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Some details of Mari historical phonology

Mari historical phonology was broadly worked out during the twentieth century and summarized in classic works by Gruzov and Bereczki. Nevertheless, subsequent Uralic and Mari reconstructions were published with ramifications for historical phonology, and a vast trove of new data appeared in Mari dialectal dictionaries published since the turn of the millennium. The article examines four aspects of Mari historical phonology where this newly available data either leads us to posit new reconstructions at the Proto-Mari stage, or supports or overturns reconstructions published elsewhere: 1) Eastern Mari evidence for Ante Aikio's reconstruction of Proto-Mari reduced labial vowels; 2) regular lowering of *i before sonorants in Eastern Mari and irregularities sometimes suggesting that a vowel other than *i must be reconstructed; 3) palatalized *ŕ in the Krasnoufimsk dialect and the environment for this palatalization; and 4) the reconstruction of all three possible voiced sibilant + velar clusters in Proto-Mari, i.e. *-zɣ-, *-žɣ- and *-źɣ-. Additionally, a loan etymology of Mari *užɣar* 'tool' from Alanic *zɣar 'metal object' (cf. Ossetic *zɣär* id.) is proposed.

1. Introduction

While Mari historical phonology was broadly worked out during the twentieth century and summarized in works by Gruzov (1969) and Bereczki (1992; 1994), since that time new Uralic and Mari reconstructions have been published with ramifications for historical phonology (e.g. Aikio 2014a; Metsäranta 2020), as well as a vast trove of new dialectal data from the dictionaries of Beke and Veršinin and *Tscheremissisches Wörterbuch*. The article examines four aspects of Mari historical phonology where this newly available data leads us to posit new reconstructions at the Proto-Mari stage, or either supports or overturns reconstructions published elsewhere. Section 2 presents Eastern Mari evidence for Aikio's reconstruction of Proto-Mari reduced labial vowels. Section 3 examines regular lowering of *i before sonorants in Eastern Mari and irregularities sometimes suggesting that a vowel other than *i must be reconstructed. In Section 4 palatalized *ŕ* in the Krasnoufimsk dialect and the environment for this palatalization is described. Finally, Section 5 reconstructs all three possible voiced sibilant + velar clusters for Proto-Mari, i.e. *-zɣ-, *-žɣ- and *-źɣ-. Additionally, a loan etymology of Mari *užɣar* 'tool' from Alanic *zɣar 'metal object' (cf. Ossetic *zyär* id.) is proposed.[1]

2. Eastern Mari evidence for the reconstruction of Proto-Mari reduced labial vowels

Recent decades have seen two competing hypotheses on the history of the labial reduced vowels *ŭ* and *ü̆* in the Mari dialects. Gábor Bereczki (1994: 65ff.) did not reconstruct the labial reduced vowels for the Proto-Mari stage, instead he believed that they represent a later development. His hypothesis has been continued by Agyagási (2019), who views the reduced labial vowels as a post-Proto-Mari development which took place under the influence of Chuvash and affected only Hill Mari, Northwestern Mari and the Upša dialect of Meadow Mari (a grouping of dialects which I shall refer to as the "Western Complex").

However, Aikio (2014a) noted a number of irregularities in the Bereczki reconstruction and attempted to put the reconstruction of Mari historical vocalism on a firmer Neogrammarian footing. In Aikio's view, already in the Proto-Mari era there existed an opposition between full *u and *ü and reduced *ŭ and *ŭ̈, respectively. His key insight is that *ü and *ŭ̈ can be traced back to different sources in Proto-Uralic: where *ü* is a full vowel across the Mari dialects it goes back to PU *i̬ or *ä, while the counterpart front labial vowel that appears as reduced in various Mari dialects goes back to PU *ü, *i, or *e.

Aikio's use of strict sound laws is already sufficient to make his reconstruction more convincing than Bereczki's. The later work by Agyagási (2019) fails to take into account Aikio's argument on different Proto-Uralic sources for the front labial vowels, and exceptions are readily found for the conditioning environments which Agyagási proposes for the reduction of the single original front labial vowel. Therefore, Agyagási's reconstruction suffers from the same flaw as Bereczki's.

We may in fact find further proof for Aikio's reconstruction of Proto-Mari front labial reduced vowels in some hitherto overlooked data from Eastern Mari. Bereczki and Agyagási drew mainly on the range of dialects found in Beke's (1997) dictionary (hereinafter referred to simply as Beke), while Aikio's paper relied on the material in *Tscheremissisches Wörterbuch* (TschWb). However, Veršinin (2011) has published a dictionary of Mari dialects of Tatarstan and Udmurtia that were not previously documented in either Beke or TschWb. Two of those dialects, namely the Menzelinsk dialect (Me) and the Bol'šaja Šija dialect (Ši), strikingly feature reduced vowels. In fact, the existence of reduced labial vowels in the Menzelinsk dialect has been known since Isanbaev (1964).[2]

If we extend Aikio's data on the interdialectal correspondences of the reduced labial vowels to encompass also the Ši and Me dialects (see Appendix), then we find that these two dialects regularly show reduced vowels in words for which Aikio has reconstructed PMari reduced vowels on the basis of the other Mari dialects documented in TschWb. In the

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2. Curiously, however, in his textbook of Mari historical phonology published over four decades later, Isanbaev (2008: 54–55) reconstructs *ŭ and *ŭ̈ for Proto-Mari and mentions their survival in, besides Northwestern Mari, the Joškar-Ola and (partially) the Volga dialects of Meadow Mari, but he makes no mention of the Menzelinsk dialect.

Me dialect, PMari *ŭ and *ǚ are broadly preserved as such, for example, *kŭm* '3' < PMari *kŭm, *mǚškər* 'belly' < PMari *mǚškər. The Ši dialect, on the other hand, has preserved the reduced quality of these vowels but delabialized them, resulting into *ə̂* and *ə*, respectively, cf. *kə̂m* and *məškər*. At the same time, it should be noted that the Ši dialect preserves PMari *ü according to Aikio's reconstruction as a full vowel *ü* (as did the Me dialect previously, see below), for example, Ši *šüδəməšö* '100th' < PMari *šüδə < PU *śita.

One attempting to uphold the Bereczki–Agyagási reconstruction, or at the very least its view that reduced labial vowels are a feature unique to the Western Complex, might still argue that the Me and Ši dialects originated in migrants from the Western Complex. After all, while the Eastern Mari diaspora was of basically Meadow Mari origin (Lallukka 2003: 100ff.), it cannot be excluded that some of the migrants coming down from the Middle Vyatka into the present Eastern Mari regions spoke a variety with Western Complex features.

However, from the Ši dialect we find evidence that this dialect should in fact be categorized not among the Western Complex but among the remaining Meadow and Eastern Mari dialects, and therefore the Proto-Mari reduced vowels persisted for a time in Meadow and Eastern Mari, and not simply in the Western Complex. This evidence consists firstly of the reflexes of PMari *pŭśkəla- 'sting' across the dialects. In the dialects attested in TschWb, we find the following outcomes for the first-syllable vocalism of *pŭśkəla-:

B	Kr	Ka	Ki	S	M	MU	U	V	Nw	W
ü	ü	ü	ü	ü	u, ü	u	ŭ	ŭ	ŏ	ə̂

(Abbreviations for the Mari dialects employed by TschWb: B = Birsk, Kr = Krasnoufimsk, Ka = Kaltasy, Ki = Bol'šoj Kil'mez, S = Sernur, M = Morki, MU =Mari-Ušem, U = Upša, V = Volga)

In most Meadow and Eastern Mari varieties, the outcome of PMari *ŭ in this word is front *ü*, a reflex which Aikio judges to be irregular but which can easily be explained by the fronting effect of the following palatal *ś.

