

Examining Variant Character Writings in a Passage From the Text <Tai Ping Yu Lan>

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Foreword

“heil yan2 zhi1 cuo4” (黑鉛之錯) is abstracted from 《Tai Ping Yu Lan》 vol.812. In classical books, “qian1 dao1” (鉛刀) and “yan2 dao1” (鉛刀) are both used to mean lead knife, 《Shi Ji》 and 《Han Shu》, for example. As for the word “cuo4” (錯, mistake), Joseph Needham has considered it as a mistaken writing of “cu4” (醋, vinegar). The meaning of “heil yan2 zhi1 cuo4” (黑鉛之錯) is that metal lead (qian1 鉛) and vinegar (cu4 醋) interacts with each other would become lead oxide first, then white powder. Joseph Needham (1976-) has thought it is a record of great significance in chemistry. He said that it seems that Chinese could produce alkaline lead carbonate by “Dutch method” before 300 B.C (*Chinese Science and Civilization* vol.15 pp.18-20). However, Liu Guang-ding (1986) has disagreed that “cuo4” (錯) is a mistaken writing. “cuo4” (錯) has the meaning of little pot, so he has thought that “heil yan2 zhi1 cuo4” (黑鉛之錯) means lead is put in a little pot and heated, then it will become lead oxide. “cuo4” (錯) has another explanation: Lao Gan (1990) has considered “cuo4” (錯) denoting “dispose, manage”, so this passage means “after some procedures black lead can become minium, which can become basic carbonate of lead after another procedure”. Although three scholars have different explanations about the word “cuo4” (錯), they all have regarded the passage “heil yan2 zhi1 cuo4” (黑鉛之錯) as the record of the process of people making alkaline lead carbonate in old time. What they have observed is the early Chinese knowledge of artificial chemistry. However, in my opinion, according to the development of Chinese grammar, this passage from 《Tai Ping Yu Lan》 should not be considered as the evidence of history of science development directly, (no matter the

time of the text or the method of production). Lao's explanation on "heil yan2 zhi1 cuo4" (黑鉛之錯) is more practical among the three, though Liu's opinion has its theory background as well. Joseph Needham's association for explaining this passage has made me to have an interesting idea. "heil yan2 zhi1 cuo4" (黑鉛之錯) might be the visible evidence of different readings of the same word in different dialects in old time. Hence, we may get some meaningful internal reconstruction about AC phonology by explaining "heil yan2 zhi1 cuo4" (黑鉛之錯) from the viewpoints of character and phonology.

The main purpose of this article is to discuss the following questions related to this passage "heil yan2 zhi1 cuo4" (黑鉛之錯). 1. If "heil yan2 zhi1 cuo4" (黑鉛之錯) equals to "heil yan2 zhi1 cu4" (黑鉛之醋), "chou2 cu4" (酬醋) have been written as "chou2 zuo4" (酬酢) sometimes in classical texts, and "cu4" (醋) and "zuo4" (酢) both mean 'bitters' (which means vinegar also), then is it possible that "cuo4" (錯) "cu4" (醋) and "zuo4" (酢) in spoken language are the cognates denoting 'bitters'? 2. Why can "qian1" (鉛) be written as "yan2" (鉛)? Why is "qian1" (鉛), whose phonetic status in 《Guang Yun》 is yu zhuan, Yu Si initial, pronounced the fricative tɕh- now? 3. The relationship between the phonetic elements replacement and phonetic transformation of some variant characters, such as "qian1" (鉛), "yan2" (鉛), "cuo4" (錯), "cu4" (醋), "zuo4" (酢), and "xi1" (醯), "la4" (臘), "la4" (腊), "xi2" (蜡). In addition, 4. "cuo4" (錯) in this passage should not be explained as a noun actually, and it seems that "hua4 cheng2" (化成), or "hua4 zhi1 cheng2" (化之成) written in classical books does not mean "to process natural elements artificially".

