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Observations on the Reflexes *k*- and *h*- for Initial **k*- in Hungarian

Jan Henrik Holst

ABSTRACT

Hungarian has a well-known sound law **k*- > *h*- before back vowels, which is seen e.g. in Hungarian *hal* 'fish', cognate with Finnish *kala* 'fish'. Old Hungarian exhibits *ch*-, i.e. IPA [x-], which represents an intermediate stage. This paper presents a couple of reflections on the sound law. First of all, another intermediate stage **q*- (voiceless uvular plosive) is reconstructed in order to arrive at phonetically plausible developments. Moreover, the investigation treats the law's consequence that inherited words usually show either *k*- + front vowel or *h*- + back vowel, and how this state of affairs was blurred. In addition, the relation between diachronic change and synchronic systems is briefly looked at. Finally, the text investigates interrogative pronouns with former **k*- in Hungarian and draws attention to interrogative pronoun systems from other languages which developed in a parallel way – and it is here where things become interesting for long-range comparison.

Contents:

1. INTRODUCTION

Uralic initial **k*- is represented in Hungarian in two ways, as is well known: partly as *k*-, partly as *h*-. There is a sound law: under certain conditions **k*- was shifted, and today's result is *h*-. If, however, the conditions were not met, **k*- was preserved as *k*-. The overall event is therefore a split: from a single sound, two reflexes arise. The conditioning for the sound law is known as well: it applied before back vowels, while before front vowels the shift did not apply. (The development of medial **-k-* in Hungarian is different; it ends up as *-v-*, with a different result or with no reflex at all, see Sammallahti 1988: 516, but the present paper will not be concerned with medial **-k-*. A new medial *-k-* arises from Uralic **-kk-*.)

There are numerous examples for what has been said; the facts can be illustrated by comparison with Finnish, which preserved *k*-:

***k- > k-:**

Hungarian	Finnish	*Gloss*
kéz	käsi	*'hand'*
könny	kyynel	*'tear'*
kő	kivi	*'stone'*
köt	kytke-	*'to tie'*
kettő	kaksi	*'two'*

***k- > h-:**

Hungarian	Finnish	*Gloss*
hal	kala	*'fish'*
hal	kuole-	*'to die'*
három	kolme	*'three'*
hall	kuule-	*'to hear'*
hat	kuusi	*'six'*

In 'two' Finnish exhibits a back vowel, but what counts is what was present in Hungarian (to be more precise: present in Hungarian at the time when the law applied), and that was a front vowel.

In Old Hungarian, instead of *h* a voiceless velar fricative appears, IPA [x]; hence in the oldest documents, e.g. the Halotti Beszéd, *chomuv* is found for *hamu* 'ashes' and *chod* rather than *had* 'army' (the orthographic representation as *ch* is the same as in Czech and German). The second word is cognate with Finnish *kunta* 'municipality'.

The statements and data laid out so far are well-known. They are mentioned in introductions to Uralic linguistics, and they also found entry into a general textbook on historical linguistics (not tied to a specific language family or region): Campbell (1998: 132–137). At first glance it looks as if there was not much to add to the topic. On a closer look, however, a couple of remarks arise, which will be made in the following.

Section 2 offers a specification of the phonetic development, section 3 points out a consequence for the vocabulary of Hungarian, section 4 highlights the relation between the diachronic events and the synchronic linguistic system, and section 5 treats the Hungarian interrogative pronouns in a wider context.

2. SPECIFICATION OF THE PHONETIC DEVELOPMENT

As already laid out, Old Hungarian did not have *h*-, but *x*- (*ch*-). Therefore, when writing **k*- > *h*-, this is a shortening for **k*- > *x*- > *h*-. Abbreviating notations are legitimate with phonetic (and other) changes since often the goal is merely to focus on the starting-point and the end-point of a development; for a more elaborate presentation the intermediate stage can be inserted.

With **k*- > *x*- > *h*- the second part *x*- > *h*- is unconditioned: all *x* are shifted to *h*, so that *x* now does not exist any longer. The conditioning to have a back vowel following, addressed in section 1, refers to the first part, **k*- > *x*-. Using a diagram, the split of Uralic initial **k*- can be depicted as follows:

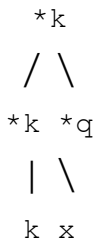
Here the oblique line represents the change before back vowels, while the vertical line stands for the preservation of the original consonant.

