with that syllable being made long. Short vowels or particles were not given primary stress at any time.

The language also used two lesser and weaker levels of stress, the secondary and the tertiary. These latter stresses appeared only on the first syllables of multisyllabic (i.e., containing two or more syllables) satellite words; in cases where the primary stress fell on the first syllable of a multisyllabic satellite word, the secondary and tertiary stresses were not applied. The secondary and tertiary stresses operated in a way akin to the proximate-obviative distinction, which in Primordial PCM had yet to come into existence: the secondary stress typically marked the most important or "in focus" third person satellite word in an expression, while the tertiary stress marked the lesser or "out of focus" third person. These stresses were still applied after the proximate-obviative distinction was innovated, and their application remained the same even when the placement of the primary stress shifted in Late PCM. The secondary and tertiary stresses were not tied to vowel length as was the primary stress, likely because of their weaker nature.

The language was very strict on sequences of vowel length; it would allow any number of short vowel syllables contiguously, but two or more long or mid-length syllables in succession were illegal. Extensive sandhi rules, applied to underlying vowel-length during word-formation, ensured that illegal vowel length sequences did not occur. This "disharmony" of vowel length would endure even into the pitch system of N.

The PCM aspirated stops  $p^h, t^h, k^h$  arose in the following ways:

(1) Consonant clusters with  $p, t, k$  as the first member and  $h$  as the second resulted in the disappearance of the  $h$  and the  $p, t, k$  becoming aspirated. PCM also developed a series of glottalized stops,  $p^ʔ, t^ʔ, k^ʔ$ , from geminate consonant clusters involving  $p, t, k$ ; the glottalization on these stops opened up toward  $h$ , and so they merged with the aspirated stops from  $ph, th, kh$  clusters. (The language likewise developed glottalized varieties of  $m, n, s, š$ -- $m^ʔ, n^ʔ, s^ʔ, š^ʔ$ --from geminate clusters involving  $m, n, s, š$  at the same time as  $p^ʔ, t^ʔ, k^ʔ$  arose; in time, these changed to the normal consonant clusters  $mh, nh, sh, šh$ . Glottalized consonants from geminate clusters apparently came about by erosion and/or dissimilation of one member of the clusters to a

glottal stop or partial glottal closure; and the remaining consonant in a cluster and the glottal sound became co-articulated. This is the only known instance of the glottal stop appearing in PCM; and, following its disappearance, it would not resurface again phonemically until after Classical N. Geminate h simply reduced to a single h.)

The PCM palatalized consonants  $t^y, s^y, n^y, t^{hy}$  arose thus:

(2)The coronal dentals  $t, s, n$  became heavily palatalized allophonically before and after front vowels  $i, e$ ; certain other sounds may have been palatalized to a lesser degree in the same environments, but this cannot be determined; then in succession came two developments that granted the palatalized coronals phonemic status.

(3)First, in vowel clusters beginning with short front vowels, the initial vowel had been allophonically weakened to an ultra-short length and had been partially devoiced; and so in the clusters  $iu, io, ia, ie, ei, eu, eo, ea$ , where this ultra-short vowel was present initially, the opening vowel vanished. This did not occur, however, if it resulted in the creation of a sequence of two or more contiguous long or mid-length syllables. The remaining vowel of a former cluster then became mid-length if it was short (but only if its doing so did not create a sequence of two or more contiguous mid-length syllables; when it did, the vowel became long instead, unless thereby a sequence of two or more contiguous long syllables was created; in these cases, the length of the vowel remained unchanged). If the remaining vowel of the former cluster was mid-length, it became long, but only if its doing so did not create a sequence of two or more contiguous long syllables; when it did, the length of the vowel was unchanged. (The ultra-short  $i, e$  that remained were, in the chain-shift detailed in [4] below, replaced by strengthened vowels--by fully-voiced short  $e$  and short  $u$ , respectively.)

Second, there came a massive vowel shift; vowels not in clusters underwent a chain-shift, while vowel clusters underwent both the chain-shift and then a kind of assimilation. The chain-shift was thus:

(4)  
 $u > i$   
 $u^{\cdot} > i^{\cdot}$   
 $u : > i :$   
 $i > e$   
 $i^{\cdot} > e^{\cdot}$   
 $i : > e :$

e>u  
e´>u´  
e:>u:  
a>e  
a´>a´  
a:> (see below)  
o>e  
o´>o´  
o:> (see below)

Long a and long o remained long in most environments, but shortened to mid-length in morpheme-initial syllables or before or after another vowel, when not preceded or followed by a mid-length vowel or syllable.

All vowel clusters in the language were assimilated by the "favored" clusters ae,ea,eo,ui,iu, with vowel length being maintained across the change:

(5)

All vowel clusters ending in e > ae  
All vowel clusters ending in a > ea  
All vowel clusters ending in o > eo  
All vowel clusters ending in i > ui  
All vowel clusters ending in u > iu

Before the preceding vowel changes, the vowels in all word-final syllables had been long, likely because these closing syllables were consistently primarily stressed; vowels in word-final syllables did undergo shortening when the preceding changes called for it, but those vowels made mid-length or short reclaimed their long status very soon thereafter.

(2cont.)t,s,n continued to be palatalized in the same positions as they had been before the short vowel loss and vowel shift occurred. The aspirated stop t<sup>h</sup> palatalized like its non-aspirated counterpart, resulting in the new phoneme t<sup>hy</sup>. Furthermore, following the above vowel changes, t,s,n,t<sup>h</sup> became palatalized when they appeared before or after front vowels i,e; i.e., following the vowel changes, the front vowels continued to palatalize the coronals.

(6)In clusters of two consonants, t<sup>y</sup> was realized as č before another consonant and s<sup>y</sup> was realized as š before another consonant.



