

# Deciphering Indus script as a cryptogram

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## Abstract

Indus inscriptions hold the key to unlocking the history of pre-Iron age India and all Indo-European peoples but remains undeciphered for over a century. All prior attempts have been unsatisfactory and non-falsifiable. We decipher the Indus script by treating it as a large cryptogram. We solve every sign one by one using a regular expression search and use set-intersection to obtain the exclusive value of each sign. Indus script is discovered to be proto-abugida segmental with signs for consonants and vowels. Indus inscriptions are in Sanskrit language compatible with Paninian grammar. Variants of 79 allographs constitute most signs. Composite signs constitute the rest. Our decipherment can read every inscription and we translate 500+ inscriptions including the 50+ longest, 50+ shortest and 400+ medium sized inscriptions including 100+ inscriptions with composite signs. Brahmi glyphs are discovered to be standardized Indus signs. We find significant continuation of Indus linguistic features and cultural elements in post-bronze age India.


*Keywords:* Indus, Epigraphy, Brahmi, Sanskrit






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## 1. Introduction

Indus script was in use from first half of the 4th millenium BCE[14] to 50 CE[2] in India. Indus script continued to be used on coins from Varanasi 800 BCE[5] to Maurya era[4]. Findings at Keezhadi[21] show usage of both Brahmi and Indus symbols. B. B. Lal noted that 89 percent of megalithic symbols go back to Indus symbols[10]. Megalithic sites show Indus signs up to 50 CE[2]. This provides evidence of broad geographical usage of Indus symbols all over India and 650 years overlap for the possibility of Brahmi script evolving from Indus script. Mixed Indus/Brahmi inscriptions from Iran[9] to South India[19] support this finding.

Attempts to decipher the Indus script have started with some assumptions regarding the language and epigraphy. Mahavedan[12] and Parpola[15] assume a logsyllabic script encoding Tamil. S. R. Rao[16] assumes an abjad script encoding

Sanskrit. Sue Sullivan[20] derives Sanskrit encoded in a script featuring complex logosyllabic, phonetic and segmental features. The fundamental flaw of logossyllabic and abjad interpretations is that they can never be acceptable without a rosetta stone. The readings themselves are also dubious. For example, Mahadevan translates the sign  as *pali*, "city"[11]. This claim is non-falsifiable and one could as well read it as "egg" or "wheel" or "chair". All logographic scripts that only read short inscriptions are invalidated without a rosetta stone for the simple reason that assigning random words to a set of signs will create an adjective-noun pair like "chicken fort" or "pregnancy bangles". The real test of decipherment is in reading a set of long inscriptions that all fall into a coherent theme without the introduction of unattested mythology.

S. R. Rao and Sue Sullivan start with a set of similar-to-Indus semitic signs with known values and deduce in the values for rest of the signs using an ad-hoc dictionary search. This method results in a dramatic improvement in the length and the number of readable seals but continues to give meaningless results for anything but short inscriptions. Like their logossyllabic counterparts, they also fail for unusual patterns such as seal M-1123     . The reason for the improvement is that they have the right value for common symbols and the reason for failure on long inscriptions is that some of their starting symbols are incorrect, resulting in incorrect values on deduced symbols.

## 2. Methods

The fundamental flaw in prior approaches to deciphering inscriptions is to first guess the sound/meaning of a sign based on appearance and then attempt to read inscriptions. These guesses are usually wrong for pictorial signs and impossible for abstract signs. We invert this and determine the sound value of a sign first and then optionally interpret what object the sign represents. This eliminates entire chains of assumptions regarding sound values of each sign.

### 2.1. Undeciphered scripts as cryptogram puzzles

Cryptograms are popular puzzles that encode a sentence (usually famous quotes) in a completely new script. The new script is usually just a rearranged alphabet but can be numbers, runes, arbitrary symbols or even Morse code. Cryptograms without spaces or punctuation are harder to solve since there are no clues on word boundaries. Automated cryptogram solvers exist with support for many European languages[1]. However, no automated cryptogram solvers exist for Sanskrit or non-latin scripts as of this writing, so we manually apply the same techniques to Indus seals. Solving

cryptograms using regular expressions is a known art[6] and we will only touch upon the techniques used for deciphering the Indus script.

The first step to solve a cryptogram is to guess the language itself. If the language is incorrect, we reach a dead end very soon and move on to the next language. Hypothetically, we could try every known language and the correct language would eventually be self-evident unless the script is written in a lost language. Realistically, the Indus script is from ~3500 BCE to 1900 BCE and our best chances are Sanskrit and old Tamil. Other Indic languages have been attested much more recently and their ancient forms are relatively less known.

The second step is to guess or decipher the first sign using unusual patterns in the text that will enable us to read one or two syllabic words. We can rely on the fact that every seal is one or more complete words and choose the shortest available seals to avoid the issue of detecting word boundaries on longer inscriptions.

We can then use the known signs to decipher the next unknown sign by exhaustive search on a dictionary using regular expressions. With sufficient inscriptions that only have a single common undeciphered sign, we can uniquely determine its value. Regular expressions enable us to solve for individual signs regardless of nature of the script.

## 2.2. Script Type and Writing Direction

Mahadevan classifies Indus script into 417 signs, epigraphica.de classifies them into 709 signs, treating minor variants as separate signs since a sizeable number (1000+) of signs is a prerequisite for a logosyllabic analysis. This is based on the assumption that a script from 3500 BCE must be logosyllabic.

However, a large signary is untenable on thorough analysis. Mirrored signs such as ) ( and signs with minor variations 𑀩 𑀪 𑀫 must be seen as variants of the same sign. Signs surrounded by "tally marks" '𑀭' '𑀮' '𑀯' etc are rare enough that they must be seen as word fragments. Since "tally marks" appear independently, for example in M-2069 𑀭, they are likely to be independent signs and not diacritics. Gradual abstractions of complex signs such as 𑀱 𑀲 𑀳 must be seen as a single sign. Composite signs like 𑀴 𑀵 𑀶 must be seen as diphthongs or digrams of their component signs rather than as completely different unrelated signs. After these adjustments, the sign count drops to under a hundred and the script cannot be logographic. The only options are syllabic or segmental.

The presence of the odd mirrored sign on seals indicates that the carving of the seals was not made with a planned template and the fact that certain seals have letters squeezed on the left side indicate two things: writing direction was from right to left and the script is non-logographic. Logographic scripts do not need spacing



Table 1: Extensively abstracted signs

and planning since one word maps to one sign and the approximate space required is already known to the carver but in a syllabic script, the word-to-sign mapping cannot be visualized easily and sometimes causes squeezing.

### 2.3. Sign classification

Indus script is a hand-carved writing system and not a typeset or a tool based script (unlike say, cuneiform). Therefore, just as two handwriting samples of the same letter are unique, no two instances of any Indus sign are exactly alike. If two renditions of a sign are close enough in appearance, its acceptable to treat them as variants of the same sign. Usually, there are unique characteristics for variants of the same sign that helps us correctly identify variants.

For example, the jar sign is unique for having zero to four small numeric strokes within it  $\cup \cup \cup \cup \cup \cup \cup \cup$ . All renditions of this sign are treated as variants. For simplicity, we use the most common rendition in the paper, i.e., any of  $\cup \cup \cup$  will be denoted as  $\cup$  in the derivation section. Signs that have evolved over the lifetime of the script show stage by stage progress of branching and abstraction, which we may classify as a single sign. While variants of most signs are quite apparent, we present a concise list of the most expansive variants in table 1.