Turning now to the Eastern Mari data provided by Isanbaev and Veršinin, we find no descendant of PMari *pŭśkəla- 'sting' attested from the Me dialect, but the form in the Ši dialect is *paškəlä-*. Since *ə* in the Ši dialect is the regular outcome of PMari *ǚ, the Ši dialect must have shared

in the fronting of PMari *ŭ found in the other Meadow and Eastern Mari dialects. Otherwise the changes PMari *ŭ > pre-Ši *ŭ > Ši *ə̂ would have occurred and the attested form would be **pə̂škə̂la instead. This isogloss leads us to assume that the merger of the reduced and non-reduced front labial vowels is subsequent to the common ancestor of the Birsk, Krasno-ufimsk, Kaltasy, Bol′šoj Kil′mez, Sernur, Morki and Bol′šaja Šija varieties of Meadow and Eastern Mari. Thus, not only are reduced labial vowels not a post-Proto-Mari development, but *pace* Agyagási, even the retention of reduced labial vowels after the end of Mari unity was not limited to the Western Complex but must have encompassed, for a time, most Meadow Mari dialects.

With regard to full *ü in the Ši dialect, here, too, it is interesting to note that this dialect reflects a sound change shared with most other Meadow Mari and Eastern Mari dialects, and not found in the Western Complex. Ši *küzem* 'climb' shows the same fronting of PMari *u before palatal *ź as in all MariE dialects except the Volga dialect. The Western Complex, on the other hand, shows an unfronted vowel in MariNW W Upša *kuzem*.

In the Menzelinsk dialect, there are some instances of the reduced front rounded vowel *ŭ* against a full rounded vowel in the Western Complex and in the Aikio reconstruction of Proto-Mari vocalism. These in-stances include Menzelinsk *ŭp* 'hair' versus MariE NW W *üp* < PMari *üp, Menzelinsk *mŭkš* 'bee' versus MariE NW W *mükš* < PMari *mükš. Especially striking is Menzelinsk *tŭz* 'pregnant [of animals]', where this dialect shows a reduced vowel even though all other Mari dialects show a full vowel *ü* and the word in fact goes back to a Proto-Mari form *tüəž with a vowel sequence that was later contracted (see Aikio 2014b: 190–191 for this etymology). The presence of a reduced vowel can be noted also in Isanbaev's Menzelsink form *sŭn* 'жила', where all other Mari dialects (with the exception of a single Morki attestation in TschWb) show a full vowel, the Western Complex included. In this case, however, the irregular vocalic correspondences *i ~ ö ~ ü* among the dialects complicate the reconstruc-tion of the Proto-Mari form, in spite of the longstanding Uralic etymology for the word (UEW 441). Nor is this reduction limited to inherited vocab-ulary, as it affected material borrowed from Chuvash, too, cf. *šŭlö* 'дыши' cited by Isanbaev versus MariE W NW *šülem* 'atmen' < Cv. *sïvla-* id.

Such cases of reduction specific to the Menzelinsk dialect must be re-garded as a fairly recent sound shift. Isanbaev (1964: 97) noted the absence of full *ü* in absolute initial position in the Menzelinsk dialect, along with

the rarity of initial-syllable post-consonantal *ü*, and the frequent substitution of this full front rounded vowel by either reduced *ŭ* or a centralized vowel *u̇*. Isanbaev claimed that this tendency was stronger in the speech of younger generations, while older generations sometimes preserved full *ü*. This feature is yet another factor which speaks against any close identification of these Eastern Mari dialects with Northwestern Mari, Hill Mari or the Upša dialect with regard to the full and reduced labial vowels.

However, in Me *ŭŋšö* 'tame', the reduced front labial vowel may be original. This is because a reduced vowel is found also in Ši *əŋəšö* id., but the dialect of Bol'šaja Šija permits initial *ü* and continues to show such a full front rounded vowel in, for example, *ülän* 'внизу'. If this in fact points to PMari **ŭŋəšə* with first-syllable reduced vowel, this challenges the etymology recently proposed by Metsäranta (2020: 120–121) that this word is descended from PU **wajŋə-* 'henki; hengittää'. On the basis of the Northwestern Mari form *üŋᵘšö* Metsäranta had assumed a PMari full vowel **ü-* which would be compatible with PU **waj*. Instead, it may be the case that MariNW *ü* here represents an irregular development of PMari **ŭ* (compensatory lengthening after syncope of medial *ə*, followed by later insertion of an epenthetic vowel in the cluster?) and the origins of this word may lie somewhere else entirely.

3. Eastern Mari data on lowering of *i before sonorants

There is another detail of Mari historical phonology where the Eastern Mari dialects from Udmurtia and Tatarstan documented in Veršinin's dictionary can shed new light. This concerns, among other things, the reflexes of Proto-Mari **i* across the Mari varieties as explored by Aikio (2014a: 138–139).

To briefly review Aikio's findings, in the immediate post-Proto-Mari epoch two lowerings of the vowel **i* occurred. The first lowering was PMari **i > e* before *r* and this affected all Mari dialects, cf. for example MariE W *ner* 'nose' < PMari **nir* < PU **närə*. The second lowering, which affected **i* before sonorants, occurred in all Meadow and Eastern Mari dialects documented in TschWb with the exception of the Upša dialect, cf. for example MariE *βeŋe* but W *βiŋgə* 'son-in-law', MariE *leβa* 'it becomes warm' but W *liβä*, etc.[3]

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3. Aikio exempts MariE *ime* from this second lowering before sonorants, on the basis that the word is vowel-initial and perhaps the lowering rule did not apply

A consequence of the first lowering process is that the sequence *-ir- was first lost from all Mari dialects, and then it was restored from loanwords, for example in Chuvash borrowings, cf. MariW *irǝk* 'freedom' < Cv. *irĕk* id. The sequence *-ir- in early Chuvash loanwords then underwent the second lowering process in Meadow and Eastern Mari, producing MariE *erǝk* 'freedom'.

Based on this observation, Aikio speculates that the words MariE *šere* NW W Upša *širǝ* 'unleavened' and MariE *ter* NW W Upša *tir* 'sled', with an unlowered sequence *-ir-* in the western varieties, "could be loanwords from some as yet unidentified source". However, not only has no candidate for borrowing ever been found among the languages with which Mari has been in contact in the post-Proto-Mari era, but in Chuvash the words *šerĕ*, *širĕ* 'несоленый, без соли (о кушанье)' and *yĕltĕr* 'skis' represent borrowings from Mari. Though Cv. *šerĕ*, *širĕ* represent a somewhat late Mari > Chuvash borrowing because it already reflects the shift of PMari *s > š,[4] Cv. *yĕltĕr* (if from a Mari compound *jol* 'foot' + *ter* 'sled', see Fedotov 1990: 301) must have been borrowed quite early to have participated in the Chuvash reduction of original mid and high vowels. Thus, one is inclined to seek some other explanation for these two Mari words than post-Proto-Mari borrowing from some unknown source.