(7) There came a number of assimilative changes among short vowels:

i > o between {k, k<sup>h</sup>} and {k, k<sup>h</sup>}

e > o between {k, k<sup>h</sup>} and {k, k<sup>h</sup>}

i > u between h and h

e > u between h and h

i > a between {k, k<sup>h</sup>} and h or between h and {k, k<sup>h</sup>}

e > a between {k, k<sup>h</sup>} and h or between h and {k, k<sup>h</sup>}

(8) Further assimilative changes took place in consonant clusters involving certain nasals and stops:

pn > tn

tm > pm

mt > nt

np > mp

pn<sup>y</sup> > tn<sup>y</sup>

mt<sup>y</sup> > nt<sup>y</sup>

n<sup>y</sup>p > mp

(9) These metathetical changes occurred following the above assimilation:

tn > nt

kn > nk

pm > mp

km > mk

čn > nč

čm > mč

tn<sup>y</sup> > n<sup>y</sup>t

kn<sup>y</sup> > n<sup>y</sup>k

čn<sup>y</sup> > n<sup>y</sup>č

sn > ns

šn > nš

hn > nh

sm > ms

šm > mš

hm > mh

sn<sup>y</sup> > n<sup>y</sup>s

šn<sup>y</sup> > n<sup>y</sup>š

hn<sup>y</sup> > n<sup>y</sup>h

hnm > nhm

hmn > mhn

hmn<sup>y</sup> > mhn<sup>y</sup>

(10) The high vowels u, i became nonsyllabic (first before other vowels, then elsewhere); u > w and i > y except in the environments listed in (12)-(14); however, following non-palatalized t, s, n, t<sup>h</sup>, i > y always occurred (even in the exception environments listed in [12]-[14]) and then (11) applied.

(11)  
ty > t<sup>y</sup>  
sy > s<sup>y</sup>  
ny > n<sup>y</sup>  
t<sup>h</sup>y > t<sup>hy</sup>

(12) u > o and i > e word-finally (with vowel length being maintained across the change)

(13) In sequences of palatalized consonant+i, i+palatalized consonant and i+palatalized consonant+i, i > e occurred (with vowel length being maintained across the change).

(14) When clusters of four or more consonants would have potentially formed due to u > w or i > y, u > o or i > e occurred instead, with vowel length being maintained across the change. Resolution of potential four-consonant clusters by u > o or i > e generally occurred at the first available spot in a morpheme, starting at the left and continuing to the right until the potential for four-consonant clusters ceased to exist (but if both a three and four-consonant cluster could be avoided/resolved by u > o or i > e, the change occurred later, at the first available opportunity to do so); if, after this, a three-consonant cluster remained, it was then resolved by vowel insertion as described hereafter. When clusters of three consonants formed due to u > w or i > y, a short vowel was inserted either before or after the first occurring semivowel: a short o was inserted either before or after w (after was preferred, but it was inserted before if--and only if--the cluster could not be resolved by placing it after); and a short e was inserted either before or after y (after was preferred, but was inserted before if--and only if--the cluster could not be resolved by placing it after).

(15) Compensatory vowel lengthening occurred with u > w and i > y; where u > w and i > y occurred, the vowel of the following syllable (or the vowel of the preceding syllable if the change occurred in the final syllable of a morpheme) lengthened: short vowels became mid-length and mid-length vowels became long; but this did not occur when a sequence of two or more long or mid-length syllables in succession

resulted. A short vowel could become long instead of mid-length in cases where its becoming mid-length resulted in an illegal vowel-length sequence. Further, when short o or short e was inserted to break up a cluster of three consonants, as described in (14), no compensatory vowel lengthening occurred.

(16) In clusters of aspirated stop+{w,y}, the stop lost its aspiration; {p<sup>h</sup>,t<sup>h</sup>,k<sup>h</sup>,t<sup>hy</sup>}>{p,t,k,t<sup>y</sup>} before w or y.

(17)  
ty>t<sup>y</sup>  
sy>s<sup>y</sup>  
ny>n<sup>y</sup>  
t<sup>h</sup>y>t<sup>hy</sup>  
ww>w  
yy>y

(18) Clusters of two vowels of the same quality formed due to some of the preceding changes. These clusters dissimilated in the following ways, with the length of a dissimilated vowel being maintained across the shift:

ee>ae  
aa>ea  
oo>eo

Some illegal vowel-length sequences also formed due to some of the preceding changes. These changed thus:

(19)  
LL>ML  
MM>SM  
MMM>MSM  
LLL>LML

(20)  
t<sup>y</sup>>č before another consonant  
s<sup>y</sup>>š before another consonant

(21)  
tš>č  
šš>šh  
sš>šs  
šs<sup>y</sup>>šh

(22) All long vowels become mid-length in word-final syllables; all morphemes capable of ending a word had long vowels in their closing syllables up until this time (but only when the morphemes actually did end words), likely because these closing syllables were consistently primarily stressed. This change coincided with the shift of the language's primary stress system, as described above. Before PCM split into Hlh and Q, all of these word-final mid-length syllables had further contracted to have short vowels.

We may call the language with the foregoing changes incorporated Late PCM. Late PCM diverged into the sisters Hlh and Q.

#### Late PCM > Pre-Hlh

Changes (23)-(26) are undoubtedly the earliest, and likely occurred before Hlh had fully broken off from PCM; they parallel the first changes in Pre-Q and differ from Q's changes in only minor ways.

(23) o raised to high back vowel (o>u) (with vowel length maintained across the change)

(24) p<sup>h</sup>>f (universally)

(25) t<sup>h</sup>>θ (universally)

(26) k<sup>h</sup>>ķ (universally)

(27) s<sup>y</sup>>š (universally)

#### Pre-Hlh > Early Hlh

(28) In morphemes of two or more syllables, morpheme-final long vowels become mid-length vowels unless preceded by another mid-length vowel, in which case they become short vowels; morpheme-final mid-length vowels become short vowels.

Short e is rounded and backed before w

(29) e>u before w (with vowel length being maintained across the change)

Geminate u from the above change dissimilated.

(30) uu>eu (with vowel length being maintained across the change)

(31)

sp>ps  
st>ts  
sk>ks  
šp>pš  
št>tš  
šk>kš  
št<sup>y</sup>>t<sup>y</sup>š  
st<sup>y</sup>>t<sup>y</sup>s

(32)

t<sup>y</sup>š>čš  
t<sup>y</sup>s>čs

(33)

čs>čš  
čš>č  
šs>š

HLh begins its process of delabialization (which eventually results in the loss of all bilabial consonants, save m) with the loss of p. In consonant clusters, p assimilates to a non-bilabial stop (i.e., t or k) nearest to the point of articulation of the other consonant in the cluster; and when a geminate or near-geminate cluster thus occurs, one of the consonants deletes, with t being preferred for deletion over t<sup>y</sup> in the case of pt<sup>y</sup>.