When individual variants have sufficient attestations, we may prove each variant individually for example, all 3 variants  $\times \times \times$  may be independently proven to have the value /ka/  $\overline{\text{ka}}$ . Where sufficient attestations don't exist we can narrow down the possibilities to a handful and attempt to read all the inscriptions meaningfully. For example, by applying the regex method to identify  $\cup$  we do not get a unique value, but narrow down to /ra/  $\overline{\text{ra}}$  or /va/  $\overline{\text{va}}$ . Based on sign similarity and readability in inscriptions, we can confirm the sign is a variant of  $\cup$ .

Although the above is helpful in identifying variants, the method is self-correcting and an incorrect identification will be easy to identify:

1. two signs which are actually different are assumed to be the same

112 2. two signs that are actually the same are assumed to be different

113 In the first case, regular expression search yields two disjoint sets of inscriptions with  
114 two different phonetic values. An attempt to narrow the matches from the first set  
115 using a member of the second set will yield a null set. This immediately alerts us to  
116 the fact that the signs are indeed distinct.

117 In the second case, both sets will yield the same phonetic value. In fact, this is  
118 how we discover allographs.

119 While an optimal reachability graph can be constructed analyzing the inscrip-  
120 tions, we can use the heuristic of solving signs in the descending order of frequency  
121 with a few detours as needed.

#### 122 2.4. *Strengths and limitations*

123 A sufficiently long cryptogram is unsolvable in two different languages or in two  
124 different ways. We prove this in section 10, which also is a proof of correctness.  
125 With this method, incorrectly decoded sign will not match further downstream and  
126 quickly result in a dead end making this approach self-correcting. This approach does  
127 not depend on symbol shape, evolution history of a sign, assumptions on cultural  
128 aspects, geography, etc. Indeed, because none of these aspects are inputs, they can  
129 be credibly deduced as outputs once sufficient signs are deciphered. Cryptogram  
130 method is superior to frequency analysis, since it's immune to frequency changes due  
131 to passage of time[13].

132 Any lost words (not found in dictionary) in the inscription may result in false  
133 negatives and occasionally false positives. Dictionary may need to be augmented with  
134 sandhi, gender and number declined forms. As long as there are enough inscriptions,  
135 these limitations are generally not an issue except for signs with limited number of  
136 distinct attestations (say less than 10).

#### 137 2.5. *Progression of Cryptogram*

138 We illustrate how cryptogram solver quickly finds possibilities and how rapidly  
139 the solution converges to a unique answer with an examples.

140 In table 2, using the small American dictionary, we can tabulate the open pos-  
141 sibilities as words are solved one by one for the phrase "have you any white wool,  
142 love?" as we decipher word by word from the first to last.

143 When "HAVE" is solved, the possibilities for "you" and "wool" which don't have  
144 any common letters with "have" are only halved, but the words that do have common  
145 letters drop significantly. The possible decipherments for the word "any" drops by  
146 20x from 401 possibilities to 21, love drops 83x from 251 possibilities to 3 and "white"  
147 drops 80x from 1697 possibilities to 21. If one of the words was deciphered incorrectly,

Solved words	"lomw eac ope qlbjw qaah, hamw"
(none)	????(597) ???(476) ???(401) ?????(1697) ???(93) ???(251)
HAVE	HAVE ???(213) A??(21) ?H??E(21) ???(50), ??VE(3)
YOU	HAVE YOU ANY ?H??E(6) ?OO?(34) ?OVE(3), ?OVE(3)
WHITE	HAVE YOU ANY WHITE WOO?(4), ?OVE(3)
WOOL	HAVE YOU ANY WHITE WOOL, LOVE

Table 2: Rapid convergence of a cryptogram solution

for example, the word "you" was incorrectly deciphered as "BID", then the word "wool" could not be deciphered since there are no words matching the pattern ?II?. At this point we would have to back track and try some other possibility.

As is apparent from this example, even short cryptograms of a dozen or so words can be uniquely deciphered. Indus corpus is a 15000+ signs long cryptogram and it would be infinitesimally unlikely that it can be readable if solved incorrectly.

## 2.6. Formalization

Let  $G = \{g_0, g_1, g_2, \dots\}$  be the set of symbols whose sound value is known.  
Let  $X = \{x_0, x_1, x_2, \dots\}$  be the set of all symbols.  
Let  $S = \{s_0, s_1, s_2, \dots\}$  be the set of inscriptions where  $s_i$  is a vector from symbols in  $X$

1. Let two inscriptions  $s_a = g_i x_a g_k x_c \dots$  and  $s_b = g_j x_a g_l x_f \dots$
2. Let set of symbol matches  $G_{x_a} = /g_i(.+)g_k. + / \cap /g_j(.+)g_l. + /$
3. Repeat intersection with new inscription above until  $G_{x_a}$  is of unit length
4.  $x_a = G_{x_a}$
5.  $G = G \cup x_a$
6. Repeat until  $G = X$

## 3. Results

Indus script is made of 79 allographs representing the most common signs shown in table 3. The complete derivation can be traced in section 8. A compact one-pager is given in table 4. Long inscriptions and inscriptions with composite signs are listed in sections 5 and 6 respectively. Some signs have variants that mark reading direction or word boundaries and they are listed in table 5. Consonant clusters using syncope are shown in table 6. Table 8 shows Indus signs standardized into Brahmi.

	Name	Meaning	Symbols	
अ	अयुग	one	'	1
	आयु	man	人 𠤎	2
	अग	mountain	山	3
	अङ्क	curve	) )) )) )) ( )) 𐀀	4
	आजनि	stick	1 𐀀 目	5
	अज	horn	𐀀 山	6
आ		repeated अ	𐀀 ' 人 人 (𐀀) (𐀀) (𐀀)	7
इ	इषीक	stalk of grain	𐀀	8
ई		doubled इ	𐀀𐀀	9
उ	उद्धाटक	rope	𐀀 𐀀	10
	उद्धट	tortoise	𐀀 𐀀	11
ए	अङ्क	one	'	12
ओ	ओपश	lock of hair	1 𐀀	13
अन् अं	अनुतर्ष अंशु	drinking vessel; drink	𐀀 𐀀 𐀀 𐀀 𐀀 𐀀 𐀀 𐀀	14
अस् अः	अष्टापद	eight legged/spider	𐀀 𐀀 𐀀 𐀀 𐀀 𐀀 𐀀 𐀀	15
	अष्ट	eight	𐀀 𐀀 𐀀 𐀀	16
क ख	कट	wood	𐀀 𐀀 𐀀 𐀀 𐀀 𐀀	17
	खट	axe	𐀀 𐀀	18
	खट	plough	𐀀 𐀀 𐀀 𐀀	19
ग घ	गडु गडुर	spear; bent	𐀀	20
च छ	चतुर	four	𐀀	21
	छत्र	mushroom	𐀀	22
ज झ	झर	waterfall; cascade	𐀀 𐀀 𐀀	23
	झ	rain and wind	𐀀 𐀀	24
त थ ट ठ	ताडुल्य	drum	𐀀	25
	ताडुल	fighter	𐀀	26
	तण्डुल	rice plant	𐀀	27
	ताल	small cymbal	𐀀	28