At this point a critical reflection can start, based on phonetics. As is well-known, *k* is a voiceless velar plosive (stop), and *x* is a voiceless velar fricative. Hence what changes here is the manner of articulation: from plosive to fricative; the other features – in the phonetic sense of the term – remain unchanged. But why, after all, should a plosive develop into a fricative in the neighbourhood of back vowels? Phonetically this is not straightforward. Sound laws are not haphazard, but every sound law has a phonetic background. That this critical questioning arises is due to a way of reasoning which has not been pursued much yet in linguistics, and not either in Uralic studies very much. From time to time the situation arises that a sound law can admittedly be inferred from a formal point of view, but this leaves an aftertaste since the law does not really make sense from a phonetic point of view. In such cases the impression arises that the actual events of language history have not been captured yet in their entirety.

In the Hungarian case at issue the data do not permit doubts on the following circumstance: Uralic **k*-, which is preserved in Finnish and many other daughter languages as such and which can be reconstructed unequivocally, is represented in Old Hungarian as *x*- before back vowels. In such problematic cases the solution can be that an intermediate stage should be assumed. This applies here as well, as will be argued now. (This is about an intermediate stage between **k*- and *x*-. The fact that *x*- is itself an intermediate stage on the way to modern *h*-, see section 1, is irrelevant in this context.) The task is to find a relation between back vowels and a possible event which may affect **k*-.

Back vowels cannot shift a plosive to a fricative; there is no reason for this to happen. What back vowels

can do, however, is to shift the consonant **k* itself further back; as with so many sound laws this is an assimilation at the end of the day. The result then is a uvular (or post-velar) plosive, which in many linguistic fields, also Uralic studies, is written *q*. Precisely this event should be assumed for Hungarian. In a second step then, the uvular plosive becomes *x*; this is a typical development as well. Seen from the perspective of this view, the diagram given above is only an abbreviation, and the full events are:



Here the first oblique line represents the conditioned rise of **q*, and the second oblique line describes an unconditioned sound change. The literature usually only speaks of **k*- > *x*- – e.g. Kálmán (1972: 50), Sammallahti (1988: 516), Mátai (2002: 16), and further sources could be adduced. However, **q* is required as an intermediate stage in order to arrive at a phonetically plausible development.

Both parts of the development can be backed up typologically with parallels. Thus, **k* > *q* in the context of back vowels is a sound law which can be found in many languages; it can also be observed, for instance, in various Turkic languages. Since Hungarian was in contact with Turkic it could even be wondered whether this context may be responsible for the development – but *k* > *q* with back vowels is a law so simple and frequent that no such relation needs to be assumed. Moreover, among the Uralic languages themselves there are some which exhibit this law, e.g. among the Samoyed languages and among varieties of Ob-Ugric. For **q* > *x* parallels are found for instance in the history of Georgian (Fähnrich 1994: 36, Holst 2014: 34) and in the history of the neighbouring Zan languages (Holst 2014: 70). In general *q* is a plosive which can easily be shifted to a fricative. This is due to its auditive impression: when releasing the closure, it comes to an acoustic event which reminds of a fricative already. To sum up, the Hungarian development in its entirety is **k*- > **q*- > *x*- > *h*-.

3. MAIN CONSEQUENCE OF THE DEVELOPMENT OF **K*-

The main consequence of the development of initial **k*- consists of the fact that phonetically regular, from a historical point of view, are almost only such words which exhibit *k*- + front vowel or *h*- + back vowel, hence for instance *kéz* 'hand' and *hal* 'fish'. This insight should be highlighted. It is relevant for etymological research, especially when it comes to the establishing of inherited words. Moreover, it also contributes to the rise of a feel for the Hungarian language when this knowledge is at one's disposal.