(34) p>k (except in consonant clusters)

(35)

hp>hk  
pt>t  
pk>k  
mp>mt>nt  
ps>ts  
pš>kš  
tp>t  
kp>k  
čp>čk  
pt<sup>y</sup>>t<sup>y</sup>

pw>tw  
py>ky  
wp>wt  
yp>yk

(36)  
tš>č  
ks>ķ  
kš>ķ

(37)  
nhm>nm  
mhn>mn  
nmh>nh  
mnh>mh  
mhn<sup>y</sup>>mn<sup>y</sup>  
n<sup>y</sup>mh>n<sup>y</sup>h

(38)  
t<sup>y</sup>>č (universally)  
t<sup>hy</sup>>č (universally)

(39) ts>θ

(40)  
w>y after another consonant  
w>m elsewhere

(41)  
ky>č  
hy>š

(42)  
ny>n<sup>y</sup>  
n<sup>y</sup>y>n<sup>y</sup>  
mm>m  
mt>nt  
yy>y

The delabialization process is completed by the loss of f.

(43)  
f>š before e

f>h elsewhere

(44) In consonant clusters of C+h, the h drops out

The semivowel y undergoes lateralization to become ʎ.

(45) y>ʎ (universally)

(46) m>n morpheme medially (except in consonant clusters; they change as shown below)

(47)

mk>nk

ms>ns

mš>nš

mč>nč

mʎ>nʎ

mķ>nķ

mθ>nθ

ʎm>ʎn

Early Hlh > Middle Hlh

Sequences of ML and LM change.

(48)

ML>SL

LM>LS

(49)

ķ>č before e

Cķ>Cč

ķ>x in all other positions

The affricate č changes to š in consonant clusters.

(50)

čk>šk

nč>nš

kč>kš

hč>hš  
n<sup>y</sup>č>n<sup>y</sup>š  
čλ>šλ  
λč>λš

The process of lateral differentiation begins as λ is assimilated to produce two new laterals, l and ɭ.

(51) λ>ɭ before a,u (except in consonant clusters)

(52)

nλ>nɭ

tλ>tɭ

sλ>sɭ

λk>ɭk

λt>ɭt

λn>ɭn

λθ>ɭθ

λs>ɭs

When it begins a consonant cluster, n<sup>y</sup> loses palatalization.

(53)

n<sup>y</sup>t>nt

n<sup>y</sup>k>nk

n<sup>y</sup>š>nš

n<sup>y</sup>m>nm

n<sup>y</sup>s>ns

Short e is backed before h

(54) e>a before h (with vowel length being maintained across the change)

Geminate a from the above change dissimilated.

(55) aa>ea (with vowel length being maintained across the change)



### Middle Hlh > Late Hlh

The process of lateral differentiation continues as ʎ and ɬ come into being.

The lateral l is devoiced after a voiceless consonant and quickly becomes fricativized to ʎ.

(56)

tl > tʎ

sl > sʎ

(57) tʎ > ɬ

The lateral ʎ is also devoiced after a voiceless consonant (ʎ does not occur after voiceless consonants in clusters); and the devoiced ʎ is subsequently lost.

(58) ʎʎ > ɬ

The stop t assibilates to c before e, which soon shifts to ɬ.

(59) t > c before e

(60) c > ɬ (universally)

(61)

In morphemes of three syllables or more, a morpheme-final short vowel deletes. In morphemes of three syllables or more that are not affected by this rule, an entire morpheme-initial short syllable deletes.

(62) n > ɬ morpheme-initially and finally (except in consonant clusters)

(63) t > θ morpheme-initially and finally (except in consonant clusters)

(64) θ > ɬ morpheme-medially (except in consonant clusters)

(65)

nVmV > nVnV

$n^yVmV > n^yVn^yV$   
 $mVnV > mVmV$   
 $mVn^yV > mVmV$

Save for some word-final consonants, the language shifts its syllabic structure to strict CV; preaspiration, prenasalization and long nasals develop to help maintain syllable length as the remaining consonant and vowel clusters are eroded.

Morpheme-initially, these changes occurred:

(66)

$V_1V_2C.(V_3) > V_1^hC.(V_3)$   
 $V_1V_2C_+(V_3) > V_1^nC_+(V_3)$  (except when  $C_+$  is a nasal)  
 $V_1V_2\{m,n,n^y\}(V_3) > V_1\{\underline{m},\underline{n},\underline{n}^y\}(V_3)$   
 $V_1V_2CC_- > V_1^hC_-$   
 $V_1V_2CC_+ > V_1^nC_+$  (except when  $C_+$  is a nasal)  
 $V_1V_2C\{m,n,n^y\} > V_1\{\underline{m},\underline{n},\underline{n}^y\}$   
 $VC_- > ^hC_-$   
 $VC_+ > ^nC_+$  (except when  $C_+$  is a nasal)  
 $V\{m,n,n^y\} > \{\underline{m},\underline{n},\underline{n}^y\}$   
 $CC_- > ^hC_-$   
 $CC_+ > ^nC_+$  (except when  $C_+$  is a nasal)  
 $C\{m,n,n^y\} > \{\underline{m},\underline{n},\underline{n}^y\}$

Morpheme-medially and finally, these changes occurred:

(67)

$V_1V_2C.(V_3) > V_1^hC.(V_3)$   
 $V_1V_2C_+(V_3) > V_1^nC_+(V_3)$  (except when  $C_+$  is a nasal)  
 $V_1V_2\{m,n,n^y\}(V_3) > V_1\{\underline{m},\underline{n},\underline{n}^y\}(V_3)$   
 $V_1V_2CC_- > V_1^hC_-$   
 $V_1V_2CC_+ > V_1^nC_+$  (except when  $C_+$  is a nasal)  
 $V_1V_2C\{m,n,n^y\} > V_1\{\underline{m},\underline{n},\underline{n}^y\}$   
 $CC_- > ^hC_-$   
 $CC_+ > ^nC_+$  (except when  $C_+$  is a nasal)  
 $C\{m,n,n^y\} > \{\underline{m},\underline{n},\underline{n}^y\}$

Morpheme-finally, changes (68)-(70) also occurred:

(68)

All morpheme-final consonants except  $m,n,n^y,l,\lambda,L,h$  (or their

prenasalized or long nasal counterparts) are lost; but if the final consonant is <sup>(h)</sup>t, <sup>(h)</sup>θ or <sup>(h)</sup>ʎ, it changes to l.