	Name	Meaning	Symbols	
	तर्दू	wooden ladles	𑖦 𑖧	29
	तर्द	Indian blackbird	𑖪 𑖫 𑖬 𑖭	30
	त्र	three		31
	त	tail	人	32
	ट	hollowed coconut	⌒	33
द ध ड ढ	दण्डार	bow	𑖯 𑖰 𑖱 𑖲 𑖳	34
	दन्त	teeth	𑖴 𑖵	35
	धात्र	receptacle	𑖶 𑖷 𑖸	36
	दुन्दम	hourglass drum	𑖹 𑖺 𑖻 𑖼 𑖽 𑖾	37
न	नाल	time-card	𑖿	38
	नाल	stalk	𑗀 𑗁 𑗂 𑗃 𑗄	39
	नल	reed	!	40
	नव	nine		41
	नाव	boat	𑗅	42
प फ	पञ्चन्	five		43
	पञ्चन्	hand	𑗆	44
ब भ	भक्षपत्र	betel leaf	𑗇 𑗈 𑗉 𑗊	45
	भक्षत्र	oven	𑗋	46
म	मदार मस्त	elephant head	𑗌 𑗍 𑗎 𑗏 𑗐 𑗑 𑗒 𑗓	47
	मदार मस्त	boar head	𑗔	48
	मत्स्य	fish	𑗕	49
	मन्दार	hibiscus flower	𑗖	50
	मन्दिर	dwelling	𑗗 𑗘 𑗙	51
	मय	horse	𑗚 𑗛 𑗜 𑗝 𑗞 𑗟 𑗠 𑗡	52
य	यवश्रेष्ठि	barley merchant	𑗢 𑗣 𑗤 𑗥 𑗦	53
	यव	barley	𑗧 𑗨	54
	यष्टि	pearl necklace; pillar	𑗩 𑗪 𑗫	55
	यष्टि	twig; arm	𑗬	56



	Name	Meaning	Symbols	
र	रथर्वी	split snake	𑀮 𑀮	57
	रथारि	chariot wheel	𑀮 𑀮 𑀮 𑀮 𑀮	58
	रथ	chariot	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	59
	रथ	Dalbergia tree	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	60
ल	लता	lightning; lash of whip	𑀮	61
	लता	creeper	𑀮	62
व	वरण्ड	lamp wick	𑀮	63
	वण्ड	spear	𑀮	64
	वरट	wasp	𑀮	65
	वट	banyan tree	𑀮 𑀮	66
स श ष ह	शाखर	squirrel	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	67
	शिखर	mountaintop	𑀮 𑀮 𑀮	68
	शुक्र	seed	𑀮 𑀮 𑀮	69
	शुक्र	chitraka flower	𑀮 𑀮	70
स श ष ह	शशाद	falcon	𑀮	71
	षष्	six	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	72
	सप्त	seven	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	73
	शस	repeating (merger of 𑀮 𑀮)	𑀮	74
<b>Common Composites</b>				
𑀮 𑀮	अणि	point of arrow	𑀮	75
𑀮 𑀮	अम	power	𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮 𑀮	76
𑀮 𑀮	उष	dawn	𑀮 𑀮	77
𑀮 𑀮	तर	beyond	𑀮 𑀮	78
𑀮 𑀮	वि	two	𑀮	79

Table 3: Indus-Saraswati script allographs

[illegible]

Sign	Marked Variants
अ	
अ	
अन्	
अन्	
अस्	
त	
द	
द	
द	
द	
न	
ब	
म	
म	
य	
र	
र	
व	

Table 5: Directional and word-boundary variants

Seal-Id	Inscription	Sanskrit	Translation
H-43		वक्र	Mars
Ns-79		विश्व	to pervade
H-904		विद्वान्	learned
M-1316		वाव वल्लभ दाद	verily god-given

Table 6: Examples of writing consonant clusters using schwa and double syncope

Indus Sign	Meaning	Vedic Altar
	falcon	श्येन
	mountain	प्रौग
	solid wheel	प्रधियुक्त रथचक्र
	spoked wheel	सारा रथचक्र
	tortoise	वक्राङ्ग कूर्म
	tortoise	परिमण्डल कूर्म

Table 7: Signs corresponding to Vedic altars

अ a 𑀅 𑀆	इ i 𑀇 𑀈	उ u 𑀉 𑀊	ए e 𑀋 𑀌	ओ o 𑀍 𑀎
क k 𑀏 𑀐	ख kh 𑀑 𑀒	ग g 𑀓 𑀔	घ gh 𑀕 𑀖	ङ ṅ 𑀗 𑀘
च c 𑀙 𑀚	छ ch 𑀛 𑀜	ज j 𑀝 𑀞	झ jh 𑀟 𑀠	ञ ṇ 𑀡 𑀢
ट ṭ 𑀣 𑀤	ठ ṭh 𑀥 𑀦	ड ḍ 𑀧 𑀨	ढ ḍh 𑀩 𑀪	ण ṇ 𑀫 𑀬
त t 𑀭 𑀮	थ th 𑀯 𑀰	द d 𑀱 𑀲	ध dh 𑀳 𑀴	न n 𑀵 𑀶
प p 𑀷 𑀸	फ ph 𑀹 𑀺	ब b 𑀻 𑀼	भ bh 𑀽 𑀾	म m 𑀿 𑁀
य y 𑁁 𑁂	र r 𑁃 𑁄	Brahmi vs	ल l 𑁅 𑁆	व v 𑁇 𑁈
श ś 𑁉 𑁊	ष ṣ 𑁋 𑁌	Indus	स s 𑁍 𑁎	ह h 𑁏 𑁐

Table 8: Indus signs standardized into Brahmi

#### 4. Discussion

SSC script is a segmental script that is best described as proto-abugida. The major differences from Brahmi seem to be that retroflexes use the same signs as dentals and aspirated and unaspirated stops use the same signs. With a couple of exceptions, letters have a default vowel of अ unless overridden by an immediately following vowel sign. No diacritics are used.

Signs retain the same sound value on even major rendering variations presumably because the script has unlimited options for creating new signs and has no need to rely on a minor stroke variation to denote phonetic distinctions.

Name	Sign	Meaning	Operator	Operand
अयुग	'	one		
आयु	人	man	खण्डन	अयुग
अग	⌒	mountain	प्रत्याहार	अयुग
अइक	'	one	साम्य	अयुग
अइक	ʔ	curve	अपभ्रंश	अइक
कट	⌘ ⌘ ⌘ ⌘ ⌘ ⌘	wood		
खट	𑀓 𑀔	axe	साम्य	कट
खट	𑀕 𑀖 𑀗 𑀘	plough	साम्य	कट

Table 9: Allograph derivation for अ and क

181 While signs are obviously distinct in most cases, occasional ambiguities do ex-  
182 ist, which are discussed below. Signs may be classed into several groups based on  
183 characteristics specific to them.

#### 184 4.1. Allographs

185 The script has 79 total allographs for the most common signs (including 5 com-  
186 mon composite signs) with a median of three allographs. These allographs seem to  
187 have occurred accidentally when orally transmitting the sign name or deliberately as  
188 a प्रत्याहार based on the fact that many allographs are simply the first and last letter  
189 of a longer name. Occasionally a synonym or homonym transmutation occurs, which  
190 we call साम्य. A comprehensive allograph chart is in table 3. An average of a little  
191 over 4 variants per allograph for 79 allographs explains the approximately 400+ total  
192 signs. Allograph derivation examples are shown in table 9.

#### 193 4.2. Line strokes and Numeric signs

194 A numeric sign does not encode an actual number, but rather the first syllable  
195 of its name. The sound values are shown in table 10. A sign with eleven strokes  
196 does not exist, suggests the Indus civilization used a decimal system. The name for  
197 a single numeric stroke, अयुग represents the अ sound. अयुग may have mutated into  
198 अइक which may have been used as the diphthong अइ. The word एक evidently evolved  
199 from अयुग via अइक. The other signs are self-explanatory of which only वि has the  
200 non-default अ vowel.