In fact, Hungarian does have many words with the opposite combinations today, i.e. *k*- + back vowel or *h*- + front vowel, e.g. *kút* 'well' (noun), *hív* 'to call'. It can be investigated why this is so. The observation has mainly three causes:

- a) younger events in sound history

- b) coinages which can be called onomatopoetic, expressive etc.
- c) the adoption of loanwords

On a): The Hungarian vowel *i* has more than one regular source. It can go back to **i*, but also to a back vowel – probably the high back unrounded vowel, IPA [ɯ]. The latter option is shown by cognate sets such as Hungarian *ín* – Finnish *suoni* 'sinew'; in addition, there are loanwords such as Hungarian *ír* = Turkish *yaz-*, Chuvash *śır-* 'to write' (Hungarian *ír* stems from that branch of Turkic which contains Chuvash). The double nature of Hungarian *i* with regard to sound history can also be seen from the not constant behaviour of *i* in vowel harmony; stems with *i* from a back vowel take back vowel suffixes: *in-ak* 'sinews' (nominative plural of *ín*), *ír-ok* 'I write', *hív-nak* 'they call'. It now turns out that a word such as Hungarian *hím* 'male' (noun) corresponds with Selkup *qup* 'man, human' (with *-p* < **-m* in final position) etymologically. The crucial concept here is that of relative chronology: obviously it came first to the sound law **k-* > **q-*, and only later to the shift of the back vowel to *i*. In this way it becomes clear why the predecessor of Hungarian *hím* was affected by **k-* > **q-*: at the time of the law there still was a back vowel.

On b): The fact that onomatopoetic and similar coinages can use new combinations of sounds hardly needs any illustration.

On c): As is well-known, Hungarian took up a large number of loanwords. For generalities about loanwords in Hungarian see Benkő (1972: 176–193). It was within this context that also words beginning with *k-* + back vowel or with *h-* + front vowel entered the language, or that these combinations arose. An example is provided by Hungarian *hörcsög* 'hamster' from Slavic, cf. Serbo-Croatian *hrčak* 'hamster'. Especially interesting with regard to *k-* and *h-* are loans from Turkic languages since they fall into two groups. For the sake of comparison modern Turkish is cited in the following two brief lists. (This was not the specific contact language, but proceeding in this way is ostensive.) In one group, Hungarian has *h-*:

Hungarian	Turkish	*Gloss*
hód	kunduz	*'beaver'*
homok	kum	*'sand'*
hajó	kayık	*'ship' / 'boat'*

In the other group, in contrast, Hungarian exhibits *k-*:

Hungarian	Turkish	*Gloss*
kapu	kapı (ı < u)	*'gate'*
kút	kuyu (y < *δ)	*'well' (noun)*

kos	koç	*'ram'*

Two options arise for an interpretation with historical linguistics. With the first group, the donor languages could have been such Turkic languages which exhibited *q-* (or *x-*), so that this led to *h-* later. A different solution would work with different times: the words of the first group would have been taken up earlier, while those of the second group would have been taken up later and hence were not affected by the sound law. Research tends towards the latter view (Mátai 2002: 16). The Hungarian words of the first group make the same impression as inherited words with regard to their phonetic shape, while those of the second group illustrate the point that loanwords can exhibit *k-* + back vowel. (Both groups of words bear no relation to Ottoman rule over Southeastern Europe – the loans related to this are considerably younger, and *k-* is always represented as *k-* in them.)

There are only few words with *h-* + front vowel which do not fall under any of the three explanations but which must definitely be considered part of the basic vocabulary of Hungarian. One of these is *hét* 'seven'. This word also means 'week', which is significant, and untypical for Uralic languages. Similar data with 'seven' / 'week' are found in Iranian languages, and Hungarian *hét* has long been identified as a loanword from an Iranian source. However, the initial *h-* in *hét* is unexpected, since the absence of a consonant would be regular (**ét*). Therefore, influence from *hat* 'six' (cognate with Finnish *kuusi* 'six') has often been assumed (Honti 1993: 104); as is well-known, neighbouring numerals can influence each other. Another item of the type discussed is *hisz* 'to believe'. Décsy (1965: 176) mentions this verb in a list of Hungarian words which have no etymological counterparts in other Uralic languages but which cannot be regarded as loanwords either; hence for Décsy these words are etymological mysteries. Many years later Rédei (2001: 503) made an effort to explain *hisz* on the basis of two verbs as a contamination.

At the beginning of this section the view was expressed that knowledge of the facts discussed contributes to the rise of a feel for the Hungarian language. One will then see any word with the initial combination of *k-* + back vowel or *h-* + front vowel with different eyes. Mostly one will be dealing with a rather young word. Thus, for instance, confronted with *kulcs* 'key' one will easily arrive at the suspicion that this is a loanword, and one will then rightly be reminded of words from Slavic languages such as Polish *klucz* 'key'. (In Hungarian a metathesis occurred in order not to have an initial consonant group.) In a similar vein, *konyha* 'kitchen' (also here a metathesis is involved, concerning the consonant cluster) belongs with Polish *kuchnia* 'kitchen', English *kitchen* etc., Latin *coquīna*. These relations are relevant didactically, and it is in my opinion legitimate to point them out in a linguistic treatment.