(69) V<sub>1</sub>V<sub>2</sub>>V<sub>1</sub>

(70)

Compensatory vowel-lengthening occurred with the preceding change, (69); if V<sub>1</sub> was a short vowel, it became mid-length, and if it was mid-length, it became long; but this did not occur when a sequence of two or more long or mid-length syllables in succession resulted. A short V<sub>1</sub> could become long instead of mid-length in cases where its becoming mid-length resulted in an illegal vowel-length sequence.

(71)

The consonants h and x never underwent preaspiration in the above changes. Instead, whenever a preaspirated h or x would have resulted, the change occurred without the h or x preaspirating, and then the vowel following the h or x underwent compensatory lengthening, according to the same rules described above in (70). If there was no following vowel, the preceding vowel underwent the lengthening.

The vowels e,a are centralized.

(72)

e>ə

e˙>ə˙

e:>e:

a>ə

a˙>ə˙

a:>a:

Non-preaspirated voiceless sounds, except h and x, are universally assimilated by the preaspirates, even word-initially.

(73) C-><sup>h</sup>C. (except when C. is h or x)

(74) Short ə is lost word-finally when it follows

m,n,n<sup>y</sup>,m,n,n<sup>y</sup>,<sup>(n)</sup>l,<sup>(n)</sup>ʎ,<sup>(n)</sup>L, or h.

Word-finally, long nasals are shortened to normal nasals.

(75)  $\{\underline{m}, \underline{n}, \underline{n}^y\} > \{m, n, n^y\}$  word-finally

### Late PCM > Pre-Q

Changes (76)-(79) parallel the first changes from Late PCM to Pre-Hlh and differ from Hlh's changes in only minor ways.

(76) o raises slightly (o>u) (with vowel length maintained across the change)

(77)  $p^h > f$  (universally)

(78)  $t^h > c$  (universally)

(79)  $k^h > x$  (universally)

(80)  $ts > c$

(81)  $t^{hy} > \check{c}$

### Pre-Q > Early Q

Mid-length syllables are assimilated between two short syllables.

(82)  $SMS > SSS$

(83)

$mk > nk$

$ms > ns$

$m\check{s} > n\check{s}$

$m\check{c} > n\check{c}$

$ms^y > ns^y$

(84)

$wp > pw$

$wt > tw$

$wk > kw$

$wt^y > t^yw$

$yp > py$

$yt > ty$

$yk > ky$

yw>wy  
wm>mw  
wn>nw  
wn<sup>y</sup>>n<sup>y</sup>w  
ym>my  
yn>ny

(85)  
ty>t<sup>y</sup>  
ny>n<sup>y</sup>  
t<sup>y</sup>>č before another consonant

(86)  
wf>f  
wx>x  
wč>č  
ws<sup>y</sup>>s<sup>y</sup>  
wc>c  
ws>s  
wš>š  
wh>h  
yf>f  
yx>x  
yč>č  
yc>c  
ys>s  
yš>š  
yh>h

(87)  
wVyV>wVwV  
yVwV>yVyV

Short a is fronted in the vicinity of a semivowel or nasal

(88) a>e before or after a semivowel or nasal (with vowel length being maintained across the change)

Geminate e dissimilates differently depending on whether the previous change occurred to a before or after the semivowel or nasal:

(89)  
When the change occurred before, ee>ae (with vowel length being maintained across the change)

When the change occurred after, ee>ea (with vowel length being maintained across the change)

(90)

x>š before e

x>s elsewhere

(91) š>s<sup>y</sup> in all positions except when š is the first member of a consonant cluster

(92) čs<sup>y</sup>>č

(93) t>c before e

(94)

sc>s

šč>šs

(95) n<sup>y</sup>t>n<sup>y</sup>c

(96)

nhm>nh

mhn>mh

nmh>nm

mnh>mn

mhn<sup>y</sup>>mh

n<sup>y</sup>mh>n<sup>y</sup>m

Stops and nasals labialize before u.

(97) {p,t,k,t<sup>y</sup>,m,n,n<sup>y</sup>}>{p<sup>w</sup>,t<sup>w</sup>,k<sup>w</sup>,t<sup>yw</sup>,m<sup>w</sup>,n<sup>w</sup>,n<sup>yw</sup>} before u

(98)

pw>p<sup>w</sup>

tw>t<sup>w</sup>

kw>k<sup>w</sup>

mw>m<sup>w</sup>

nw>n<sup>w</sup>

n<sup>y</sup>w>n<sup>yw</sup>

(99) Long and mid-length vowels are shortened when they occur before consonant clusters: long vowels become mid-length, and mid-

length vowels become short; but the former does not occur when an illegal vowel length sequence would result, and instead a long vowel becomes short.

(100) ae>ea (vowel length is maintained across the change except when an illegal vowel length sequence results; in such cases, vowel length does not metathesize with the vowels themselves--i.e., the two vowels essentially swap length, so that the original vowel length sequence is maintained)

(101) h is lost between u and a, u and e, unless a cluster of three or more vowels results

### Early Q > Middle Q

(102) The vowel clusters ea,eu,ua,ue undergo diphthongization to monosyllables when both vowels are short

(103) Compensatory vowel lengthening affects the new diphthongs formed in (102): the diphthongs become mid-length, unless an illegal vowel length sequence is thus formed, in which case they become long; if their becoming long also creates an illegal vowel length sequence, no compensatory lengthening occurs.

The opening sounds of the diphthongs ea,eu,ua,ue raise to high.

(104)  
ea>ia  
eu>iu  
ua>ua  
ue>ue

The closing sounds of the diphthongs centralize to ə.

(105)  
ia>iə  
iu>iə  
ua>uə  
ue>uə

Sequences of w,y + short a,e become syllabic semivowels (semivowel+schwa).