It is here that Veršinin's data from Mari dialects of Udmurtia and Tatarstan is helpful. Aikio bases his claim of the second lowering process (i.e. before sonorants in Meadow and Eastern Mari) on the following

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in this case. However, with regard to the other non-lowered vowel-initial word Aikio points to, i.e. Mari *imńe* 'horse', in spite of his remark that the word is "not known to be a recent borrowing", already Wichmann (1953: 51) saw Mari *imńe* as a borrowing of Mongolic *emnig*. The highly irregular first-syllable vowel correspondences among the forms of *imńe* attested in TschWb and Beke ($i \sim a \sim e \sim \hat{\partial}$) leave no doubt that this word is a post-Proto-Mari borrowing. I am grateful to Alexander Savelyev for drawing my attention to Wichmann's etymology.

4. For 'unleavened' we must reconstruct PMari initial *s- on the basis of the Malmyž form *śer(ǝ)* in TschWb. Bereczki (1968: 73) dates the shift *s > š, which occurred in all Mari dialects except certain Eastern varieties, to the 17th century. Note that while Agyagási (2000: 15) has considered Mari *šere* to represent a borrowing into both Chuvash and Mari from an unknown, third language of the region, on the basis of the Mari *s > š shift there is no obstacle here to viewing the word as a straightforward loan from Mari into Chuvash, like many other words on her list of "Late Gorodets" loanwords (Culver 2021).

words from TschWb where Meadow and Eastern Mari show *e* while their Hill Mari, Northwestern Mari and Upša cognates show *i*: *leβa* 'it becomes warm', *pembe* 'finch', *šem* 'black', *šen* 'tinder', *ter* 'sled', *βeleš* 'it falls', *βem* 'marrow' and *βeŋe* 'son-in-law'.

For the most part, all Eastern Mari dialects documented by Veršinin reflect the same vowel *e* as the other eastern varieties which Aikio drew from TschWb, that is, Veršinin gives *leβe*, *pembe*, *šen*, *βeleš*, *βem* and *βeŋe*. However, for the words 'sled' and 'black', only some of the Eastern Mari dialects in Veršinin show the vowel *e* which would be expected if this was a matter of Eastern Mari lowering of *i; other dialects feature instead a different vowel which Veršinin represents as *uᵊ*: *muᵊр* and *шиᵊме*, respectively. As Veršinin (2012: 7) explains in the introduction to his dictionary, by the use of the symbols *uᵉ* and *eᵘ* he denotes a vowel that is intermediate between *e* and *i* (not a diphthong).

The following is a list of all such words in Veršinin where a different vowel, denoted by *uᵊ*, *uᵉ*, or *eᵘ*, is found in various Eastern Mari dialects alongside *e* in other dialects of the region, together with the traditional etymology if one exists (here I will preserve Veršinin's own Cyrillic orthography for these particular forms while transliterating the more mainstream forms into the standard Latin notation):

- *ješ*, *йиᵉш* 'семья' < Chuvash *yïš* id. (Räsänen 1920: 34; Fedotov 1990: 186)
- *preze*, Kukmor *preźe*, Me *приᵊже* 'телёнок, лосёнок'
- *ser*, also *cuᵊр*, Me *cᵘер* 'берег' < Cv. *śïr-* id. (Räsänen 1920: 191; Fedotov 1990: 240)
- *serem*, Ši *cuᵊрем*, Me also *cᵘерем* '(на)писать' < Cv. *śïr-* id. (Räsänen 1920: 191; Fedotov 1990: 239–240)
- Sarap. *šekš*, Jelabuga Kukmor *šeɣǝš*, Me *шиᵉк�̈ш* 'желчь' < PU *säppä + *ksi (UEW 435–436 cites earlier claims for this etymology, though it dismisses Mari from the cognate set)
- *šem(e)*, Mamad. Ši, Me *шиᵊме* 'черный, тёмный' < PU *šimɜ 'Rost, rostig werden' (UEW 758–759; Bereczki et al. 2013: 224–225)
- *šere* 'пресный, без соли' but Mamad. *шеᵘрäк-шовак* 'нормальный на вкус в отношении соли или кислости'
- *ter*, *muᵊр* 'сани, санный воз'

Thus, Aikio considered *šere* 'unleavened' and Mari *ter* 'sled' to be post-Proto-Mari borrowings because they reflect the same development of restored *ir as in Chuvash loanwords. However, the vowel *uᵊ/eᵘ* that appears in those two words' Eastern Mari forms is not the typical reflection of *i lowered before sonorants. Moreover, Veršinin's unusual *uᵊ/eᵘ* vowel is also found in words which we have no reason to consider late borrowings, i.e. Mari *šem(e)* 'black' and *šekš* 'gall', which have always been assumed to represent Uralic inheritance in Mari, or at least to date from a time before Proto-Mari broke up and Mari entered into contact with Turkic and Russian. Furthermore, in the 'gall' word the vowel appears outside of any conditioning environment involving a sonorant, as it does also in 'family' < Chuvash.

Based on this, we might consider certain revisions to our understanding of Mari historical phonology. Firstly, it is possible that Mari *šere* and *ter* are inherited vocabulary, but they simply must be reconstructed for the Proto-Mari stage with a different sequence than *-ir-, where the *i would have undergone lowering. I suggest that we view Veršinin's unusual vowel *uᵊ* in these words as the result of contraction of an original disyllabic sequence (such as *-iə-) at the post-Proto-Mari stage, after the initial lowering of PMari *-ir- to MariE NW W -er-. After all, we know from the etymology of MariE standard *tüz* < PMari *tüəž 'pregnant (of animals)' < PU *tejniš (Aikio 2014b: 90–91) that Proto-Mari possessed sequences of a full vowel followed immediately by a reduced vowel that underwent contraction in most (but not all) dialects. As another example, compare Mari *juž* 'Luft' with the dialectal data in Beke and TschWb: Eastern Mari (Birsk) *juŭž* preserves the original disyllabic state, while the Hill Mari cognate *jož* assumes an earlier vowel sequence because the correspondence MariE *u* ~ W *o* is regular before a hiatus.

Evidence that Veršinin's vowel is the outcome of contraction comes from the Uralic etymology sometimes proposed for Mari *šekš* 'gall' where the original intervocalic labial stops in PU *säppä would have been lost at some stage. It is known that the PU geminate sequence *pp sometimes gave PMari *w, cf. PU *appa- 'syödä ahnaasti' > PMari *uwe- 'ahmia' (for this etymology, see Metsäranta 2020: 119). However, there is a dearth of examples of words of the shape Cewə̂CC/Cewə̂CV in Mari, suggesting a phonotactic constraint in the prehistory of the language and allowing us to posit loss of intervocalic *w* in this environment; the sole exception *lewə̂še*

'warm' is the present participle of *lewem* 'be warm' and the *w* could have been restored on the basis of that verb.[5]

Therefore, for 'gall' we might reckon with the sequence of changes PU *säppäksi > *sewəks > *seəks > MariE NW *šekš* W *šäkš*. Ultimately only certain Eastern Mari varieties attested in Veršinin preserved a trace of the original disyllabic sequence as the *u³* vowel, while in all other dialects the sequence underwent contraction and the result merged with PMari *e and then underwent the divergent developments of Proto-Mari *e (namely preservation in Northwestern Mari and Meadow and Eastern Mari, lowering to *ä* before a velar in Hill Mari, see Aikio 2014a: 135ff).