Phonetic elements replacement and connection between phonetics and semantics

This section attempts to explain "cuo4" (錯), "cu4" (醋) and "zuo4" (酢) might be the cognates denoting 'bitters' in AC from Joseph Needham's viewpoint, "cu4" (醋) was written as "cuo4" (錯) by mistake. In addition to discuss the phonological transformation which results from the phonetic element replacement of certain words with the phonetic radical "xi2" (昔), and their variant characters. And the complicated relationship between *yu* (魚), *jia* (佳), *ge* (歌), *ji* (祭), and *ye* (葉) Rhyme Classes; *lai* (來) initial and second Division words, as well as *xin* (心) initial and velar initial words.

'Bitters' in AC: "cuo4" (錯) "cu4" (醋) "zuo4" (酢) "xi1" (醢)

As the foregoing, Joseph Needham has considered "cuo4" (錯) is a mistaken word of "cu4" (醋), that is, the phonetic radical "you3" (酉) was written as "jin1" (金) by mistake. However, why is it "you3" (酉), not other words with "xi2" (昔)? Actually the reason why Joseph Needham has thought it "cu4" (醋) is considering the text meaning. Because "qian1" (鉛, lead) and "cu4" (醋, vinegar) have interacted, the chemical change will be caused. The consideration of text meaning has important significance on explanations of jia3 jie4 characters (假借) in classic writings undoubtedly. From this point of view, Joseph Needham's explanation is quite reasonable. Besides word form and semantic considerations, we can also think about the phonetic relationship. Theoretically, the answer seems to be clear, "cuo4" (錯) and "cu4" (醋) have the phonetic radical "xi2" (昔) in common, and based on the principle of 'those sharing the same phonetic radical belong to the same rhyme class', we could believe that "cuo4" (錯) and "cu4" (醋) have pronounced in the same way in old time. Since the considerations of word form, word meaning and word sound are all reasonable, there is no difference to write either "cuo4" (錯) or "cu4" (醋) to mean 'bitters' in AC. Therefore, it is not a mistake, "heil yan2 zhi1 cuo4" (黑鉛之錯) is equivalent to "heil yan2 zhi1 cu4" (黑鉛之醋).

However, the considerations are supposed to be more complicated. Liu Guang-ding has disagreed with Joseph Needham, and his reasons are also reasonable. He (1986) has taken 《Shuo Wen》 as an example to prove that "cu4" (醋) does not have the meaning of 'bitters' originally. Besides, he has also pointed out that people have written "zuo4" (酢) and "xi1" (醢) denoting 'bitters' before Tang dynasty. In other words, so far as AC, the considerations about word form and meaning mentioned above might not be adequate. Hence, the evidence of "heil yan2 zhi1 cuo4" (黑鉛之錯) equivalent to "heil yan2 zhi1 cu4" (黑鉛之醋) are lacking actually, if based on the classic texts only.

Though "cuo4" (錯) and "cu4" (醋) are not exchangeable in certain contexts, we still could say that "cuo4" (錯) "cu4" (醋) and "zuo4" (酢) are cognate possibly if we consider their sound. Therefore, the following section attempts to infer their early sounds via examining their middle sounds, and combining the viewpoint of variant readings in different dialects to discuss the possible cognate phonological relationship between "cuo4" (錯) "cu4" (醋) and "zuo4" (酢).

“cuo4” (錯) and “cu4” (醋)

According to 《Guang Yun》, “cuo4” (錯) has two pronunciations; one is Tone Qu *mu* (暮) Rhyme, spelling *cang gu*, and the other is Tone Ru *duo* (鐸) Rhyme, spelling *cang ge*. ‘cang gu’ and ‘cang ge’ both belong to *yu* (魚) Rhyme Class in AC, and their reconstructions are:

‘cuo4’ (錯): *tshag > *tshuo ~ *tshak > *tshâk

‘cu4’ (醋): *tshag > *tshuo

The final *-g of Yin Sheng Rhyme in AC has lost early, which has made the main vowels *a > *uo of Yin Sheng Rhyme in MC become quite different from Tone Ru Rhyme. We now have considered these two pronunciations of “cuo4” (錯), *tshag ~ *tshak as the common phonological correspondence in AC dialects (Lin 1999a, b). It is probably that people of A dialect speak “cu4” (醋) *tshag, but people of B dialect write it as “cuo4” (錯) *tshag. People of A dialect might think that people of B dialect write “cuo4” (錯) representing “cu4” (醋) denoting ‘bitters’. Then “cuo4” (錯) might be given the meaning of ‘bitters’ after a long time, and become the synonym of “cu4” (醋) in A dialect. However, “cuo4” (錯) may have different meanings in different contexts, but it is not used to mean ‘bitters’ in standard language. Scholars before Tang dynasty, according to their individual dialects, have pronounced “cuo4” (錯) differently, and recorded it differently in texts.

“cuo4” (錯) “cu4” (醋) “zuo4” (酢) “xi1” (醢)

According to 《Shuo Wen》, “cu4” (醋) means that guests drink a toast to the host. Duan Yu-cai (段玉裁) has thought that it is the same situation in 《Li Jing》, while in other texts “cu4” (醋) has been replaced by “zuo4” (酢). Afterward, “zuo4” (酢) in written language has meant guests drink a toast to the host, and “cu4” (醋) has meant ‘bitters’. However, in texts before Tang dynasty, “cu4” (醋) is written as “zuo4” (酢) or “xi1” (醢). Why are “cu4” (醋) and “zuo4” (酢) exchangeable? It is hard to say that ‘bitters’ and ‘guests drink a toast to the host’ have the direct word meaning relationship. Since “cu4” (醋) has been replaced by “zuo4” (酢) in many texts, it is not an individual case or mistake. Moreover, according to 《Guang Yun》, “zuo4” (酢) belongs to Tone Ru *duo* (鐸) Rhyme

Class spelling *zai ge*. The difference between “zuo4” (酢) and “cuo4” (錯), which belongs to the same rhyme class as “zuo4” (酢), is voiceless and voiced initial. “zuo4” (酢), “cuo4” (錯) and “cu4” (醋) all belong to *yu* (魚) Rhyme Class in A. We assume that “cu4” (醋) and “zuo4” (酢) in spoken language bear the meaning ‘bitters’ and ‘guests drink a toast to the host’ respectively in different dynasties and regions. While in written language they might be exchangeable due to the variant readings in different dialects, it is a dynamic phenomenon. What we read now is the result of language standardization, a static phenomenon.

If we connect the sound relationship between “zuo4” (酢), “cuo4” (錯) and “cu4” (醋), we could see:

‘zuo4’ (酢): *dzak > *dzâk

‘cuo4’ (錯): *tshag > *tshuo ~ *tshak > *tshâk

‘cu4’ (醋): *tshag > *tshuo

Hence, the assumption that “cuo4” (錯), “cu4” (醋) and “zuo4” (酢) in spoken language are the cognate words denoting bitters is reasonable. The relationship between “cu4” (醋) and “zuo4” (酢) in written language, corresponding to the variant readings in language, is the replacement of phonetic elements.

In early Qin (秦) dynasty, “xi1” (醢) is the most common used word denoting bitters in texts. The pronunciations of “cu4” (醋) and “xi1” (醢) are quite different, and it seems that the reason why “xi1” (醢) has been written as “cu4” (醋) or “zuo4” (酢) is just to replace the more complicated *hui4yi4* words by the simple phonetic compound. Since “cu4” (醋) and “zuo4” (酢) are the variant writings of “xi1” (醢), is it possible for them to have sound relationship with “xi1” (醢)?