(106)

w+{a,e}>wə (w)

y+{a,e}>yə (y)

(Note: The syllabic consonants, i.e., the syllabic semivowels and nasals, are treated as whole syllables in their own right and not as lone consonants; thus, they never form consonant clusters with other consonants.)

The opening sounds of the diphthongs iə,uə become semivowels and the diphthongs merge with the syllabic semivowels formed in the previous change.

(107)

iə >yə (y)

uə >wə (w)

(Note: The length of syllabic semivowels varies and follows from their origin: those formed in (106) are all short; those formed in (107) retain the length of the diphthongs which they formerly were; those formed in (119), (121) and (127) are all short; and those formed in (123) derive their length from the vowel that is deleted in (122).)

(108) c>s (universally)

(109) č>h before a,u

### Middle Q > Late Q

p,t,k,m,n,f,s,h (and their labialized counterparts) palatalize before e,y (but not y).

(110) {p,t,k,m,n,f,s,h,p<sup>w</sup>,t<sup>w</sup>,k<sup>w</sup>,m<sup>w</sup>,n<sup>w</sup>}>{p<sup>y</sup>,t<sup>y</sup>,k<sup>y</sup>,m<sup>y</sup>,n<sup>y</sup>,f<sup>y</sup>,s<sup>y</sup>,h<sup>y</sup>,p<sup>yw</sup>,t<sup>yw</sup>,k<sup>yw</sup>,m<sup>yw</sup>,n<sup>yw</sup>} before e,y (but not y)

(111) When y triggers palatalization, it drops out

(112)



k>k<sup>y</sup> before any palatal, dental or bilabial consonant, or before any palatalized consonant

(113)

šs<sup>y</sup>>s<sup>y</sup>

čs<sup>y</sup>>č

čy>č

šy>š>s<sup>y</sup>

šh<sup>y</sup>>š>s<sup>y</sup>

(114) In consonant clusters of C+h, the h drops

(115) In morphemes of two or more syllables, a short or mid-length vowel is lost between intervocal or morpheme-initial n,m (but not n,m in morpheme-initial consonant clusters) and any intervocal or morpheme-final nasal (but not a nasal in a morpheme-final consonant cluster)

(116) In a consonant cluster of any two nasals occurring at the same primary place of articulation (e.g., nn, nn<sup>y</sup>, mm<sup>w</sup>), the first nasal in the cluster is lost

(117) Compensatory vowel lengthening occurs when a vowel is lost in (115); where a vowel is lost, the vowel of the following syllable (or the vowel of the preceding syllable if the loss occurs in the final syllable of a morpheme) is lengthened: short vowels become mid-length and mid-length vowels become long; but this does not occur when an illegal vowel length sequence results; a short vowel may become long instead of mid-length in cases where its becoming mid-length results in an illegal vowel-length sequence; and if a short vowel's becoming either mid-length or long results in an illegal vowel length sequence, no compensatory vowel lengthening occurs. Syllabic semivowels and syllabic nasals, if they form the syllable designated for compensatory lengthening, undergo lengthening just as vowels do, by the same rules.

(118) Word-final vowels are lost in words of three syllables or more.

(119) In word-final consonant clusters, when neither of the consonants is a nasal or semivowel, the second consonant is lost; in other word-final clusters, where C is a non-nasal and non-semivowel consonant and S is a nasal or semivowel, the following occurs:

CS>C+syllabic S

SC>syllabic S+C  
SS>S+syllabic S

(120) Consonants lose palatalization and/or labialization word-finally

(121) Semivowels become syllabic word-finally

(122) In morphemes of two or more syllables, a short or mid-length vowel is lost (a) between a nasal or semivowel and a consonant cluster, or (b) between a consonant cluster and a nasal or semivowel; the nasal or semivowel must be intervocal, morpheme-initial or morpheme-final, and it must be non-syllabic. In cases of (a) vowel loss does not occur when the first member of the consonant cluster is similar to the nasal or semivowel (e.g., {n,m}+V+nk); and in cases of (b) vowel loss does not occur when the second member of the consonant cluster is similar to the nasal or semivowel (e.g., čy+V+y). All nasals are considered to be "similar" here; but not w and y.

(123) After a vowel is lost in the previous change, the nasal or semivowel becomes syllabic

(Note: The length of syllabic nasals varies; those formed in (119) and (127) are all short; those formed in (123) can be either short or mid-length, depending on the length of the vowel lost in (122).)

(124)  
MM>SM  
LL>ML (if this change results in an illegal vowel-length sequence,  
LL>SL occurs instead)

(125) Word-final long and mid-length vowels become short

(126) Morpheme-initial VC sequences metathesize to CV, except when the C is a syllabic semivowel or syllabic nasal, and/or a cluster of three or more vowels is thus formed

(127) Word-initially, where C is a non-nasal and non-semivowel consonant and S is a non-syllabic nasal or semivowel, the following occurs:

CS>S  
SC>syllabic S+C  
SS>syllabic S+S  
C<sub>1</sub>C<sub>2</sub>>C<sub>2</sub>

(128)

šp > sp

šp<sup>w</sup> > sp<sup>w</sup>

šp<sup>y</sup> > sp<sup>y</sup>

šp<sup>yw</sup> > sp<sup>yw</sup>

št > st

št<sup>w</sup> > st<sup>w</sup>

šs > s

čp > sp

čp<sup>w</sup> > sp<sup>w</sup>

čs > s

čp<sup>y</sup> > sp<sup>y</sup>

čp<sup>yw</sup> > sp<sup>yw</sup>

št<sup>y</sup> > st<sup>y</sup>

št<sup>yw</sup> > st<sup>yw</sup>

čw > sw

šw > sw

(129)

n, n<sup>w</sup> > n<sup>y</sup>, n<sup>yw</sup> before any palatalized consonant or š, č

t, t<sup>w</sup> > t<sup>y</sup>, t<sup>yw</sup> before any palatalized consonant, then t<sup>y</sup>, t<sup>yw</sup> > č in that position

(130)

čs<sup>y</sup> > č

čp<sup>y</sup> > sp<sup>y</sup>

čp<sup>yw</sup> > sp<sup>yw</sup>

### Late Hlh/Late Q > Pre-N

(131) h + {t, t<sup>y</sup>, t<sup>w</sup>, t<sup>yw</sup>, k, k<sup>w</sup>, k<sup>y</sup>, k<sup>yw</sup>, s, s<sup>y</sup>, š, č} > <sup>h</sup>C<sup>(yw)</sup>

Preaspiration assimilation occurs: all of the stops, fricatives and affricates (and their variants) coming from Q than Hlh also has as preaspirates become preaspirated

(132) {t, t<sup>y</sup>, t<sup>w</sup>, t<sup>yw</sup>, k, k<sup>w</sup>, k<sup>y</sup>, k<sup>yw</sup>, s, s<sup>y</sup>, š, č} > <sup>h</sup>C<sup>(yw)</sup> intervocally, morpheme-intially or finally, or when the consonant is the first member of a consonant cluster

This preaspiration assimilation rule will continue to be active in the language through the end of the Middle Old Classical N period. Furthermore, whenever a preaspirated consonant changes to another preaspirated sound, preaspiration is maintained across the change.