'	"	'''							
अ	वि	त	च	प	ष	स	अस्	न	द

Table 10: Numeric signs

अ	व	ज	ज	न	ष

Table 11: Non-numeric line stroke signs

In addition to numeric signs, line strokes denote several signs shown in table 11. Non-numeric signs seem to be invented earlier than numeric signs, evidenced from workarounds to comply with non-numeric signs. Evidence for this is that other अ signs can be doubled to form आ but not the | vertical stroke since it would be read as व and inscriptions work around this by inserting ऋ between the two to create |ऋ|. The sign |||| often written as |||| representing rain, is not a numeric sign. Its allograph ||| is not to be confused with the numeric sign ' read as त.

#### 4.3. Vowels

A vowel sign overrides the default अ vowel just as in abugida. Repeated vowel signs make a long vowel. In practice, a leading अ can be either अ or आ. An अ in addition to the default अ vowel makes it आ. The only long vowels attested are आ and ई. Other vowels such as ऊ simply use the same sign ँ to indicate both long and short vowels. ऋ uses signs for र and presumably so do the unattested ऋ लृ.

#### 4.4. Diphthong

The sequence अइ exists as a diphthong in some seals indicating that is possibly used for ऐ as in H-1056 ॥ऋँ॥ जमनै. An equivalent diphthong for औ is not attested but may be reconstructed as ँऋ.

#### 4.5. Proto-vowels

The signs for अन् ँ and अस् ऋ seem to have eventually evolved into अं and अः respectively. The ँ sign is used for both न ण and ड sounds. The ऋ variant seems to be preferred for ञ but in principle, all jar-like signs are interchangeable.

#### 4.6. Sibilant fluidity

All signs for श ष स ह seem to be interchangeable including अस् signs. These four phonemes were possibly allphones, vestiges which can be seen in later Sanskrit with equivalent words with the same meaning but different sibilants such as तुस = तुष for husk. At some point post-Indus script invention, these consonants seem to have differentiated.

#### 228 4.7. Base consonants

229 Base consonants here refers to signs that represent ordinary consonants with the  
230 default vowel अ. Retroflex and dentals use the same signs, similar to usage of Latin  
231 alphabet to write Sanskrit. Aspirated and unaspirated sounds also use the same  
232 signs.

#### 233 4.8. Shorthand signs

234 The sign अणि|अणि meaning arrowpoint which is very often found as a terminal  
235 sign is a shorthand for अणि, which also reads as अणि|अणि. This was an innovation to  
236 address running out of space at the end of the inscription. This evidently led to the  
237 invention of other supplementary signs to the consonant+vowel system. The sign "   
238 for phoneme वि is a numeric, but may be seen as a shorthand for वि. The introduction  
239 of " as a shorthand, probably led to the introduction of other numeric signs to stand  
240 for their respective initial syllables.

#### 241 4.9. Composite signs

242 Composite signs are created by combining two (or rarely more) signs and rep-  
243 resents the sounds of the combined signs. The most common are उष् combining  
244 and signs for अम. The sign for अम can take a variety of forms by vertically  
245 assembling a rotated ) and one of the म signs, given many possible signs, being the  
246 most common. In addition to these, there are over 100 rarely used composites that  
247 are deciphered in Section 6






#### 248 4.10. Sign disambiguation

249 Numeric signs in general take all strokes as a single sign. Spacing, stroke size  
250 differences and incline differences are used to distinguish two adjacent numeric signs  
251 or signs made of simple line strokes.




252 For example, the sign M-734 reads ||| ||| ॥ वरण जज, "protecting warrior." The  
253 clear space between ||| ||| is unambiguously read as two ||| ज signs, rather than a single  
254 ||||| ष sign, which would need to be read as वरणष, "excellent protector." Seal M-1822  
255 |//००१०० uses incline differences to distinguish || वा to avoid being read as || ज.

256 When strokes are arranged in rows, if the upper row has equal or higher number  
257 of strokes than the lower row, then the sign is read as representing the total number  
258 of strokes. Inscriptions use spacing to ensure clear separation between distinct signs.

259 For example, the sign M-1904 reads "||, जज, "warrior." Three strokes representing  
260 the first syllable is marked as distinct from the other by horizontal and vertical  
261 spacing. If there was no clear spacing, the seal would look like ||| and be read as ष,  
262 "excellent."

263 When the upper row has fewer strokes than the lower row, spacing or other  
 264 indications of separateness become important for an accurate reading. For example,  
 265 M-948 reads  अवविजय "desiring victory", rather than अवपाय "desiring water"  
 266 due to slight offset of two rows of strokes. While signs with five or more strokes can  
 267 appear in one or two rows, signs with two and four always appear in a single row. If  
 268 they appear in two rows, they are a distinctly different sign with a distinctly different  
 269 sound value. Note the differences between " वि  ज  च versus  न " त  श.




#### 270 4.11. *Ligatured signs*


271 Occasionally adjacent signs are joined by a small stroke to create a ligatured  
 272 character pair for clarity. Either one of the signs is vertical bar sign  (आजनि) and  
 273 could be easily missed without the ligature as in  or if a sign was carved in later  
 274 for space or other reasons as in . These are described in detail in 6.

#### 275 4.12. *Directional markers*

276 We know that the direction of writing is generally right-to-left based on the fact  
 277 that in some inscriptions signs have been squeezed near the left end of the inscrip-  
 278 tion. Unlike pottery graffiti and tablets, seals themselves are mirrored left-to-right  
 279 in order to produce the desired right-to-left inscription. However a small percentage  
 280 of inscriptions are left-to-right. Since the vast majority of signs are symmetric and  
 281 sometimes even the asymmetric signs are inscribed mirrored horizontally, there is  
 282 a chance that the inscriptions are read in the wrong direction. For large inscrip-  
 283 tions, this is usually not a problem, since they would be unreadable the wrong way.  
 284 However, short inscriptions have the risk of being read incorrectly.

285 Indus signary evolved to address this challenge by deliberately adding asymmetry  
 286 to some signs. For example, the elephant's ears and the wasp's eyes were made  
 287 asymmetric. The signs are read from the pointed-side to blunt-side:

- 288  elephant ears, trunk, tusks
- 288  wasp eyes
- 289  tree branching

290 The most common sign, the  jar sign repeated sufficiently within inscriptions  
 291 to enable a directional marker of its own, by adding one to four small strokes inside  
 292 the jar. The strokes appear in non-ascending order. The first jar always has the  
 293 highest number of strokes and the next sign can either decrease or maintain the  
 294 number of strokes. Typically, the final jar sign will end up with no strokes. This  
 295 pattern holds for over two hundred inscriptions with just a handful of exceptions.  
 296 The improbability of these strokes to have any kind of phonetic meaning is easily  
 297 verified by testing the inscriptions against a dictionary. These strokes are evidently



Seal-Id	Inscription	Sanskrit	Translation	Direction
H-1711	ॐॐॐॐॐॐ	कान्तदान	delightful gift	←
M-1353	ॐॐॐॐॐॐ	अन्नादन	eating food	←
M-1304	ॐॐॐॐॐॐ	अनवरन्	equal or superior	←
H-1801	ॐॐॐॐॐॐ	अनवरन्	equal or superior	←
M-862	ॐॐॐॐॐॐ	अनरन्	superhuman	←
M-1470	ॐॐॐॐॐॐ	अण्डावानन्	protector of the universe	←
M-420	ॐॐॐॐॐॐ	अनाचार	unconventional	←
M-1822	ॐॐॐॐॐॐ	अण्डवा	Name of Shiva	←
M-1700	ॐॐॐॐॐॐ	अन्धै	in darkness	←
Ns-86	ॐॐॐॐॐॐ	अनु	human	→
M-1336	ॐॐॐॐॐॐ	आणवम्	small; fine	→
M-2062	ॐॐॐॐॐॐ	चर (line 1)	follow	←
	ॐॐॐॐॐॐ	अन्व (line 2)		→

Table 12: Directional markers on jar sign

a directional marker similar to a fuel gauge, tracking the remaining text portions from full to empty. The directional mark is placed on a nearby sign if the starting sign is a numeric or otherwise unsuitable for a directional indicator.