“la4rou4” (臘肉) equals to “xi2rou4” (腊肉), discussion of words with phonetic radical “xi2” (昔)

“la4rou4” (臘肉) is equivalent to “xi2rou4” (腊肉) in contemporary writing, and both mean ‘salted meat’. It is generally believed that “xi2” (腊) is the simplified writing of “la4” (臘), and “t̥sa4” (蜡) the simplified writing of “la4” (臘), 𦉰 the simplified writing of “lie4” (獵) by analogy. However, there is no any sound relationship between “la4” (臘)

and “xi2” (腊) as well as “la4” (臘) and “tɕa4” (蜡) now. Therefore, the reason of replacement of writings might be simply to replace the complexity by simplification, no direct relationship with phonetic element replacement. But it might not be the case in old time if we observe such words distribution in classic texts.

We would find there seems no relation between “tɕa4” (蜡) and “la4” (臘) in texts before Han dynasty. “tɕa4” (蜡) and “la4” (臘) both are related with almanac, but “xi2” (腊) is not. It seems clear that “xi2” (腊) and “la4” (臘) have complementary functions. Afterward, “la4” (臘) is used more often, and “tɕa4” (蜡) denoting almanac is replaced by it. It also replaces “xi2” (腊) gradually. Hence, the assumption that “xi2” (腊) is the simplified writing of “la4” (臘) might happen in later times, and which just aims to simplify the writing form.

Anyway, “tɕa4” (蜡) is replaced by “la4” (臘) in early literatures. Besides, in 《Guang Yun》 the phonetic status of “la4” (臘) and “la4” (臘) is *he* (盍) Rhyme, spelling *lu he*, which have demotic writing form 𦉰 and 𦉱. Though 𦉰 and 𦉱 are rare words in modern time, I assume that such writing form change should have some linguistic reason.

“la4” (臘), “la4” (臘) and 𦉰, 𦉱

Based on our knowledge of AC, we could not find the XieSheng (諧聲) relationship between “la4” (臘), “la4” (臘) and 𦉰, 𦉱 from their writing. They should be the phonetic element replacement from their reconstruction. It is Pang Zhuan (旁轉) between *ye* (葉) Rhyme and *ji* (祭) Rhyme:

臘 (𦉰), 蠟 (𦉱): *rap > *lap > *lâp

葛 : *kat > *kât

曷 : *gat > *yât

It is obvious that rhymes have correspondence with each other, and “la4” (臘) might be consonant combination with *l* originally. That is to say, the sound relationship of phonetic element replacement between “la4” (臘), “la4” (臘) and 𦉰, 𦉱 is parallel with the phenomenon that words with *lai* (來) initial often have XieSheng relationship with velar sounds.

“la4” (臘) and “tʂa4” (蜡) “xi2” (腊)

I thought that “la4” (臘) and “tʂa4” (蜡) “xi2” (腊) in texts before ancient time also have some trace of phonetic element replacement resulted from different languages.

The other names for “la4” (臘) in four dynasties are: “jialping2” (嘉平) in Xia, “qing1si4” (清祀) in Yin, “da4tʂa4” (大蜡) in Zhou, and “la4” (臘) in Han (Cai Yong, 《Du duan》). According to 《Guang yun》, the phonetic status of “tʂa4” (蜡) is *yu* (御) Rhyme, spelling *qi lu*, *yu* (魚) Rhyme Class, Yin Sheng. “tʂa4” (蜡) has other sound, “zha4”, whose spelling is *chu jia*, the same as 乍, 禡. “zha4” 乍 belongs to *yu* (魚) Rhyme Ying Sheng, but the second element “jia” belongs to *ge* (歌) Rhyme Class. The difference between *ge* (歌) and *yu* (魚) Rhyme Class of archaic sound is their place of articulation of consonant finals, and the difference between the initial “qi” and “chu” is voiced and voiceless. Afterward, the initial has been divided into *jing* (精) *zhuang* (莊) systems due to the influence of medial, which has made the final divided into two rhymes. Their reconstruction is as following:

蜡 (spelling *qi lü*): *tshjag > *tshjwo

蜡 (tʂa4): *dzrag > *dza

禡 (spelling *chu jia*): *dzrar > *dza

I thought that the sound relationship between “la4” (臘) and “tʂa4” (蜡) is parallel with the Xie Sheng relationship between words with *lai* (來) initial and other second Division words. The one is “la4” (臘) with *lai* (來) initial, and the other is the word with second Division medial, “tʂa4” (蜡). They have phonological correspondence indeed.