The labialized consonants become consonant clusters.

(133)  $C^w, C^{yw} > C+w, C^y+w$  (except for syllabic nasals)

(134)

$m^w > mw$

$m^{yw} > m^y w$

$n^w > nw$

$n^{yw} > n^y w$

In the preceding changes, the w becomes part of the following syllable, unless the sound following the w is a non-syllabic consonant other than y or another syllabic consonant, in which case the w drops

(135)

$t^y w > čw$

$pt^y w > pčw$

$k^y t^y w > k^y čw$

$st^y w > sčw$

$n^y t^y w > n^y čw$

The three-term consonant clusters formed in the preceding change (133) erode to two-term clusters.

(136)

$hpw > pw$

$ptw > pw$

$pkw > pw$

$mpw > pw$

$ntw > nt$

$tpw > pw$

$hp^y w > p^y w$

$pk^y w > pw$

$mp^y w > p^y w$

$tkw > kw$

$k^y pw > pw$

$k^y tw > tw$

$nkw > kw$

$mnw > mw$

nmw>mw  
spw>sw  
stw>sw  
skw>sw  
k<sup>y</sup>p<sup>y</sup>w>p<sup>y</sup>w  
sp<sup>y</sup>w>sw  
sk<sup>y</sup>w>sw  
šk<sup>y</sup>w>šw  
čkw>čw  
n<sup>y</sup>kw>kw  
n<sup>y</sup>mw>mw  
pčw>pw  
k<sup>y</sup>čw>čw  
šk<sup>y</sup>w>šw  
čk<sup>y</sup>w>čw  
n<sup>y</sup>k<sup>y</sup>w>k<sup>y</sup>w  
n<sup>y</sup>m<sup>y</sup>w>m<sup>y</sup>w  
mn<sup>y</sup>w>mw  
sčw>sw  
n<sup>y</sup>čw>n<sup>y</sup>č

(137) kw>k<sup>y</sup>w

(138) h<sup>y</sup>>š (universally)

(139)  
mš>nš  
sš>š

(140)  
s<sup>y</sup>>x before a,ɔ,u  
s<sup>y</sup>>š in all other positions

(141)  
f<sup>y</sup>>x before a,ɔ,u  
f<sup>y</sup>>š in all other positions

(142)  
px>p  
pš>tš>č  
k<sup>y</sup>x>kx>k  
k<sup>y</sup>š>č  
n<sup>y</sup>x>n<sup>y</sup>

The palatalized stop  $k^y$  is voiced to  $g^y$  by influence of its palatalization, and where preaspirated it loses its preaspiration; then  $g^y$  nasalizes. (Note:  $g^y$  is an unattested and hypothetical intermediary between  $k^y$  and  $\tilde{n}$ .)

(143)  $k^y > g^y > \tilde{n}$  (universally)

Short e is backed in certain environments

(144)  $e > \text{ɯ}$  when e falls between  $\{k, x, h, l, ^n l\}$  and  $\{k, x, h, l, ^n l\}$  (with vowel length being maintained across the change)

### Pre-N > Early Old Classical N

Consonant clusters with  $\tilde{n}$  undergo metathesis and assimilation.

(145)

$p\tilde{n} > \tilde{n}p$

$\tilde{n}p > mp$

$\tilde{n}t > nt$

$s\tilde{n} > \tilde{n}s$

$\tilde{n}s > ns$

$\check{s}\tilde{n} > \tilde{n}\check{s}$

$\check{c}\tilde{n} > \tilde{n}\check{c}$

$n^y\tilde{n} > \tilde{n}$

$\tilde{n}w > mw$

(146)  $\tilde{n} > n^y$  (universally)

(147)  $t^y > \check{c}$  (universally)

(148)  $p^y > \check{c}$  (universally)

(149)

$h\check{c} > ^h\check{c}$

$nw > mw$

$n^yw > m^yw$

mč>nč  
sč>č  
pč>tč>č  
čw>sw  
šw>sw

(150) n>n<sup>y</sup> before any palatalized consonant or š,č

The six vowels inherited from Hlh and Q merge into a tri-vowel system during a chain-shift (with vowel length being maintained across the changes)

(151)

e>a (unless e is preceded by y)

a>u

u>e

u>e (unless u is preceded by w)

ə>e before š,č,y,n<sup>y</sup>,m<sup>y</sup>,ʌ,<sup>n</sup>ʌ

ə>a otherwise

ɐ>e before š,č,y,n<sup>y</sup>,m<sup>y</sup>,ʌ,<sup>n</sup>ʌ

ɐ>u otherwise

(152) p,k are lost in all positions except when they are the second member of a consonant cluster or are morpheme-final

Clusters of three and four vowels formed by the preceding change are made into clusters of two vowels. In three-vowel clusters, one of the vowels is deleted; where S=short vowel, M=mid-length vowel and L=long vowel, the following occurs:

(153)

L<sub>1</sub>SL<sub>2</sub>>SL<sub>2</sub>

LS<sub>1</sub>S<sub>2</sub>>S<sub>1</sub>S<sub>2</sub>

LSM>SM

L<sub>1</sub>ML<sub>2</sub>>ML<sub>2</sub> (M becomes short if preceded by another mid-length syllable)