A directional marker may be used even when its the only jar sign in the inscription to avoid accidental reading in the wrong direction.

When the leftmost sign has a directional marker and the rightmost sign doesn't, the seal may be preferentially read left-to-right. This is most useful for multi-line boustrophedon inscriptions but occasionally also occurs in single line seals.

#### 4.13. Word boundaries

The jar sign directional marker breaks its rule in only a handful of signs among over a thousand. Evidently, a secondary use of directional markers is to indicate word boundaries. The leftmost sign's marker could be a word boundary rather than a directional marker, so some judgement is needed for a correct directional read. Fortunately, these exceptional inscriptions are rare. These are shown in table 13

#### 4.14. Directional sign variants

Signs other than jar sign can also have one to four strokes to indicate direction or word boundary. Usually, these are the first character of an inscription and act as a directional indicator but occasionally occur mid-inscription and act as a word boundary. These are listed in table 5

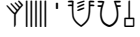
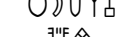

Seal-Id	Inscription	Sanskrit	Translation
M-378		वननापर	unsurpassed wealth
H-454		अनवरन्	excellent
M-968		वरणाम्	protection
Ns-78		रण	delight
H-1075		उषपन्	the Sun



















Table 13: Directional marker used as word boundary

#### 317 4.15. Consonant clusters

318 Clustered consonants are simply written adjacent but are pronounced with a  
319 schwa syncope. Doubled consonants are written as a single consonant. Examples are  
320 shown in table 6.

#### 321 4.16. Evolution

322 Signs that take up horizontal space undergo rotation to fit them in large inscrip-  
323 tions. Complex and time consuming signs undergo abstraction and simplification.  
324 Boldface versions are identical to normal versions.

				rotation
				rotation
				abstraction of elephant head to trunk and tusk
				simplification
				simplification

#### 325 4.17. Evolution to Brahmi

326 Indus seals stopped being produced around 1900 BCE, but Indus inscriptions  
327 continued on Mauryan coins and pottery graffiti in Kheezhadi and South Indian  
328 megalithic sites until 50 CE.

329 When we arrange Brahmi signs with their closest corresponding Indus script  
330 allograph for the same sound value, we notice that every Brahmi sign other than  
331 the sign for इ, seem to be a minor variant or simplification of a pre-existing Indus  
332 sign. Indus script glyphs are closer to Brahmi than Brahmi glyphs are to modern  
333 Devanagari script.

334 Table 8 is an accurate snapshot of the Indus signs chosen to be standardized into  
335 Brahmi using the observation that retroflexes and dentals are interchangeable as a  
336 group as are non-labial nasal consonants.

#### 4.18. Religious continuity

We see several linguistic and cultural features that continued post Indus phase. The Indus signs that have corresponding Vedic altars[8] are remarkably similar in appearance shown in table 7

The deities in Indus inscriptions are the same as Vedic. Sun, Varuna, Soma, Vishnu, Shiva, Indra, Agni, Ushas, Ashlesha and Bharani constellations, ashva, Ardhanareeshwara (seals depicting one breasted human), pipal tree and the Sun continue to be revered to this day. Soma worship is congruent with the vedic ritual, Viṣṇu as protector of sacrifice is congruent with the Śivapurāṇa.

#### 4.19. Vestiges of Indus linguistic forms

Indus script characteristics are also attested into post-IVC inscriptions[18][7], coins[3] and seals.

Indus Script feature	Post-IVC attestation	Attested	Read as
no virama	Ajagara 300 BCE	अगसतय	अगस्तय
merged dentals/retroflex	Avanti fish seal	देवटाह	देवताः
	Mansehra	दुवडश	दुवदश
merged asp./unasp.	Girnar	उस्तान	उस्थान
merged sibilants	Kalsi	दाश, दाष	दास
	Girnar	वर्स	वर्श
no doubled consonants	Qutub Iron pillar	मूर्त्या	मूर्त्य्या
	Girnar	अगि	अग्गि
अं अन् flexibility	Qutub Iron pillar	प्रन्शु	प्रंशु
	Girnar	अंज	अन्य
elided anusvara	Girnar	इद	इदं
shortened initial आ	Girnar	अरोपितं	आरोपितं

Table 14: Post-IVC attestation of script elements

Iron pillar[17] presently in Qutub complex retains some of the archaic language features of Indus inscriptions. It uses a lone consonant to represent a doubled consonant (mūrtyā instead of mūrtyyā) and the anusvara अं is denoted अन् as opposed to अम् (pranśu instead of pramśu). Indus script provides evidence that Qutub inscription was not an aberration, but rather that अं was once read as अन्.

Inscriptions with mixed Indus/Brahmi signs are now readable such as Marungur[19].

The usage of common signs for अ-ए, अ-ओ aspirated-unaspirated dental-retroflex and sibilants-/h/ phonemes in a writing system is similar to old Arabic, which did

Source	Inscription	Reading	Translation
Marungur 200 BCE	𑀘𑀓𑀭𑀮	अमहस्	the mighty one
Annakodai 300 BCE	𑀧𑀧+𑀓𑀭	रर कावात्	given by Kava(a Saman)
Vietnam Gold foil 100CE	𑀓𑀭𑀮	वराह	Varaha avatar
Copper Hoard 1800 BCE?	𑀭𑀧𑀮 + 𑀓𑀧	शंखात् किं	what emanated from
Turkmenistan	𑀭𑀧𑀮	रँ डय	the conch?
	𑀭𑀮𑀭𑀮	याशुना	with embrace
	𑀭𑀮/𑀧𑀮𑀧	रहःऋणाः	private debts
	𑀭𑀮𑀮	अन्तेः	should be ended
	𑀭𑀮𑀮𑀮	गुहलु	Guhalu (name)
	+𑀭𑀮	ऐशिक	Royal

Table 15: Readings of possibly mixed IVC/Brahmi inscriptions



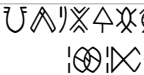
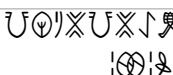
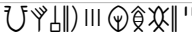
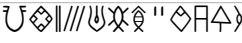
not have dots (i jām) to distinguish different phonemes, despite having multiple forms (initial, media, terminal) for the same phoneme. Eventually, it appears that these were standardized into Brahmi.

#### 4.20. Falsifiability

The ability to meaningfully read a cipher in an *attested* language is sufficient proof of decipherment. Claiming such an outcome is accidental requires a premise that random assignment leads to a similar outcome. This decipherment may be falsified by assigning verifiably random syllabic or abugida values to signs and reading them as Sanskrit or any natural language. A more thorough falsification may be attempted by cryptogram method using a dictionary of a different language. As long as the longest 50 inscriptions are meaningfully readable in consistent themes in an attested natural language, we can assume the decipherment is falsified.

## 5. Long and unusual inscriptions

Translating long inscriptions sans spacing between words poses some challenges. The meanings can change dramatically based on word boundary and sandhi splitting. For example, the string *beforeman* could be read as *before man* or *be foreman*. The purpose of these translations is to show supplementary evidence of decipherment. The actual intended meaning is beyond the scope of this work. We have chosen translations that are consistent with the overall themes of the corpus, early Brahmi inscriptions and grammar.