Of course, it cannot be concluded in a reverse manner that words with *k-* + front vowel or *h-* + back vowel must necessarily be inherited items. Hungarian *kék* 'blue' is a loanword despite the fact that from a structural point of view it does not exhibit anything conspicuous; it belongs with Turkish *gök* 'sky'.

4. SOUND LAWS AND MORPHOPHONOLOGY

Conditioned sound laws often have consequences for morphophonology. In Balto-Finnic, for instance, there was a sound law **t* > *s* before *i*, and by this the nominative singular **käti* became Finnish *käsi*

'hand', while in the essive case *käte-nä* **t* remained unshifted. The result is a morphophonological alternation of *t* and *s* in the paradigm. (Further forms contain *d* < **t* due to gradation – which, however, is a different issue.) For the relationship between sound laws and morphophonology see Bynon (1977: 89f.), Haspelmath (2002: 195), Holst (2009: 147), Holst (2014: 15) and especially Holst (2023: 37, 109–112).

The Hungarian development under study could possibly have left traces in morphophonology. However, it is difficult to obtain examples – hardly any exist. This is due to the fact that Hungarian roots usually do not alter the quality of their vowels – in contrast to typical Indo-European languages, in which ablaut may make *e* and *o* alternate, for instance. Since such vowel alternations are almost totally lacking in Hungarian in the first syllable, a **k*- preceding the vowel of the first syllable could not split up into *k*- and *h*- within a paradigm or with words linked by derivation.

What does exist in Hungarian is vowel harmony. Thus, suffixes frequently have two or more allomorphs with vowels which are determined by the stem vowels. Such suffixes may begin with *k* or with *h*. An example is provided by *-hat*, *-het* 'to be able to', a suffix attachable to verbs: *mond* 'he says', *mond-hat* 'he can say'. The allomorph *-hat* is the one which corresponds to the regular makeup of inherited roots in Hungarian, while the allomorph with *-het* is not of this type. It turns out that this suffix is from a formerly independent word which still exists in the language: *hat-ni* 'to work, to operate', cf. also *hat-alom* 'power' (Collinder 1969: 413, Bárczi 2001: 57, and other sources). A similar situation exists with a local case called allative whose suffix has the allomorphs *-hoz -höz -hez*. It turns out that the original vowel in this suffix was *o*, which can still be seen in the corresponding postposition inflected for person and number: *hozzá-m* 'to me', *hozzá-d* 'to thee', etc. To cite a suffix with *k*, there is *-kor* for references to time – without allomorphy in this instance. This suffix comes from the independent noun *kor* 'age, time'.

5. THE HUNGARIAN INTERROGATIVE PRONOUNS AND THEIR WIDER CONTEXT

As seen in the previous section, usually initial **k*- did not split up in Hungarian into *k*- and *h*- in one and the same paradigm or in words connected by derivation, the reason being that a difference in vocalism in the first syllable, providing the prerequisite for such a split, usually does not exist.

There is, however, an interesting instance in Hungarian where the split of **k*- did lead to *k*- and *h*- existing side by side in interrelated words. Possibly it is not appropriate to speak of morphophonology here (this would be a matter of definition), but the words in question do indeed belong together. They constitute the major part of the Hungarian interrogative pronouns. Some space must be devoted to discussing this.

In many languages – this is a typological observation – the interrogative pronouns have a characteristic "key consonant" with which all of them or almost all of them begin (Holst 2019: 22). In Georgian, for instance, this is *r*-, cf. *ra* 'what', *rogor* 'how', *romeli* 'which' and others; exceptions are *vin* 'who' und *sad* 'where'. English has as the typical beginning *wh*-, Danish *hv*-, Swedish *v*-, German *w*-, etc. The usual reason for this finding is probably that at an earlier time one interrogative pronoun existed from which then others were formed. This is possible by compounding, for instance. In Turkish, to give an example, *ne zaman* 'when' consists of *ne* 'what' and *zaman* 'time'. A different procedure is the use of cases. Hence in

Finnish, *mikä* 'what' provides the basis for other interrogative pronouns which are formally nothing but case forms of *mikä*: *missä* 'where' is its inessive, *miksi* 'why' is its translative, etc. The causes can lie back in time to such an extent that certain specific connections are not visible any longer; thus, the Georgian data, for instance, cannot be segmented readily.