If contraction is the source of Veršinin's vowel in inherited vocabulary, then we may provisionally reconstruct PMari forms along the lines of *siərə 'unleavened' and *tiər 'sled', though the ultimate etymology of these words requires further investigation.

Also, we must reckon with PMari *siəmə 'black' and in fact reconstructing a trisyllabic form helps to explain those Eastern Mari dialectal forms documented in TschWb that unexpectedly show *i* while other Meadow and Eastern varieties show *e*: in the Ob₂ and Oka (*šim*), Okr (*šime*), and Ok (*śim*) dialects the lowering of PMari *i before the sonorant *m* must have run its course prior to the contraction of an original sequence, *-iə- or the like.

This new Proto-Mari reconstruction in fact fits well with the traditional etymology (UEW 758–759; Bereczki et al. 2013: 224–225) of Mari *šeme* 'black' that compares it to Udmurt *sįnomį̄-*, *sįnem* 'rosten, rostig werden'. As *-n- is lost in Mari after front vowels in *i*-stems, a Pre-Proto-Mari form *sinəm-, cognate with the Udmurt forms, would have lost the first nasal consonant and been left as *siəm. On the other hand, as a peer reviewer notes, the new Proto-Mari reconstruction *siəm bears "(even more) of a

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5. The same holds also for words of such shape with initial-syllable *u*, that is, we find a dearth of examples in Mari of CuwôCC/CuwôCV. Bereczki et al. (2013: 220–221) reconstruct a trisyllabic proto-form for Mari *suzo* 'Auerhahn', of Uralic origin according to the UEW (780). Here contraction of an original *šuβəćə would explain those dialectal forms such as UP (Beke's abbreviation for the village of Petrušin/Pečan-Počiŋga) *šúźź̂* and Eastern Mari *šujźo* that would be irregular if the proto-form had been disyllabic instead. (The specific proto-form which Bereczki et al. propose is *ćuwićз and they argue that the correspondence *s ~ ś* across dialects requires reconstructing initial *ć-. However, considering the palatal nature of the medial *-ć-, it is far more parsimonious to assume original *š-, which in some dialects assimilated to the medial consonant, producing *ś- which then gave modern *s-*.)

resemblance" to Iranian *syāma- 'black' (see Mayhofer 1992–2001: II 661 for the reflexes of this (Indo-)Iranian root). However, evidence is lacking for the existence of a descendant of Iranian *syāma- in steppe Iranian; Ossetic – as the descendant of the Alanic spoken in the south Russian steppes – preserves only a root of a different shape, *saw* 'black' < *syāwa- (Cheung 2002: 222–223).

Above it was stated that Veršinin's dialectal data supports Aikio's assumption of a second lowering of *i > *e* before sonorants in Meadow and Eastern Mari, as this is found in *leβe, pembe, šen, βeleš, βem*, and *βeŋe*. In all of Veršinin's dialects, this second lowering appears to have affected also borrowings from Chuvash, cf. Veršinin's *em* 'medicine' < Cv. *im* versus *im* in MariW, Veršinin's *er* 'morning' vs. MariW *ir*, and Veršinin's *terke* 'plate' < Cv. *tirkĕ*.

Yet while most Meadow Mari dialects reflect both Chuvash *i* and *ï* as *e*, certain of Veršinin's Eastern Mari dialects reflect Cv. *i* as *e* but Cv. *ï* as the *u³* vowel. Since it was suggested above that the *u³* vowel is the result of contraction of a Proto-Mari sequence *-iə-, this points to Cv. *ï* having been in fact borrowed into Mari as the sequence *iə, preserved as such in certain of Veršinin's Eastern Mari dialects, and only later merging with *e* in other dialects. After all, the Chuvash high back unrounded vowel *ï* has no counterpart in the Mari vowel system and would have posed a challenge of assimilation to Mari speakers.

If Chuvash *ï* were borrowed into Mari as a sequence that would be reflected among Veršinin's dialects as the *u³* vowel, then this could have had ramifications for the etymology of Mari *βer* 'place'. Fedotov (1990: 179) suggests that the Mari word represents a borrowing of Cv. *vïrăn* id. Veršinin's data on Mari *βer* shows a uniform *e* vocalism and not the *u³* vowel. If these Eastern Mari varieties show only the form *βer*, then along with MariE *βer* W *βär* documented from other dictionaries, perhaps the word is to be reconstructed as PMari *βer and represents inherited material instead of being a loan from Chuvash.

Unfortunately however Veršinin does not clearly state which of his Eastern Mari dialects have the *u³* vowel, which would allow the reader to determine if *e* is given as the sole vocalism simply because no form whatsoever was elicited from one of the dialects which possess *u³*. A similar conundrum exists in the case of Mari *serlaɣem* 'уберечь от беды' < Cv. *śïrlăx* (on the etymology see Fedotov 1990: 240), where absence of evidence for the *u³* vowel in Veršinin does not necessarily mean evidence of absence.

4. Palatalized *ŕ* in the Krasnoufimsk dialect

A palatalized *ŕ* exists in certain Mari dialects alongside unpalatalized *r*. These have been briefly touched on by Gruzov (1969: 177–178) and Bereczki (1994: 64), who mention the phenomenon's existence in the Volga dialect, the Kilʹmez dialect and in islands of Tatarstan and Bashkiria. Gruzov dates the rise of this phenomenon to the 17th and 18th centuries and notes its presence in early written sources for the Mari language.

Tscheremissisches Wörterbuch contains data on the Krasnoufimsk dialect in phonetic transcription, as gathered by Arvid Genetz in the village of Nižnij Potam. The Krasnoufimsk data stands somewhat at odds with the picture given by Gruzov and Bereczki. Firstly, Gruzov emphasizes that the palatalized *ŕ* in the Russian source words was replaced by a hard *r* in these dialects, and he cites the following examples: *радам*, *рат* 'ряд', *лар* 'ларь', *лодыр* 'лодырь', *понар* 'фонарь', *кир*, *кира* 'гиря', and *косор* 'косарь'. This lack of palatalization is found in Krasnoufimsk *rat* and *ponar* (Mari *lar*, *loδǝr*, and *kosor* are not attested from the Krasnoufimsk dialect in Genetz's material). However, in its borrowing of Russian *гиря*, Krasnoufimsk does indeed show a palatalized *ŕ*: *kiŕ*.

Secondly, Bereczki speaks of Mari *r* undergoing palatalization in these dialects mainly under the influence of the vowel *i*. In the Krasnoufimsk dialect, however, the data actually shows that palatalization occurred mainly in the environment of the vowel *e*.