*rap > *lap > *lâp : *dzrag > *dza ~ *dzrar > *dza

After comparing with different names of “la4” (臘) in four dynasties, we could say that “jialping2” (嘉平) and “qing1si4” (清祀) were totally different word usage from “la4” (臘), but “da4tʂa4” (大蜡) were writing different phonetic element because dialect was spoken differently in different dynasties. 腊, 蜡 and 禡 in written language have the same phonetic element “xi2” (昔). “la4” (臘), “tʂa4” (蜡) and 禡 have phonological correspondence, so theoretically “la4” (臘) and “xi2” (腊) should have phonological correspondence as well.

腊 has been pronounced “xi2” (昔) before

We could infer that the exchange of “la4” (臘) and “xi2” (腊) in texts should have phonetic reason from the fact that 臘, 蜡 and 蜡 have phonological correspondence.

Some of words belonging to “xi2” (昔) Rhyme (whose spelling is si ji) in ancient time came from *yu* (魚) Rhyme Class, and some came from *jia* (佳) Rhyme Class. If we consider the second element of *qi1yu3* (切語), *ji* (積) has two pronunciations, Tone Qu and Tone Ru. The former's phonetic status is *Zhi* (真) Rhyme, spelling *zi zhi*, and its correspondent Ping Sheng word, *zhi1*, belongs to *zhi* (支) Rhyme. *zhi* (支), *zhi* (紙), and *zhi* (真) Rhyme of MC should belong to *jia* (佳) or *ge* (歌) Rhyme Class in AC, instead of *yu* (魚) Rhyme Class. Hence, according to 《Guang Yun》, the phonetic reconstruction of “xi2” (昔) in AC is as following:

昔 : *sjiak > *sjäk (Yu Rhyme Class)

*sjiar > *sjě (Ge Rhyme Class)

*sjig > *sjě (Jia Rhyme Class)

“xi2” (昔) might come from *ge* (歌) and *yu* (魚) Rhyme Class, and “tɕa4” (蜡) has two spelling, *qi lu* and *chu jia*. These two phenomena seem to be parallel. From the Xie Sheng relationship, we also could find the instances that *lai* (來) initial and *xin* (心) initial have Hu Xie (互協) relationship, as follows:

“lou3” (樓) (spelling *luo hou*) *lug > *lǒu : “sou3” (攬) (spelling *su hou*) *sug > *sǒu

So “la4” (臘), the first Division *lai* (來) initial, still has phonological correspondence with “xi2” (腊), whose phonetic element is “xi2” (昔) with *xin* (心) initial. We could assume that originally the written word 昔 might carry at least two meanings, ‘before’ and ‘dried (meat)’, in spoken language. Afterwards, 昔 means ‘before’ specifically, so 腊 is used to mean ‘dried (meat)’ to distinguish these two meanings. Through some phonetic change the pronunciations of 腊 and 昔 become separate. 腊 is read as “tɕa4” (蜡), “la4” (臘), and its written form is apt to use 臘.

As for one of the reconstruction of 昔 in AC is *jia* (佳) Rhyme Class, it means that 醋 (錯), whose phonetic element is 昔, might belong to *xin* (心) initial *jia* (佳) Rhyme Class. So we could connect 醋 (錯) with 醃.

醃: *hig > *xie

醋: *tshag > *tshuo~ *sjig > *sjě

From the Xie Sheng (諧聲) relationship, we also could find good examples of *xin* (心) initial and velar sound with *xiao* (曉) initial being Hu Xie (互協):

荀 (spelling xiang lun) *sk^wjin > *sjuěn : 絢 (spelling xu xian) *h^win > *xiwěn

恤 (spelling xin lü) *sk^wjit > *sjuět : 血 (spelling hu jue) h^wit > *xiwět

Therefore, the reason of “cu4” (醋) being the variant character of “xil” (醯) might be to correspond to phonetic change possibly. That is to say, to replace “xil” (醯) by “cu4” (醋) is a phonetic replacement, not due to the semantic distinction, because they have the same semantic element “you3” (酉).