Seal-Id	Inscription	Sanskrit	Translation
1 M-314		रवि अमं मानि सक्षनरं जठलधार रह	O honored Roarer(Shiva) O Sustainer, O Ocean(Shiva) yield to the powerful capable man
		रवि vns. रविन् roarer √रु+अच्+णिनि [रविन् MBh] अमं ams. the powerful[RV], सक्ष capable[TS] जठल vms. Ocean[Sāy] जठल=समुद्र=Shiva[MBh] नरं ams. man[TS] मानि vns. honored[MBh] धार vms. Sustainer[MBh 13.14.13] √रह लोट् 2s. yield, let go, release	
2 M-23		दा अममणिकम् सम् नः रन्धन	By the giver, this cup is full for us, O Shiva
		दा ims. of दा giver[RV]; अम this[AV]; मणिकम् ans. cup/jar[MBh]; सम् indc. full[RV] नः dp. of अस्मद् for us[RV]; रन्धन vms. destroying[Bhp]	
3 M-234		दा अममणिकम् सम् च आस नदन्	By the giver, this full cup is taken roaringly!
		दा ims. of दा giver[RV]; अम this[AV]; मणिकम् ans. cup/jar[MBh]; सम् indc. full[RV]; आस √अस् लिट् 1s/3s taken; नदन् √नद् + शर्त्तु roaring;	
4 M-626		कम् माखं कंसं दात नदन्	Excellent sacrificial cup O roaring purified one!
		कम् indc. good/well[TS]; माखं ans. oblation[Hariv]; कंसं ans. cup[AV]; दात vms. purified[Pāṇ]; नदन् √नद् + शर्त्तु roaring;	
5 H-1657		दकवि वमाम सज्जावरम्	O water covered one(Shiva), we gave an excellent prepared gift
		दकवि vns. दक water[Phetk], वी covered, [Shiva=प्रवाह पावितस्थले]; वमाम √वम् लोट् 1p. given; सज्ज prepared[MBh], अव favor/gift[RV], वरम् ams. excellent[MBh];	
6 M-355		तद्दानिम रवि अमं अज्जवरम्	O Roarer, we harvested that powerful gift of Soma
		तत् ans. that; ददानिम √दान् लिट् 1p. cut/harvested; रवि vns. रविन् roarer;	

[illegible]

Seal-Id	Inscription	Sanskrit	Translation
		वटात् abms. वट banyan tree of Shiva[Śivapurāṇa 2.2.40]; अवि vns. favorable one[RV]	
18	Ns-60	मम gs. my[RV]; वम emit √वम् लोट् 2s; अञ्जनि anp. radiance √अञ्ज् + अच्; इद्वाचल विहनामनशं तर इद्ध shining अचल vns. immovable[RV,BG]; तर overcome √तृ लोट् 2s.; विह sky[RV]; नामन् water[Naigh]; नशं ams. loss[MW];	O unwavering shine(Sun), overcome the loss of rains
19	M-714	अ रवि शासं अञ्जसभं	O Roarer, ruler of honored council
		अ vocative particle[T]; रवि Roarer, vns. of रविन्; अञ्ज honored √अञ्ज्; सभं ans. council[RV];	
20	M-677	अ रवि मम अञ्जवम आम् अ O[T]; रवि Roarer, vns. of रविन्; मम my[RV]; अञ्जवम vms. shine emitter √अञ्ज्, √वम्+अच् ; आम् indc. verily[Śak];	O Roarer, verily, O my shine emitter(Sun)
21	M-577	अदनविचर[म्] नवाव आनन[म्]	Abstaining from eating Let us both praise the (divine) face
		अदन eating √अद्+ल्युट्; विचर[म्] ans. abstaining, वि away[RV] चर act[RV]; नवाव praise √नु लोट् 1d. आनन[म्] ans. face[R];	
22	M-665	मत विच्छ दाहं ताम्र	O honored one, shine your heat! O red one(Rudra)
		मत vns. honored[Ragh]; विच्छ shine √विच्छ् लोट् 2s.; दाहं ams. heat[MBh]; ताम्र vms. red[MBh; विलोहित Shiva];	
23	Lh-1	दावरवि अम दानरं	O fiery Roarer, help the giver (of sacrifice)
		दाव √दु fire[AV], रवि vns. roarer; अम serve [√अम् लोट् 2s.; दान giving[RV]; र ams. possessor[Naiṣ];	
24	K-10	नववरं विमाखं	New boon without sacrifice
		नव new[RV], वरं ams. boon[RV]; वि ind. without [RV]; माखं ans. oblation[Hariv];	
25	H-8	दकवि अञ्जवरम् आच	O water covered one(Shiva), I seek a splendid gift
		दकवि vns. दक water[Phetk], वी covered; अञ्ज shining √अञ्ज्+अच्; वरम् ams. gift[RV]; आच I seek √अच् लोट् 1s.;	
26	M-119	दा वठधारविषमय[म्]	By the giver, a big water-filled stream
		दा ims. of दा giver[RV]; वठ big, fat, powerful; √वठ+अच्; धार stream[RV 9.109.19] विषमय[म्] ans. water-filled, विष water[Naigh];	
27	H-103	हयमदम् अञ्जानि आय[म्]	I celebrate the increase of the pleasure of having horses







## 6. Variants and Composite signs

Variants are stylistic and abstracted evolution of symbols. Composite signs combine two or more signs and are read as adjacent signs: firstly in the direction of writing, secondly top to bottom and lastly the base character followed by ligatured character.

1. Ligatured symbols that are simply touching but otherwise written in normal size and position are read as normal. For example, 𑀓𑀔 is simply read as 𑀓𑀔.
2. Symbols arranged vertically are read top to bottom. 𑀓𑀔 is read as 𑀓𑀔 𑀓𑀔 as opposed to 𑀓𑀔 which is read as 𑀓𑀔 ईर
3. The base character, i.e., the large character is read first and the embedded character is read subsequent. 𑀓𑀔 becomes 𑀓𑀔 रस्. The terminal 𑀓𑀔 अन् sign can make a useful exception and retain terminal position, i.e., 𑀓𑀔 may be read as 𑀓𑀔 रन्