The examples of Krasnoufimsk palatalized *ŕ* in TschWb are few enough that they can be cited here in full. Note that in some cases the editors of TschWb did not write *ŕ* for the Krasnoufimsk form in the headword, but further down in the entry the Krasnoufimsk resonant is indeed marked as palatalized. For example, TschWb gives "*meraŋ* Ob$_1$ Oka Okr Mm$_2$", where the abbreviation Okr represents the Krasnoufimsk dialect, but a few lines later "*meŕaŋ-gaška* Okr Falle".

Thus the examples of Krasnoufimsk palatalized *ŕ* along with the Proto-Mari form and/or, in case of loanwords,[6] the source form, are the following:

- *βeŕ* 'place' < PMari *βer or Cv. *vïrǎn*
- *βeŕa* 'religion' < Ru. *вера*
- *βüŕaŋ* 'Tüderstrick' < *βŭräŋ < Cv., also palatalized in Birsk

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6. For the Tatar loanwords, see Räsänen (1923) and Isanbaev (1994).

- *čeŕan* 'Krankhaft' < Tat. *çer*
- *čuŕi* '(Gesichts)farbe' < Tat. *çïray*, but also unpalatalized *čuri* is attested from the same dialect
- *čălβâŕ* 'Kette' < Tat. *çïlbïr*
- *eŕ* 'morning' < *ir < Cv. *ir*
- *iśeŕ* 'gelt, unfruchtbar' < Cv. *xěsěr*
- *iŕ* 'wild' < Cv. *xir*
- *jeŕ* 'lake' < PMari *jer
- *juŕan* 'regnerisch' < *jur
- *keŕam* 'hineinstechen' < PMari *kiräm
- *kiŕ* 'Gewicht' < Ru. *гиря*
- *küŕam* 'reißen, zerren' < PMari *kŭräm
- *küŕän* 'Schlitten (mit Seiten aus Lindenrinde)' < PMari *kŭrän, but *kür* 'Bast'
- *meŕaŋ* 'hare' (origin unknown, a notorious etymological crux – see Culver 2021)
- *neŕ* 'nose' in *čâra neŕ* 'Kienspan' < PMari *nir, genitive singular *neŕân*
- *śeŕ* 'riverbank' < Cv. *śir*
- *śeŕem* 'write' < Cv. *śir-*
- *šeŕɣe* 'comb' < PMari *širɣe
- *šeŕɣe* 'expensive' < PMari *širɣe
- *töŕ* 'aufrichtig, rechtschaffen', *[ik] töŕaš* 'Altersgenosse' < Cv. *türě*
- *töŕa/töŕä* 'Herr (des Hauses)' < Tat. *türä*
- *tüŕâs* 'ganz' < Tat. *döres* 'true'

Thus the most common environment for palatalized *ŕ* in this dialect is in the position after *e*, and also before *a* (< *ä), with fewer examples of *i* in spite of Bereczki's claim that this was the triggering vowel. That palatalization of *r* was triggered by specifically *e*, and not the vowel *i which was later lowered to *e* in Eastern Mari before sonorants, is suggested by *jer* 'lake'. This would mean also that in the word *šeŕɣe* 'comb' < PMari *širɣe, the palatalization must date well after the early lowering of PMari *i > *e* before *r*. Similarly, if 'sled' is to be reconstructed as disyllabic *tiər or the like, then palatalization was presumably subsequent to contraction: *tiər > *ter > *teŕ*.

Besides the general tendencies of palatalization due to the vocalic environment that are clear from Genetz' data, Krasnoufimsk *čălβâŕ* 'Kette' < Tat. *çïlbïr* suggests that an initial palatal consonant could palatalize a following *r*, as both the Tatar source form and the Krasnoufimsk word are

back-vocalic. The same is probably true of *čuŕi* '(Gesichts)farbe' < Tat. *çiray* and *juŕan* 'regnerisch' < *jur.

In spite of the above-cited data where palatalized *ŕ* is clearly documented in Genetz' data as represented in TschWb, there are a number of examples of comparable phonetic environments with *e* or other front vowels where no palatalization is attested:

- *βińer* 'Leinen, Leinwand' < PMari *βəńer
- *βüräŋeš* 'mit Blut beschmutz werden' < PMari *βŭräŋeš
- *eŋer* 'river' < PMari *eŋer
- *ere* 'sauber' < *ire < ? Cv. *ïrä*
- *jə̂raŋ* 'Beet' < *jərän < Cv. *yăran*
- *kerγe* 'Schwartzpecht' < PMari *kirγə
- *śerlaγem*, *śə̂rlaγem* 'erlösen, begnadigen, erbarmen' < Cv. *śïrlăx*
- *šer* 'Ader' < PMari *ser
- *tör* 'hinterer Teil des Raums' < Tat. *tür*

The reason for the lack of palatalization in these cases is unclear. It is possible that Genetz did not note down every instance of palatalization when collecting his data, or that the editors of TschWb obscured the presence of Krasnoufimsk palatalization when they combined his data from this dialect with that from other dialects. Nevertheless, those cases of clear palatalization cited above suffice to provide a more accurate view of this phenomenon than the traditional picture in Gruzov and Bereczki.

5. The Proto-Mari consonant clusters *-zγ-, *-žγ- and *-źγ-

Proto-Uralic did not permit voiced clusters consisting of a sibilant followed by a velar, while those unvoiced sibilant + velar clusters which did exist in PU are preserved as unvoiced in Mari, cf. for example Mari *šüškam* 'cram, pack' < PU *süskä, Mari *kəškem* 'throw' < PU *kiśkɜ- (UEW 667, 768). Consequently, any voiced sibilant + velar cluster in Mari must have arisen through either loss of an intervening vowel or borrowing.

In his survey of Mari consonantism, Bereczki (1994: 30–64) traced the evolution of Mari consonants and consonant clusters out of those which existed in Proto-Uralic. Consequently, his survey did not cover voiced clusters. Here I wish to fill in this gap by examining certain voiced clusters consisting of a sibilant followed by the velar fricative.

Firstly, MariE *küžγö* NW *kŭžγŭ* W *kəžγə* 'thick' but Malmyž *küźγö* (in Beke), *küzγö* (in Isanbaev 1964: 97) allow reconstructing PMari *küzγə, as the Malmyž dialect preserves a distinct reflex of the Proto-Mari sibilants *s, *z in a front-vocalic environment when all other dialects shifted them to š, ž.[7] (UEW 161 also connects this word to Permian and Khanty material suggesting PU *s, which would give PMari *z.). Consequently, *-zγ- clusters can be assumed to have existed by the Proto-Mari era.

Similarly, we can reconstruct the presence of *-žγ- clusters for Proto-Mari on the basis of, for example, Mari *šüžγe* 'colic pains, sharp sticking pain'.[8] The existence of Malmyž *šüžγe* (as attested in Beke) against *šüžγe* elsewhere in Meadow, Eastern, and Northwestern Mari (the word is not attested from Hill Mari) demands this reconstruction, as if the Proto-Mari cluster were *-zγ- instead, the Malmyž dialect would show instead **šüźγe*.