LMS>LS

S<sub>1</sub>LS<sub>2</sub>>S<sub>1</sub>S<sub>2</sub>

SLM>SM

S<sub>1</sub>S<sub>2</sub>L>S<sub>2</sub>L

S<sub>1</sub>S<sub>2</sub>S<sub>3</sub>>S<sub>2</sub>S<sub>3</sub>

S<sub>1</sub>S<sub>2</sub>M>S<sub>2</sub>M

SML>SL  
 S<sub>1</sub>MS<sub>2</sub>>S<sub>1</sub>S<sub>2</sub>  
 MLS>MS  
 M<sub>1</sub>LM<sub>2</sub>>LM<sub>2</sub> (L becomes short if preceded by another long syllable)  
 MSL>ML  
 MS<sub>1</sub>S<sub>2</sub>>MS<sub>2</sub>  
 M<sub>1</sub>SM<sub>2</sub>>SM<sub>2</sub>

In four-vowel clusters, a semivowel is inserted between the second and third vowels to create two separate clusters of two vowels:

(154)  
 VuuV>VuwuV  
 VueV>VuweV  
 VuaV>VuwaV  
 VeuV>VeyuV  
 VeeV>VeyeV  
 VeaV>VeyaV  
 VauV>VawuV  
 VaeV>VayeV  
 VaaV>VayaV

(155) Compensatory vowel lengthening occurs when a vowel is lost in (153); where a vowel is lost, the vowel of the following syllable (or the vowel of the preceding syllable if the loss occurs in the final syllable of a morpheme) is lengthened: short vowels become mid-length and mid-length vowels become long; but this does not occur when an illegal vowel length sequence results; a short vowel may become long instead of mid-length in cases where its becoming mid-length results in an illegal vowel-length sequence; and if a short vowel's becoming either mid-length or long results in an illegal vowel length sequence, no compensatory vowel lengthening occurs.

#### Early Old Classical N > Middle Old Classical N

The velar and palatal lateral approximants merge with the dental lateral approximant.

(156)  
 ʎ, <sup>n</sup>ʎ > ʎ, <sup>n</sup>ʎ  
 λ, <sup>n</sup>λ > ʎ, <sup>n</sup>ʎ



f weakens to h intervocally

(157) f>h between vowels

All other fricatives weaken to h between two vowels of the same quality

(158) {θ,s,š,x,t}>h between two vowels of the same quality

(159)

sk>šk

čk>šk

(160)

mp>hp

nt>ht><sup>h</sup>t

nk>hk><sup>h</sup>k

n<sup>y</sup>k>hk><sup>h</sup>k

ns>hs><sup>h</sup>s

n<sup>y</sup>š>hš><sup>h</sup>š

n<sup>y</sup>č>hč><sup>h</sup>č

n<sup>y</sup>s>hs><sup>h</sup>s

(161)

mn>nm

mn<sup>y</sup>>n<sup>y</sup>m

(162) wy>y

(163) Voiceless consonants are lost word-finally

(164) Vowels are lengthened following a consonant cluster: a short vowel becomes mid-length and a mid-length vowel becomes long, unless an illegal vowel-length sequence results; but a short vowel may become long instead of mid-length to avoid an illegal vowel-length sequence.

Middle Old Classical N > Late Old Classical N

Two of the oldest phonemes, θ and č, vanish.

(165) θ>s (universally)

(166)

č>š before e

č>s morpheme-initially and finally (when not before e)

č>š elsewhere

Morpheme-initial and final consonant clusters erode to single consonants.

(167)  $C_1C_2 > C_2$  morpheme-initially and finally

(168) h drops between two vowels of the same quality

The long nasals become VC sequences.

(169)

$\underline{m} > \text{ə} \quad m > am$

$\underline{n} > \text{ə} \quad n > an$

$\underline{n}^y > \text{ə} \quad n^y > an^y$

The syllabic nasals become VC sequences.

(170)

$\text{ɲ} > \text{ə}n(\text{ə}) > an(\text{a})$

$\text{ɲ}^y > \text{ə}n^y(\text{ə}) > an^y(\text{a})$

$\text{ɲ} > \text{ə}m(\text{ə}) > am(\text{a})$

$\text{ɲ}^y > \text{ə}m^y(\text{ə}) > am^y(\text{a})$

The length of the ə/a depends on and follows from the length of the syllabic nasal; the parenthetical vowels occur only when the syllabic nasal comes before a consonant, and they are always short

Clusters of three and four vowels formed by the preceding changes are made into clusters of two vowels. After each of the foregoing changes (168-170), the following three rules (171-173) are applied:

In three-vowel clusters, one of the vowels is deleted; where S=short vowel, M=mid-length vowel and L=long vowel, the following occurs:

(171)

$L_1SL_2 > SL_2$

$LS_1S_2 > S_1S_2$

$LSM > SM$

$L_1ML_2 > ML_2$  (M becomes short if preceded by another mid-length syllable)  
 $LMS > LS$   
 $S_1LS_2 > S_1S_2$   
 $SLM > SM$   
 $S_1S_2L > S_2L$   
 $S_1S_2S_3 > S_2S_3$   
 $S_1S_2M > S_2M$   
 $SML > SL$   
 $S_1MS_2 > S_1S_2$   
 $MLS > MS$   
 $M_1LM_2 > LM_2$  (L becomes short if preceded by another long syllable)  
 $MSL > ML$   
 $MS_1S_2 > MS_2$   
 $M_1SM_2 > SM_2$

In four-vowel clusters, a semivowel is inserted between the second and third vowels to create two separate clusters of two vowels:

(172)  
 $VuuV > VuwuV$   
 $VueV > VuweV$   
 $VuaV > VuwaV$   
 $Veuv > VeyuV$   
 $VeeV > VeyeV$   
 $VeaV > VeyaV$   
 $VauV > VawuV$   
 $VaeV > VayeV$   
 $VaaV > VayaV$

(173) Compensatory vowel lengthening occurs when a vowel is lost in (171); where a vowel is lost, the vowel of the following syllable (or the vowel of the preceding syllable if the loss occurs in the final syllable of a morpheme) is lengthened: short vowels become mid-length and mid-length vowels become long; but this does not occur when an illegal vowel length sequence results; a short vowel may become long instead of mid-length in cases where its becoming mid-length results in an illegal vowel-length sequence; and if a short vowel's becoming either mid-length or long results in an illegal vowel length sequence, no compensatory vowel lengthening occurs.