What can happen now is that with one pronoun or several a deviation arises by sound change. In Latin the characteristic consonant is *qu-* (i.e. *kw-*) as in *quis* 'who', *quandō* 'when', etc.; given that this sound loses its rounding before *u*, however, it appears as *c-* (i.e. *k-*) in *cūr* 'why' und *cūius* 'whose'. In Hungarian many interrogative pronouns exhibited **k-*, and it turns out that exactly that split is found which would have been expected by sound history. The contrast manifests itself as follows:

- *k-* in *ki* 'who', *kié* 'whose'
- *h-* in *hol* 'where', *hová* '(to) where', *honnan* 'from where', *hogy* 'how', *hány* 'how many'

Outside this system is *mi* 'what' with its derivatives such as *miért* 'why'. It pays to bring to one's mind the tracing of the above facts to a system with the consonant **k-*. The alternation *k-* / *h-* arose from the Old Hungarian alternation *k-* / *x-*, this in turn from **k-* / **q-*, and this in turn from uniform **k*.

Now the intermediate stage **k-* / **q-* in the system of the Hungarian interrogative pronouns is interesting. For precisely such a system is attested directly. Examples are provided by the Eskimo-Aleut languages, cf. Greenlandic:

- *k-* in *kina* 'who'
- *q-* in *qanga* 'when', *qaqugu* 'when', *qanoq* 'how'

While for Hungarian related languages are present which point to the once uniform **k-*, in Eskimo-Aleut access to **k* for today's *k* and *q* is possible only via internal reconstruction (Holst 2005: 212). Also, Yukaghir exhibits interrogative pronouns with *k-* / *q-* (data cited from Maslova 2003: 40f.):

- *k-* in *kin* 'who'
- *q-* in *qadā* 'where', *qan'in* 'when' (*n'* is a palatal), *quodī* 'why', *quode* 'how'

Also for Yukaghir, researchers suspect that today's *k* and *q* go back to **k*, i.e. the uvular split off from the velar under certain conditions (Fortescue 1998: 72, 91 fn. 22). Finally, Classical Mongolian constitutes another example (data cited from Grønbech / Krueger 1976: 41):

- *k-* in *ken* 'who', *kedün* 'how many', *keǰiye* 'when', *ker* 'how'
- *q-* in *qamiγa* 'where'

Hence several languages, independently, developed out of a system with *k-* one with *k-* / *q-*. Based on the insights of the present paper, Hungarian belongs here as well. This language, however, subsequently went two steps further with its development **q-* > *x-* > *h-*.

The split of **k-* depending on the following vowel is not surprising since it is, as laid out in section 2, phonetically commonplace and frequently attested. The question can be raised, however, why the characteristic consonant is **k-* in several language families of Eurasia – and not a different consonant such as the Georgian *r-*. The correspondences between Hungarian (at an early stage), Eskimo-Aleut, Yukaghir and Mongolian even go so far that *k-* is present specifically in 'who' and *q-* in some other pronouns. This is a consequence of the fact that in 'who' it was a front vowel which followed (**i* or **e*), while in some other pronouns a back vowel followed. As to 'who', it is even possible to add further language families with words with a similar structure. One may mention Turkish *kim* 'who' / Chuvash *kam* 'who' (where *a* is probably new; in Chuvash, innovations in vocalism abound). Furthermore, the Chukotko-Kamchatkan language Itelmen has *k'e* 'who' (word cited from Georg / Volodin 1999: 134, *k'* is an ejective). Last but not least, the Indo-European languages with their **kw-* in interrogative pronouns, including 'who', should be mentioned (compare the discussion of Latin above). Frequently the third item in the string of sounds for 'who' is a nasal, *n* or *m*. In Indo-European the *m* is found in the accusative: Latin *quem*, etc. As to Uralic, Hungarian does not exhibit a final nasal in *ki* 'who', but Finnish does so in its archaic nominative *ken* 'who'. Note also the irregular plural Finnish *ket-kä* (with *-kä* a suffix), and now compare Finnish *ken* 'who', pl. *ket-kä*, with Classical Mongolian *ken* 'who', pl. *ked*.