However, in the case of Mari *üzγar* 'tool, utensil, equipment; object, thing, item', we find that some dialects show the medial cluster -žγ- while others show -zγ-, and this opposition is not limited to the Malmyž dialect versus all others. Such a correspondence cannot regularly go back to either *-zγ- or *-žγ-, and this fact suggests that we are dealing with a different cluster at the Proto-Mari stage. The medial clusters attested in this word across the Mari dialects (as documented in TschWb, Beke, and Veršinin) are as follows:

-žγ-:   Hill Mari, Northwestern Mari, Birsk, Krasnoufimsk, Sernur, Mari Ušem, Volga, Upša, some Morki varieties
-zγ-:   Kugu Molamas, other Morki varieties, Menzelinsk, Bol′šaja Šija

Beke's form *ŭźγar* from the Kugu Molamas dialect, as well as the form (dialect unspecified) ‹ÿзыгäр› in the dictionary of Troitskij (1895) show a clearly palatal *ź*. This allows us to conclude that in the cases where *z* is found in the cluster, this is the result of the depalatalization of PMari *ź

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7. PMari *z can often be reconstructed on the basis of the reflex *ź* in a front-vowel environment in the Malmyž dialect versus *ž* elsewhere in Mari: MariE *môžer* 'caftan' but Malmyž *miźer*, MariE *keŋež* 'summer' but Malmyž *keŋeź*; for the latter word, see Bereczki et al. (2013: 50).
8. Important to note for the present discussion is that the headword **šüžγe** in Beke's dictionary must be viewed as a misprint for **šüžγe**. In all of Beke's example sentences under the entry with that headword, we find instead forms with *ž*, and this is reflected also by all other sources on the Mari lexicon.

in most Mari dialects,[9] and not an instance of the later *z* found in Tatar borrowings where no Mari dialect shows a palatalized sibilant (e.g. Mari *teŋ̂z* 'sea'< Tatar *deŋiz*).

Thus we are confronted here with a vacillation between *z* (or a still palatal *ź*) and *ž* on the one hand, and between front and back labial vowels on the other. While Aikio (2014a) reconstructed the word as *ŭžγar* with front vocalism and original *ž, I believe that the diverging dialectal outcomes are better explained by a proto-form *ŭźγar with back vocalism and a different PMari cluster. The reflexes with front vocalism would then be due to the fronting effect of the following palatal *ź (as in the case of PMari *pŭśkəla 'sting' and *kuźem 'climb' discussed above), and the seemingly irregular correspondence *z ~ ž* has resulted from different dialectal treatments of the *-źγ- cluster.

No solid etymology for Mari *üzγar* 'tool' has been proposed; the attempt of Veršinin (2017–2018: 581) to connect the word to Mari *ə̂štem* 'do' or Finnish *askar* 'work' can be dismissed due to the completely irregular sound correspondences. However, we find a strikingly similar counterpart to Mari *üzγar* in Ossetic, the descendant of the Alanic language once spoken in the South Russian steppes and the source of a number of Mari words. In Ossetic, the word *zγär* originally denoted 'armor' and has cognates in Khwarezmian and Pashto, all derived from Proto-Iranian *uz-gar (Abaev IV 308–309; Lurje 2019: 512). However, as Abaev notes, the Ossetic word has come to mean also simply 'metal' (and the derived adjective *zγällag* – attested in *zγällagkom* 'удила' assumes solely a meaning 'metal'). As further examples beyond Abaev's one can cite the compounds in the modern Digor dialect *zγärävdozän* 'болт' and *zγärbenden* 'трос', where all reference to 'armor' is lost. The borrowing of a word 'metal item, metal tool' from Alanic into Mari would be completely in harmony with the fact that other Mari words for metal-working were ultimately borrowed from Iranian, cf. Mari *kürtńö* 'iron' (UEW 653; see Holopainen 2019: 121–125 for a more exhaustive treatment).[10] Within Mari the meaning of the word then underwent semantic bleaching from 'tool' to 'object' in general.

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9. For a clear explanation of the reconstruction of the value *ź (< *ć) for this consonant and its reflexes, see Aikio (2014b: 86–87).
10. Furthermore, Iranian *zγar was borrowed also into Khanty (Joki 1973: 323), though there solely in the original meaning 'armor'.

The Alanic initial cluster would have required adaptation to Mari phonotaxis, and the back reduced labial vowel *ŭ has been a favored means of adapting phonologically impermissible initials, cf. for example MariE *užaβa* W *ȗžaβa* 'frog' < Ru. *жаба* id. (see Savatkova 1969).

To the best of my knowledge, this is the only instance where the cluster *-ʒ́ɣ- can be reconstructed in ordinary vocabulary; in the phonological history of Mari, this cluster clearly played a marginal role. In fact, it is doubtful whether such a voiced cluster would have even been possible in the inherited Uralic material: unlike the sibilants *z and *ž which could be voiced word-finally, the affricate *ć was voiced only medially while remaining unvoiced word-finally (an alternation which remains operative in Mari today, cf. *kambozam* 'fall' with the imperative *kamboč* 'fall!'). Consequently, addition of a velar-initial suffix could have produced only an unvoiced cluster instead.

Nevertheless, I argue that *-ʒ́ɣ- was eventually viewed as a permitted cluster, for it had already arisen in onomatopoeic or sound-symbolism roots, a highly productive class of words in Mari. For example, the notion 'thick (of hair), shaggy' is expressed by such forms as MariE Kukmor *lözɣa*, Birsk *lüžɣä*, Upša *lŭžɣa*, MariW *lȗzɣitä*, etc. (cf. also *lözmön* id.), where we can suppose earlier *-ʒ́ɣ-.

One might wonder, however, why the Alanic *-z- would be reflected by an affricate *ʒ́ in Mari. It may be simply that phonetically, Alanic *z was simply closer to PMari *ʒ́ to Mari ears than to *z; in the dialects of modern Ossetic, /z/ is realized as [z] or [ʒ] (Abaev 1964: 7). Yet, this is not a phenomenon limited to Mari. As Sampsa Holopainen has recently emphasized in an unpublished conference presentation, Permian shows an affricate for Iranian *z in certain loanwords listed by Rédei (1986): Proto-Permian *erʒí 'eagle' borrowed from Iranian *r̥zi- < *r̥dzi-, cf. Av *ərəzi-fiia-* 'Adler', and Proto-Permian *bäriʒ́ 'linden' borrowed from Iranian *barza- (< Proto-Indo-Iranian *bhr̥Hʒ́a-) > Oss *bærzæ*.

If we accept this etymology, then it entails some matters of relative chronology. Firstly, the Alanic word must have been borrowed into pre-Proto-Mari subsequent to the pre-Proto-Mari development of voiced sibilant+velar clusters through syncope, because if the Proto-Uralic phonotactic constraint of only unvoiced clusters still existed, one would have expected the source voiced cluster to be reflected by an unvoiced cluster in Mari. Secondly, turning once more to the dialectal reflexes of PMari *ŭʒ́ɣar, from those forms with both *ü* and *ž*, we can conclude that the shift

of the PMari cluster *-źγ- to -žγ- in those dialects was subsequent to fronting of the first-syllable vowel, as the new non-palatal *ž* would have bled any environment for vowel fronting.