Rediscussion of 鉛刀 or 鉛刀 in classic texts

We have examined two sets of variant characters with phonetic element replacement: “cu4” 醋, “zuo4” 酢, “xil” 醯 and “la4” 臘, 腊, “xi2” 腊 (“zha4” 蜡/蜡). And we infer that most variant characters with phonetic element replacement in classic texts should imply the phonetic change of early Chinese in different time and region.

We have known 鉛刀 and 鉛刀 have the same meaning, and 鉛, 鉛 have the same semantic element, 金. So 鉛 should be also the variant character with phonetic element replacement of 鉛. If that is true, we could infer the phonological transformation within them from examining archaic sounds. This section aims to discuss the relationship between writing form of 鉛 : 鉛 and their phonetic change, and to explain the transformation of words with Yu Si, Zhao San and velar initial words, as well as *ho/dong* 侯/東 and *yuan* 元 Rhyme Class.

The spelling of “yan2” 鉛 “yin” 寅 “zhuan” 專, phonetic element

Lu De-ming 陸德明 has thought that the spelling of 鉛 is yin zhuan, and phonetic element is 𠂔. That is to say, 鉛 and 鉛 are the same word actually. However, it is questionable that why would the character with phonetic element 𠂔 be written as 鉛? Why would the common used words, 沿, 鉛, 船, whose phonetic element is 𠂔, be written as 沿, 鉛, 船? According to the character scholars, who have examined 《Shuo Wen》, 公 might be the early word of 宮 or 谷. Since 谷 *kuk > *kuk and 公 *ku >

*ku are *ho* 侯 *dong* 東 Dui Zhuan (對轉), and the pronunciation of 宮 and 公 is identical. We could assume that was supposed to have at least sounds originally, and though has been read as Yu Si initial afterwards, it was labio-velar initial actually.

*g^wrjan > *jiwän : *kuŋ > *kuŋ ~ *kuk > *kuk

According to 《Guang Yun》, the spelling of 鉛 is zhi rong, and it is more clear. The reconstruction of 鉛 is:

*krjun > *tsjwŋ ~ *tsjuan

Based on the knowledge of archaic phonetic system, we could say that the relationship between 鉛 and 鉛 is phonetic element replacement, and their sound connection is:

鉛 *g^wrjan > *jiwän : 鉛 *krjun > *tsjwŋ ~ *tsjuan

The initial *g^wrj- : *krj- is parallel with the Xie Sheng relationship between Yu Si and velar sound. On the other hand, 鉛, whose phonetic element is 公, is read as Zhang system initial, and it is also parallel with the Xie Sheng relationship between Zhao San and velar sound. Since Yu Si and Zhao San systems both have Xie Sheng relationship with velar sound, we could say that the two readings of 鉛 in 《Guang Yun》 are cognate originally.

The spelling of 鉛 is Yu Zhuan and it is read tɕhian now

According to 《Guang Yun》 the spelling of 鉛 is yu zhuan, and its pronunciation (*g^wrjan >) *jiwän is generally accepted by Min, Hakka, Yue, Gan, and Xiang dialects. However, it is not understandable that Yu Si initial has been read tɕh- in Mandarin and kh- in Wu dialect afterwards.

If we examine the origin in detail, we could understand why Mandarin and Wu dialect have different development of pronouncing 鉛 from Min, Hakka, Yue, Gan Xiang dialects. The very first pronunciation of 鉛 was supposed to be *g^wrjan, but the voiced labio-velar sound initial has been read as *ji- Yu Si in some dialects, and it still remains the same in some dialects. After the development of devoicing, it is read as *kh-. Then *kh- in Mandarin was palatalized to become dorsal fricative tɕh- due to the final with 3rd or 4th Division medial.