	Sign	Variant	Seal-ID	Inscription	Sanskrit	Translation	
1	𑀓	𑀓	स	H-967A	𑀓𑀔𑀓	अश्वानि	horse keeper (name)
2	𑀓	𑀓	स	H-916	𑀓𑀔𑀓	अश्वानि	horse keeper (name)
3	𑀓	𑀓	स	H-917	𑀓𑀔𑀓	अश्वानि	horse keeper (name)
4	𑀓	𑀓	ज	M-1848	𑀓𑀔𑀓	जव	swift[AV]
5	𑀓	𑀓	आ	M-1151	𑀓𑀔𑀓𑀓	आम् नमन्	verily[MaitrS] worshipping[√नम्]
6	𑀓	𑀓	जि	M-409	𑀓𑀔𑀓𑀓	सज्जि	complete victory[RV]
7	𑀓	𑀓	जर	M-898	𑀓𑀔𑀓	जरम्	praise[√जृ RV]
8	𑀓	𑀓	अना	M-812	𑀓𑀔𑀓	अनाम्	indeed, indeed[RV,MaitrS]
9	𑀓	𑀓	म	H-2125	𑀓𑀔𑀓	मान	honor[MBh]
10	𑀓	𑀓	म	H-64	𑀓𑀔𑀓𑀓	मदमानि	joyfully[RV] worshipped[MBh]
11	𑀓	𑀓	म	M-523	𑀓𑀔𑀓	वम्र	[Author of RV 10.99]
12	𑀓𑀔𑀓	𑀓𑀔𑀓	अमा	RGR-7230	𑀓𑀔𑀓	अमानि	immeasurable[VP]
13	𑀓	𑀓𑀔𑀓	या	M-203	𑀓𑀔𑀓𑀓𑀔𑀓	मया अनवरं	excellence[RV] by me[RV]
14	𑀓	𑀓𑀔𑀓	यन	M-800	𑀓𑀔𑀓𑀓𑀔𑀓𑀓𑀔𑀓	चयनांशनमन	salutation[Mār̥kP] to altar[ŚBr]
15	𑀓	𑀓𑀔𑀓	आश	M-1887	𑀓𑀔𑀓𑀓𑀔𑀓	माम् आशं	obtaining me[RV]
16	𑀓	𑀓	आ	M-123	𑀓𑀔𑀓𑀓𑀔𑀓	मन अइ	ornament[RV]
17	𑀓	𑀓	अ	M-403	𑀓𑀔𑀓𑀓𑀔𑀓	अनितर	unfixed[MānGr]
18	𑀓	𑀓	अ	M-875→	𑀓𑀔𑀓𑀓𑀔𑀓	आम्र	mango[ŚBr]
19	𑀓	𑀓	अ	H-777	𑀓𑀔𑀓𑀓𑀔𑀓	अचर	immovable[RV]
20	𑀓	𑀓𑀔𑀓	अन	L-218	𑀓𑀔𑀓𑀓𑀔𑀓	अनवम	exalted(name)[SkandP]
21	𑀓	𑀓𑀔𑀓	र	H-212	𑀓𑀔𑀓𑀓𑀔𑀓	रयि	wealth[RV]
22	𑀓𑀔𑀓	𑀓𑀔𑀓𑀓𑀔𑀓	य अय	M-288	𑀓𑀔𑀓𑀓𑀔𑀓𑀓𑀔𑀓𑀓𑀔𑀓	यायनम् शरण[म्]	protecting[RV] journey[RV]
23	𑀓	𑀓	म	D-51582	𑀓𑀔𑀓𑀓𑀔𑀓	आभाम् उष	O shining[RV] dawn[RV]
24	𑀓𑀔𑀓	𑀓𑀔𑀓𑀓𑀔𑀓	दाद	Umma	𑀓𑀔𑀓𑀓𑀔𑀓𑀓𑀔𑀓	दादम् विचर	renounce[MBh] gift[MBh]
25	𑀓	𑀓𑀔𑀓	य	M-1628	𑀓𑀔𑀓𑀓𑀔𑀓	नयद	O giver[RV] of prudence[MBh]