Finally, as an example of the light that the prehistory of Mari might shed on other languages of the region, the ancestor of Ossetic *zyär* must have gained the meaning 'metal' in addition to 'armor' already while its Alanic ancestor was still spoken in the South Russian steppes in proximity to Mari, and not later when the language became restricted to the North Caucasus. This may already be implied by the derived adjective *zyällag* 'metal' < *zγär+i̯ag, as the Pre-Ossetic shift of *ri̯ > *ll was complete already by the early first millennium AD on the basis of onomastic evidence (Palunčić 2019: 313).[11]

Abbreviations

Cv.	Chuvash
Mari E	Meadow and Eastern Mari
NW	Northwestern Mari
W	Hill Mari
Me	Menzelinsk dialect of Eastern Mari
Ši	Bol'šaja Šija dialect of Eastern Mari
Mamad.	Mamadyš dialect of Eastern Mari
PMari	Proto-Mari
PU	Proto-Uralic
Ru.	Russian
Tat.	Tatar

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11. A peer reviewer suggests that *zyällag* 'metal (adj.)' could have been formed later on the basis of analogy with other examples of nouns in *-r* versus derived adjectives in *-llag*, as "the suffix *-i̯āg was quite productive in Ossetic". However, Cheung (2002: 115) presents examples of coinages subsequent to the sound change *ri̯ > *ll where the consonant *r* is preserved in the derivation, and furthermore the derivation features what Cheung calls Late *i*-Epenthesis: *bajrag* 'foal' < *bar 'horse'; *bazajrag* 'pertaining to the bazar' < *bazar* (< Persian); and *caγajrag* 'slave (adj.)' < *caγar* 'slave'. Consequently, the expected late formation from *zyär* + *-i̯āg would be **zyäjrag*. Moreover, if Komi *körtvom* 'horse bit (lit. metal mouth)' is indeed a calque of *zyällagkom* id. as Abaev (IV 308) suggests, then this is additional evidence that *zyar* came to mean generic 'metal' – and the corresponding adjective *zyällag* was coined – when Alanic was still spoken in the steppes, not later.

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Appendix:
Reflexes of the Proto-Mari reduced labial vowels across the Mari dialects

The following tables extend those in Aikio (2014a) to encompass also the Menzelinsk (Me) and Bol′šaja Šija (Ši) dialects of Eastern Mari as documented in the dictionary of Veršinin or, in cases where data is missing in Veršinin, from Isanbaev (1964). Aikio's transcription of Mari, somewhat different than the traditional transcription used in this paper, is preserved, as is the consequent alphabetical order. The question mark (?) denotes cases where Veršinin included the word in his dictionary but did not give a clearly labeled Me or Ši form, while blank entries reflect the total absence of the word from Veršinin's dictionary and from Isanbaev (1964). Reflexes in the Me and Ši dialects which are judged irregular are denoted in bold. Note the following changes from Aikio's table: *kŭsedək* 'lapwing' has been removed as this is a Permian loanword (Bereczki 1977: 69–70), the irregular dialectal correspondences of which suggest a post-Proto-Mari borrowing; the proto-forms of Mari *küžγö* 'thick' and *üzγar* 'tool; object' have been altered from Aikio's version to reflect the reconstructions argued in the present paper; and instead of Aikio's proto-form *pŭdešta-* 'burst', the Kukmor dialect form *puδestaltam* in Veršinin's dictionary and the Malmyž form *puδeśtal-* in Beke's dictionary suggest PMari *pŭdesta-* instead.

Proto-Mari *ŭ

	Me	Ši
*čŭme- 'tread'	ŭ	ə̂
*jŭgəńča- 'have hiccups'	?	?
*jŭle- 'burn'	?	?
*jŭmə 'god'	?	?
*jŭt 'night'	?	?
*kŭ- (interrogative pronoun root)	?	?
*kŭče- 'hold, grab'	ŭ	
*kŭdala- 'run (animal); ride fast'	?	?
*kŭdakša- 'take off'	ŭ	?
*kŭm 'three'	ŭ	ə̂
*kŭmda 'broad'	ŭ	?
*kŭme- 'close the eyes'	?	?
*kŭmək 'upside down'	?	?

	Me	Ši
*kŭməž 'birch-bark'	ŭ[a], ə̂[b]	ə̂
*kŭpe- 'get mouldy'		
*kŭpšəľə 'jay'	?	?
*kŭptərge- 'get wrinkled'	?	?
*kŭrala- 'plough'	ŭ	ə̂
*kŭrək 'mountain'	ŭ	ə̂
*kŭrəkš 'bark basket'	?	?
*kŭrgə 'food, fodder'		
*kŭrgəža- 'run'	?	ə̂
*kŭrməcak 'woodcock'		
*kŭškeda- 'tear'	?	?
*kŭškəža- 'mount (horse)'	ŭ[c]	?
*kŭt 'length'	ŭ	u
*kŭtkə 'ant'	ŭ	ə̂
*kŭwa 'old woman'	ŭ	?
*kŭwəl 'bubble'	?	?
*kŭž 'urine'		
*lŭda- 'count'	?	u
*lŭdə 'duck'	?	?
*lŭge- 'mix'	?	?
*lŭj 'marten'	?	u
*lŭk 'corner, bend'	?	?
*lŭkta- 'take out'	ŭ	?
*lŭm 'snow'	u	ə̂
*lŭmej 'blackfly'		
*lŭpš 'dew'	u	ə̂
*lŭpš 'whip'	?	ə̂
*lŭške- 'loosen'	ŭ	u
*mŭncalte- ~ *pŭncalte- 'slide'	?	?
*mŭč 'end'	?	?
*mŭcə 'hazel grouse'	?	?
*mŭčə-wuj 'tussock'	ŭ	?
*mŭgəľə 'gnarl'	?	?
*mŭgər 'bend'	?	?
*mŭndəra 'ball (of yarn)'	ŭ	ə̂
*mŭnə 'egg'	ŭ	ə̂
*mŭńəj 'toad'	ŭ	ə̂
*mŭrə 'song'	ŭ	?
*mŭška- 'wash'	ŭ	ə̂
*mŭškəndə 'fist'	ŭ	?
*mŭžeda- 'tell the fortune'	ŭ	ə̂

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a. As cited in Isanbaev (1964).

b. As cited in Veršinin's dictionary.

c. On the basis of *kŭškŭžmo* 'вторник' (lit. 'riding day') cited in Isanbaev (1964).