A possible cause for the agreements laid out is that the consequences of distant relationship are present here. This is what Illič-Svityč and Dolgopolsky would advocate with their "Nostratic", as well as Fortescue with his "Uralo-Siberian", and Greenberg with his "Eurasiatic". Their publications have brought forth a large number of ideas many of which are rather speculative, but the issue of the interrogative pronouns just discussed is impressive and, together with some other remarkable agreements (e.g. a frequent *m* for 1st person and a frequent *t* for 2nd person), perhaps even by and large probative. Recently it was Georg's job to give a survey of the possible relations of Uralic to the outside (Georg 2023), but he missed the opportunity to mention the tantalizing data that exist.

At this point the topic cannot be pursued in detail any further. In essence the purpose of the observations was merely to point out in what context(s) the Hungarian interplay of *k-* and *h-* in the interrogative pronouns can be seen – and perhaps should be seen.

To sum up, it can be emphasized that the seemingly so simple split of Uralic initial **k-* into Hungarian *k-* and *h-* provided the inducement for rather many trains of thought.

REFERENCES

Bárczi, Géza (2001): *Geschichte der ungarischen Sprache*. Innsbruck: Institut für Sprachen und Literaturen der Universität Innsbruck.

Benkő, Loránd (1972): The lexical stock of Hungarian. In: Benkő, Loránd / Imre, Samu (eds.): *The Hungarian language*. The Hague: Mouton. 171–226.

Bynon, Theodora (1977): *Historical linguistics*. Cambridge: Cambridge University Press.

Campbell, Lyle (1998): *Historical linguistics. An introduction*. Edinburgh: Edinburgh University Press.

Collinder, Björn (²1969): *Survey of the Uralic languages*. Stockholm: Almqvist & Wiksell.

Décsy, Gyula (1965): *Einführung in die finnisch-ugrische Sprachwissenschaft*. Wiesbaden: Harrassowitz.

Fähnrich, Heinz (1994): *Grammatik der altgeorgischen Sprache*. Hamburg: Buske.

Fortescue, Michael (1998): *Language relations across Bering Strait. Reappraising the archaeological and linguistic evidence*. London / New York: Cassell.

Georg, Stefan (2023): Connections between Uralic and other language families. In: Abondolo, Daniel / Valijärvi, Riitta-Liisa (eds.): *The Uralic languages*. London / New York: Routledge. 176–209.

Georg, Stefan / Volodin, Alexander P. (1999): *Die itelmenische Sprache. Grammatik und Texte*. Wiesbaden: Harrassowitz.

Grønbech, Kaare / Krueger, John R. (²1976): *An introduction to Classical (Literary) Mongolian. Introduction, grammar, reader, glossary*. Wiesbaden: Harrassowitz.

Haspelmath, Martin (2002): *Understanding morphology*. London: Arnold.

Holst, Jan Henrik (2005): *Einführung in die eskimo-aleutischen Sprachen*. Hamburg: Buske.

——— (2009): *Armenische Studien*. Wiesbaden: Harrassowitz.

——— (2014): *Sanische historische Lautlehre*. Aachen: Shaker.

——— (2019): *Forschungsfragen zur baskischen Sprache*. Düren: Shaker.

——— (2023): *Das Rekonstruieren von Sprachen*. Düren: Shaker.

Honti, László (1993): *Die Grundzahlwörter der uralischen Sprachen*. Budapest: Akadémiai Kiadó.

Kálmán, Béla (1972): Hungarian historical phonology. In: Benkő, Loránd / Imre, Samu (eds.): *The Hungarian language*. The Hague: Mouton. 49–83.

Maslova, Elena (2003): *Tundra Yukaghir*. München: Lincom Europa.

Mátai, Mária D. (2002): *Kleine ungarische Sprachgeschichte*. Hamburg: Buske.

Rédei, Károly (2001): Magyar hisz 'glauben'. In: Maticsák, Sándor / Zaicz, Gábor / Lahdelma, Tuomo (eds.): *Ünnepi könyv Keresztes László tiszteletére. Folia Uralia Debreceniensia 8*. Debrecen: A Debreceni Egyetem Finnugor Nyelvtudományi Tanszéke. 501–504.

Sammallahti, Pekka (1988): Historical phonology of the Uralic languages. With special reference to Samoyed, Ugric, and Permic. In: Sinor, Denis (ed.): *The Uralic languages. Description, history and foreign influences*. Leiden: Brill. 478–554.