The transformation between Ho/Dong and Yuan Rhyme Class of OC

I have thought that 鉛 in spoken language and 鉛 in written language might be read *krjun; however, their consonant perhaps was not *-un of *dong* (東) Rhyme Class but *-an of *yuan* (元) Rhyme Class for a long time. They were supposed to belong to different Rhyme Class because of their different main vowels and finals, and it is difficult to find correspondence between *ho/dong* (侯/東) and *yuan* (元) Rhyme Class in classic poetry. However, we could find that the phonetic element of 短 of *yuan* (元) Rhyme Class is 豆 of *ho* (侯) Rhyme Class, and the phonetic element of 筭 (算) of *yuan* (元) Rhyme Class is 弄 of *dong* (東) Rhyme Class.

短 *twan > *tuân : 豆 *gug > *dǎu

筭 (算) *swan > *suân : 弄 *run > *lun > *lun

Moreover, 筭 and 數 of *ho* (侯) Rhyme Class are cognate; 觀 and 覲; 犬 and 狗 as well as 猿 and 猴 are cognate respectively.

筭 (算) *swan > suân : 數 *sljug > *sju

觀 *kwan > *kuân : 覲 *kug > *kǎu

犬 *khwian > *khiwen : 狗 *kug > *kǎu

猿 *gwian > *jwen : 猴 *gug > *yǎu

They have proved the phonological alternation between *yuan* (元) and *ho/dong* (侯/東) Rhyme Class.

If we pay attention to the final difference, we could find some parallel examples, such as the phonetic element of 縣 (懸) of *yuan* (元) Rhyme Class is 晝 of *xiao* (宵) Rhyme Class; 鐵 of *zhi* (脂) Rhyme Class, whose phonetic element is 壬 of *geng* (耕) Rhyme Class, and 呈 are Xie Sheng words. These two examples both support the phonological alternation between apical and-velar finals.

縣 (懸) *gwian > *yiwen : 晝 *kiag^w > *kieu

鐵 *thit > *thiet : 壬 *thin > *thin : 呈 *din > *zjan

Besides, the transformation of velar nasal final and apical nasal final has been a common existed phenomenon actually. Hence, in addition to nasal words of *xiao* (宵) Rhyme Class were changed into *yuan* (元) Rhyme Class,

*-aŋ^w (宵) > *-an (元)

it seems to have following phenomena:

*-iŋ (佳/耕) > *-in (真)

*-uŋ (侯/東) > *-un > *-uan (元)

*-əŋ (之/蒸) > *-ən > *-uən (文)

*-əŋ^w (幽/中) > *-ən (文)

Therefore, the phonetic sound carried by 鉛 in written language might be not only the velar nasal final *-uŋ, but the apical nasal final *-un > *-uan since long time ago. The phonetic correspondence between 鉛 and 鉛 is:

鉛 *g^wrjan > *jiwän : 鉛 *krjun > *tsjuan > *tsjwän

It is also an instance to support the correspondence between *yuan* (元) and *ho/dong* (侯/東) Rhyme Class.

Conclusion

Above, I have made some observation on “heil yan2 zhi1 cuo4” (黑鉛之錯) without context via phonological point of view. We have learned that the relationship between Chinese written form and spoken sound has been obscure for a long time, but it still has provided us some clue for investigating variant readings of dialects in old times. I also think that it is a new method and issue to study AC phonology.

Supplementary Discussion

It is easy to evaluate if classic texts are real and their completed time from the viewpoint of history of Chinese. I do not aim to evaluate the truth of this text, not even to deny its existence. The purpose of this paper is to point out that this passage is not suitable for being evidence in Science History actually. I do not think this passage could prove that Dutch Process has been adopted in producing lead by East Han Dynasty. It does not reflect the production procedure for making lead compound, so it should not be regarded as the historic record of early Chinese knowledge of chemistry.