Some details of Mari historical phonology

	Me	Ši
*mŭžə 'illness; evil spirit'	?	?
*mŭsge- 'chew something soft'		
*nŭcəl- 'scratch'	ŭ	ə̂
*nŭgədə 'thick (of fluids)'	ŭ	?
*nŭle- 'lick'	?	?
*nŭlgə 'silver fir'	?	?
*nŭnə 'they'	??	??
*nŭr 'field'	ŭ	?
*nŭška-, *nŭškəšta- 'crawl'	?	?
*pŭč 'stalk, tube'	?	?
*pŭče- 'fall (of water level)'	?	?
*pŭčəšte- 'itch'	ŭ	ə̂
*pŭdesta- 'burst'	?	?
*pŭdərge- 'break'	ŭ	ə̂
*pŭl-wuj 'knee'	ŭ	ə̂
*pŭn 'hair'	ŭ	ə̂
*pŭncala- 'wring'	?	?
*pŭndaš 'bottom'	ŭ	ə̂
*pŭne- 'braid'	?	ə̂
*pŭńəlmə 'bumblebee'	?	?
*pŭnəške- 'get moldy'	**u**	?
*pŭra- 'bite, chew'	?	?
*pŭre- 'enter'	ŭ	ə̂
*pŭrgeda- 'hoe, dig up, burrow'	?	?
*pŭrgəšte- 'snow over'	?	ə̂
*pŭśkəla- 'sting'	?	ə
*pŭš 'boat'	**u**	?
*pŭškeda- 'have diarrhoea'	ŭ	?
*pŭškədə 'soft'	ŭ	ə̂
*pŭt, *pŭtərak 'strong'	ŭ	?
*pŭžar 'plane'	?	ə̂
*rŭde- 'unbind'	?	?
*rŭmbək 'mud'	ŭ	?
*šŭgəńə 'lever'		
*šŭldər 'feather'	ŭ	?
*šŭle- 'melt'	ŭ	ə̂
*šŭləkš 'boot leg'	?	ə̂
*šŭma- 'get tired'	?	ə̂
*šŭme- 'whet'	ŭ	ə̂
*šŭŋgalta- 'fall head-on'	ŭ	ə̂
*šŭpša- 'pull, suck'	ŭ	ə̂

	Me	Ši
*šŭr 'shit'	ŭ	ə̂
*šŭre- 'pound, crush'	?	ə̂
*sŭwan 'boil, abscess'	ü	?
*šŭwəkš 'leather sack'	?	?
*tŭdə 'this'	ŭ	**u, ə̂**
*tŭgər 'shirt'	ŭ	**u, ə̂**
*tŭjə 'sick, lean'	?	?
*tŭl 'fire'	ŭ	ə̂
*tŭnəma- 'learn'	ŭ	?
*tŭŋgər 'thick tree bark'	?	ə̂
*tŭp 'back'	ŭ	?
*tŭpka 'heckeled flax or hemp'		
*tŭrta- 'shrink'	ŭ	ə̂
*tŭrəža- 'trample'	ŭ	?
*tŭške- 'glue'	ŭ	ə̂
*tŭšte- 'ask a riddle'	?	**u**
*tŭtəš 'often, constantly'		
*tŭwəle- 'defend, rescue'		
*tŭwərge- 'curdle, turn sour'	ŭ	?
*ŭdəla- 'pray for'		
*ŭdəre- 'rake'	ŭ	ə̂
*ŭla- 'be'	ŭ	
*ŭlde- 'ask for'	**ə̂**	ə̂
*ŭĺmə 'man'	?	?
*ŭmša 'mouth'	ŭ	??
*ŭmər 'warm'	ŭ	ə̂
*ŭmbal 'distant'	?	ə̂
*ŭre- 'put in the ground'		**u**
*ŭrə 'two handfuls'		**u**
*ŭrge- 'sew'	ŭ	ə̂
*ŭškal 'cow'	ŭ	∅
*ŭžar 'green'	ŭ	ə̂
*ŭžga 'fur-coat'		
*wŭcək 'much'	**u**	?
*wŭče- 'wait'	**u**	**u**
*wŭĺe- 'get spoiled'	**u**	?
*wŭlnə 'tin'	?	ə̂
*wŭrde- 'tend'		
*wŭrgem 'clothes'	ŭ	ə̂
*wŭrgəže- 'be restless'	ŭ	**ŭ**
*wŭrt 'heddle'	ŭ, ə	ə̂
*wŭž (onomatopoetic root)	?	?
*wŭžale- 'buy'	**ŭ**	**u**

Proto-Mari *ŭ

	Me	Ši
čŭčə 'maternal uncle'	?	ü
čŭdə 'lack, need'		
čŭŋge- 'peck (of birds)'	?	ü
kŭč 'nail'	?	?
kŭče- 'beg'	?	?
kŭcə 'knife'	?	?
kŭdər 'black grouse'	ŭ	ə
kŭdərte- 'thunder'	?	ə
kŭnčä- 'dig'	**ü**	?
kŭpš 'shag'		
kŭr 'bast'	?	ə
kŭra- 'tear, rip'	ŭ	ə
kŭrtńə 'iron'	ŭ	ə
kŭzgə 'thick'	ŭ	?
lŭgəšte- 'itch'	?	?
lŭkə 'boggy area'	?	?
lŭm 'name'	ŭ	**ü**, ə
lŭmə 'scab'	?	?
lŭŋge- 'rock'	ŭ	?
lŭškalta- 'shake, swing'	?	?
lŭšte- 'milk'	ŭ	?
mŭndər 'far'	ŭ	?
mŭškər 'belly'	ŭ	ə
nŭštala- 'blow one's nose'	?	?
nŭškə 'blunt'	?	**ü**
nŭža- 'scrape'	?	?
pŭčka- 'cut off'	**ü**	ə
pŭnčə 'pine'	ŭ	?
pŭrde- 'cover with a cloth'	?	?
rŭce- 'shake'	**ü**	**ü**
rŭdaŋa- 'rust'	**ü**	?
rŭde- 'pick, pluck'	?	**ü**
rŭdə 'core'	?	?
rŭm(b)alge- 'get dark'	ŭ	?
rŭpśe- 'rock'	ŭ	?
rŭškalta- 'quake, rumble'	?	?
rŭškə 'gnarl'		
sŭdər(n)e- 'drag'		

	Me	Ši
sŭke- 'shove'	?	ə
sŭlə 'fathom'	ŭ	ə
sŭm 'sense of touch'	?	?
sŭre- 'smear'	?	?
sŭrtńe- 'trip, tumble'	ŭ	ə
sŭwəce- 'shell (nuts)'		
šŭc 'soot'	?	?
šŭdəkš 'barrel hoop'	**ü**	**ü**
šŭdər 'spindle'	ŭ	ə
šŭgə 'bark beetle'	?	?
šŭm 'heart'	ŭ	?
šŭm 'scale'	ŭ	ə
šŭrgə 'cheeks, face'	ŭ	?
šŭrgə 'forest'		
šŭrtə 'yarn'	ŭ	?
šŭška- 'stuff'		
šŭštə 'leather'	?	?
šŭwala- 'spit'	ŭ	ə
tŭŋ 'base'	ŭ	ə
tŭr 'edge; blade'	ŭ	ə
tŭreda- 'harvest'	ŭ	ə
tŭrəs 'full'		
tŭrwə 'lip'	ŭ	?
tŭrwənca- 'sneeze'	ŭ	ə
tŭška 'group (of people), herd'	?	ə
tŭwət 'entirely'		
tŭžem 'thousand'	ŭ	ə
ŭdər 'girl, daughter'	ŭ	ə
ŭśkərt 'stubborn'	?	?
ŭštə 'belt'	ŭ	?
ŭźgar 'thing'	?	**ü**
ŭžəwər 'common swift'	?	?
wŭčə 'cut, notch'		
wŭl- 'on, up, over'		
wŭl/ľə 'mare'	ŭ	ə
wŭr 'blood'	ŭ	ə
wŭrgeńə 'copper'	ü	ə
wŭt 'water'	ŭ	ə
wŭteľə 'snipe'	?	?