Prenasalized l becomes a consonant cluster

(174)

$\eta > n$  (except morpheme-initially and finally)  
 $\eta > l$  morpheme-initially and finally

The preaspirates vanish

(175) Preaspirated fricatives lose their preaspiration entirely in all positions

(176) Preaspirated stops and affricates become h+C clusters, except morpheme-initially and finally or before another consonant, where they lose their preaspiration entirely

### Late Old Classical N > Classical N

(177) Over the course of about a century, the long and mid-length vowels have been contracting; at this point, vowel contraction completes. Long vowels contract into high-pitched vowels, mid-length vowels into mid-pitched vowels, and short vowels become low-pitched. However, there are exceptions to this length:pitch correspondence, given below.

(178) Long and mid-length vowels that are devoiced by the N vowel devoicing rules become low-pitched

The vowel i reappears, first as an allophone of e in the environment described below.

(179)

$e > i$  between two dental or bilabial stops or affricates (with pitch maintained across the change)

$a > \text{æ}$  between two dental or bilabial stops or affricates (with pitch maintained across the change)

$u > \text{ü}$  between two dental or bilabial stops or affricates (with pitch maintained across the change)

The syllabic semivowels turn into vowels;  $\text{ɥ}$  merges with the new vowel i, and  $\text{w}$  loses its lip-rounding and ultimately merges with a

(180)

$\text{ɥ} > i$  (universally)

$\text{w} > \text{ə} > a$  (universally)

The pitch of the i or ə/a depends on and follows from the pitch of the syllabic semivowel

Semivowel insertion occurs when the preceding change results in clusters of three or four vowels; (181) covers three-vowel clusters and (182) covers four-vowel clusters

(181)

Vuu>Vuwu

Vue>Vuwe

Vua>Vuwa

Veü>Veyu

Vee>Veye

Vea>Veya

Vau>Vawu

Vae>Vaye

Vaa>Vaya

Vui>Vuwi

Viu>Viyu

Vii>Viyi

Vie>Viye

Via>Viya

Veï>Veyi

Vai>Vayi

(182)

VuuV>VuwuV

VueV>VuweV

VuaV>VuwaV

VeüV>VeyuV

VeeV>VeyeV

VeaV>VeyaV

VauV>VawuV

VaeV>VayeV

VaaV>VayaV

VuiV>VuwiV

ViuV>ViyuV

ViiV>ViyiV

VieV>ViyeV

ViaV>ViyaV

VeïV>VeyiV

VaiV>VayiV

(183) Vowel-initial morphemes gain an initial h unless the opening vowel is low-pitched and not followed by a consonant cluster or another vowel, in which case the opening vowel is lost

The two remaining palatalized consonants turn into consonant clusters; and these clusters in some environments become CV sequences.

(184)  $n^y, m^y > ny, my$  (universally)

(185)  $my > ny$

(186)

$ny > ni$  before another consonant

$ny > ni$  before V(C)

$ny > n$  morpheme-initially and finally where it does not change to ni

The above i from y is always low-pitched

(187) A vowel nasalizes if it precedes or follows a nasal consonant; if the nasal consonant triggering this nasalization is lost, the vowel remains nasalized (as when nasals are lost word-finally in the next rule)

(188) All remaining word-final consonants are lost

Certain consonants undergo fricativization or affrication before front vowels i, e

(189)

$w > v$  before i, e, unless the w is preceded by a, u

$k > x$  before i, e

$p > f$  before i, e

$t > c > \lambda$  before i, e

(190)

$tx > t$

$\check{s}x > \check{s}$

$hx > x$

Certain assimilative changes take place

(191)

$V\check{s}k > e\check{s}k$  (when V is not already i or e)

škV>ške (when V is not already i or e)  
Vš>eš (when V is not already i or e)  
šV>še (when V is not already i or e)

(192)

{i,e}s>{i,e}š (except when s occurs in a consonant cluster)  
s{i,e}>š{i,e} (except when s occurs in a consonant cluster)

(193)

h>s between i,e and t,λ  
h>š between i,e and k  
h>s between i,e and p  
h>š between i,e and i,e  
s{i,e}š>š{i,e}š (except when s occurs in a consonant cluster)  
š{i,e}s>š{i,e}š (except when s occurs in a consonant cluster)

(194) V<sub>1</sub>hV<sub>2</sub>{λ,t}V<sub>3</sub>>V<sub>1</sub>V<sub>2</sub>h{λ,t}V<sub>3</sub> word-finally

(195) V<sub>1</sub>hV<sub>2</sub>>V<sub>1</sub>V<sub>2</sub> word-finally

(196) h drops between two vowels of the same quality

Semivowel insertion occurs when the preceding changes result in clusters of three or four vowels; after each of the foregoing changes (194-196), the following two rules (197 and 198) are applied; (197) covers three-vowel clusters and (198) covers four-vowel clusters:

(197)

Vuu>Vuwu  
Vue>Vuwe  
Vua>Vuwa  
Veu>Veyu  
Vee>Veye  
Vea>Veya  
Vau>Vawu  
Vae>Vaye  
Vaa>Vaya  
Vui>Vuwi  
Viu>Viyu  
Vii>Viyi  
Vie>Viye  
Via>Viya  
Vei>Veyi

Vai>Vayi

(198)

VuuV>VuwuV

VueV>VuweV

VuaV>VuwaV

VeuV>VeyuV

VeeV>VeyeV

VeaV>VeyaV

VauV>VawuV

VaeV>VayeV

VaaV>VayaV

VuiV>VuwiV

ViuV>ViyuV

ViiV>ViyiV

VieV>ViyeV

ViaV>ViyaV

Veiv>VeyiV

VaiV>VayiV

The stop k and fricative h are fronted before or after i,e

(199)

k>k<sup>y</sup> before or after i,e

h>x before or after i,e (except when h occurs before another consonant)

The vowels a,u are universally fronted (with vowel pitch being maintained across the change)

(200)

a>ɛ

u>ɨ

As a consequence of the above vowel fronting, k and h shift forward before or after ɛ or ɨ (or any of their allophonic variants, such as æ or ü), effectively fronting these sounds universally

(201)

k>k<sup>y</sup> (universally)

h>x (except when h occurs before another consonant)