	Sign	Variant		Seal-ID	Inscription	Sanskrit	Translation
26	𑀓	𑀓	य	H-951	𑀓𑀔𑀕𑀖	वनयव	wild[RV] grain[RV]
27	𑀓	𑀓	य	M-831	𑀓𑀔	यत	controlled[RV]
28	𑀓	𑀓	य	H-455	𑀓𑀔𑀕𑀖𑀗𑀘𑀙𑀚𑀛𑀜𑀝𑀞𑀟𑀠𑀡𑀢𑀣𑀤𑀥𑀦𑀧𑀨𑀩𑀪𑀫𑀬𑀭𑀮𑀯𑀰𑀱𑀲𑀳𑀴𑀵𑀶𑀷𑀸𑀹𑀺𑀻𑀼𑀽𑀾𑀿𑁀𑁁𑁂𑁃𑁄𑁅𑁆𑁇𑁈𑁉𑁊𑁋𑁌𑁍𑁎𑁏𑁐𑁑𑁒𑁓𑁔𑁕𑁖𑁗𑁘𑁙𑁚𑁛𑁜𑁝𑁞𑁟𑁠𑁡𑁢𑁣𑁤𑁥𑁦𑁧𑁨𑁩𑁪𑁫𑁬𑁭𑁮𑁯𑁰𑁱𑁲𑁳𑁴𑁵𑁶𑁷𑁸𑁹𑁺𑁻𑁼𑁽𑁾𑁿𑂀𑂁𑂂𑂃𑂄𑂅𑂆𑂇𑂈𑂉𑂊𑂋𑂌𑂍𑂎𑂏𑂐𑂑𑂒𑂓𑂔𑂕𑂖𑂗𑂘𑂙𑂚𑂛𑂜𑂝𑂞𑂟𑂠𑂡𑂢𑂣𑂤𑂥𑂦𑂧𑂨𑂩𑂪𑂫𑂬𑂭𑂮𑂯𑂰𑂱𑂲𑂳𑂴𑂵𑂶𑂷𑂸𑂺𑂹𑂻𑂼𑂽𑂾𑂿𑃀𑃁𑃂𑃃𑃄𑃅𑃆𑃇𑃈𑃉𑃊𑃋𑃌𑃍𑃎𑃏𑃐𑃑𑃒𑃓𑃔𑃕𑃖𑃗𑃘𑃙𑃚𑃛𑃜𑃝𑃞𑃟𑃠𑃡𑃢𑃣𑃤𑃥𑃦𑃧𑃨𑃩𑃪𑃫𑃬𑃭𑃮𑃯𑃰𑃱𑃲𑃳𑃴𑃵𑃶𑃷𑃸𑃹𑃺𑃻𑃼𑃽𑃾𑃿𑄀𑄁𑄂𑄃𑄄𑄅𑄆𑄇𑄈𑄉𑄊𑄋𑄌𑄍𑄎𑄏𑄐𑄑𑄒𑄓𑄔𑄕𑄖𑄗𑄘𑄙𑄚𑄛𑄜𑄝𑄞𑄟𑄠𑄡𑄢𑄣𑄤𑄥𑄦𑄧𑄨𑄩𑄪𑄫𑄬𑄭𑄮𑄯𑄰𑄱𑄲𑄳𑄴𑄵𑄶𑄷𑄸𑄹𑄺𑄻𑄼𑄽𑄾𑄿𑅀𑅁𑅂𑅃𑅄𑅅𑅆𑅇𑅈𑅉𑅊𑅋𑅌𑅍𑅎𑅏𑅐𑅑𑅒𑅓𑅔𑅕𑅖𑅗𑅘𑅙𑅚𑅛𑅜𑅝𑅞𑅟𑅠𑅡𑅢𑅣𑅤𑅥𑅦𑅧𑅨𑅩𑅪𑅫𑅬𑅭𑅮𑅯𑅰𑅱𑅲𑅳𑅴𑅵𑅶𑅷𑅸𑅹𑅺𑅻𑅼𑅽𑅾𑅿𑆀𑆁𑆂𑆃𑆄𑆅𑆆𑆇𑆈𑆉𑆊𑆋𑆌𑆍𑆎𑆏𑆐𑆑𑆒𑆓𑆔𑆕𑆖𑆗𑆘𑆙𑆚𑆛𑆜𑆝𑆞𑆟𑆠𑆡𑆢𑆣𑆤𑆥𑆦𑆧𑆨𑆩𑆪𑆫𑆬𑆭𑆮𑆯𑆰𑆱𑆲𑆳𑆴𑆵𑆶𑆷𑆸𑆹𑆺𑆻𑆼𑆽𑆾𑆿𑇀𑇁𑇂𑇃𑇄𑇅𑇆𑇇𑇈𑇉𑇊𑇋𑇌𑇍𑇎𑇏𑇐𑇑𑇒𑇓𑇔𑇕𑇖𑇗𑇘𑇙𑇚𑇛𑇜𑇝𑇞𑇟𑇠𑇡𑇢𑇣𑇤𑇥𑇦𑇧𑇨𑇩𑇪𑇫𑇬𑇭𑇮𑇯𑇰𑇱𑇲𑇳𑇴𑇵𑇶𑇷𑇸𑇹𑇺𑇻𑇼𑇽𑇾𑇿𑈀𑈁𑈂𑈃𑈄𑈅𑈆𑈇𑈈𑈉𑈊𑈋𑈌𑈍𑈎𑈏𑈐𑈑𑈒𑈓𑈔𑈕𑈖𑈗𑈘𑈙𑈚𑈛𑈜𑈝𑈞𑈟𑈠𑈡𑈢𑈣𑈤𑈥𑈦𑈧𑈨𑈩𑈪𑈫𑈬𑈭𑈮𑈯𑈰𑈱𑈲𑈳𑈴𑈶𑈵𑈷𑈸𑈹𑈺𑈻𑈼𑈽𑈾𑈿𑉀𑉁𑉂𑉃𑉄𑉅𑉆𑉇𑉈𑉉𑉊𑉋𑉌𑉍𑉎𑉏𑉐𑉑𑉒𑉓𑉔𑉕𑉖𑉗𑉘𑉙𑉚𑉛𑉜𑉝𑉞𑉟𑉠𑉡𑉢𑉣𑉤𑉥𑉦𑉧𑉨𑉩𑉪𑉫𑉬𑉭𑉮𑉯𑉰𑉱𑉲𑉳𑉴𑉵𑉶𑉷𑉸𑉹𑉺𑉻𑉼𑉽𑉾𑉿𑊀𑊁𑊂𑊃𑊄𑊅𑊆𑊇𑊈𑊉𑊊𑊋𑊌𑊍𑊎𑊏𑊐𑊑𑊒𑊓𑊔𑊕𑊖𑊗𑊘𑊙𑊚𑊛𑊜𑊝𑊞𑊟𑊠𑊡𑊢𑊣𑊤𑊥𑊦𑊧𑊨𑊩𑊪𑊫𑊬𑊭𑊮𑊯𑊰𑊱𑊲𑊳𑊴𑊵𑊶𑊷𑊸𑊹𑊺𑊻𑊼𑊽𑊾𑊿𑋀𑋁𑋂𑋃𑋄𑋅𑋆𑋇𑋈𑋉𑋊𑋋𑋌𑋍𑋎𑋏𑋐𑋑𑋒𑋓𑋔𑋕𑋖𑋗𑋘𑋙𑋚𑋛𑋜𑋝𑋞𑋟𑋠𑋡𑋢𑋣𑋤𑋥𑋦𑋧𑋨𑋩𑋪𑋫𑋬𑋭𑋮𑋯𑋰𑋱𑋲𑋳𑋴𑋵𑋶𑋷𑋸𑋹𑋺𑋻𑋼𑋽𑋾𑋿𑌀𑌁𑌂𑌃𑌄𑌅𑌆𑌇𑌈𑌉𑌊𑌋𑌌𑌍𑌎𑌏𑌐𑌑𑌒𑌓𑌔𑌕𑌖𑌗𑌘𑌙𑌚𑌛𑌜𑌝𑌞𑌟𑌠𑌡𑌢𑌣𑌤𑌥𑌦𑌧𑌨𑌩𑌪𑌫𑌬𑌭𑌮𑌯𑌰𑌱𑌲𑌳𑌴𑌵𑌶𑌷𑌸𑌹𑌺𑌻𑌼𑌽𑌾𑌿𑍀𑍁𑍂𑍃𑍄𑍅𑍆𑍇𑍈𑍉𑍊𑍋𑍌𑍍𑍎𑍏𑍐𑍑𑍒𑍓𑍔𑍕𑍖𑍗𑍘𑍙𑍚𑍛𑍜𑍝𑍞𑍟𑍠𑍡𑍢𑍣𑍤𑍥𑍦𑍧𑍨𑍩𑍪𑍫𑍬𑍭𑍮𑍯𑍰𑍱𑍲𑍳𑍴𑍵𑍶𑍷𑍸𑍹𑍺𑍻𑍼𑍽𑍾𑍿𑎀𑎁𑎂𑎃𑎄𑎅𑎆𑎇𑎈𑎉𑎊𑎋𑎌𑎍𑎎𑎏𑎐𑎑𑎒𑎓𑎔𑎕𑎖𑎗𑎘𑎙𑎚𑎛𑎜𑎝𑎞𑎟𑎠𑎡𑎢𑎣𑎤𑎥𑎦𑎧𑎨𑎩𑎪𑎫𑎬𑎭𑎮𑎯𑎰𑎱𑎲𑎳𑎴𑎵𑎶𑎷𑎸𑎹𑎺𑎻𑎼𑎽𑎾𑎿𑏀𑏁𑏂𑏃𑏄𑏅𑏆𑏇𑏈𑏉𑏊𑏋𑏌𑏍𑏎𑏏𑏐𑏑𑏒𑏓𑏔𑏕𑏖𑏗𑏘𑏙𑏚𑏛𑏜𑏝𑏞𑏟𑏠𑏡𑏢𑏣𑏤𑏥𑏦𑏧𑏨𑏩𑏪𑏫𑏬𑏭𑏮𑏯𑏰𑏱𑏲𑏳𑏴𑏵𑏶𑏷𑏸𑏹𑏺𑏻𑏼𑏽𑏾𑏿𑐀𑐁𑐂𑐃𑐄𑐅𑐆𑐇𑐈𑐉𑐊𑐋𑐌𑐍𑐎𑐏𑐐𑐑𑐒𑐓𑐔𑐕𑐖𑐗𑐘𑐙𑐚𑐛𑐜𑐝𑐞𑐟𑐠𑐡𑐢𑐣𑐤𑐥𑐦𑐧𑐨𑐩𑐪𑐫𑐬𑐭𑐮𑐯𑐰𑐱𑐲𑐳𑐴𑐵𑐶𑐷𑐸𑐹𑐺𑐻𑐼𑐽𑐾𑐿𑑀𑑁𑑂𑑃𑑄𑑅𑑆𑑇𑑈𑑉𑑊𑑋𑑌𑑍𑑎𑑏𑑐𑑑𑑒𑑓𑑔𑑕𑑖𑑗𑑘𑑙𑑚𑑛𑑜𑑝𑑞𑑟𑑠𑑡𑑢𑑣𑑤𑑥𑑦𑑧𑑨𑑩𑑪𑑫𑑬𑑭𑑮𑑯𑑰𑑱𑑲𑑳𑑴𑑵𑑶𑑷𑑸𑑹𑑺𑑻𑑼𑑽𑑾𑑿𑒀𑒁𑒂𑒃𑒄𑒅𑒆𑒇𑒈𑒉𑒊𑒋𑒌𑒍𑒎𑒏𑒐𑒑𑒒𑒓𑒔𑒕𑒖𑒗𑒘𑒙𑒚𑒛𑒜𑒝𑒞𑒟𑒠𑒡𑒢𑒣𑒤𑒥𑒦𑒧𑒨𑒩𑒪𑒫𑒬𑒭𑒮𑒯𑒰𑒱𑒲𑒳𑒴𑒵𑒶𑒷𑒸𑒻𑒻𑒼𑒽𑒾𑒿𑓀𑓁𑓃𑓂𑓄𑓅𑓆𑓇𑓈𑓉𑓊𑓋𑓌𑓍𑓎𑓏𑓐𑓑𑓒𑓓𑓔𑓕𑓖𑓗𑓘𑓙𑓚𑓛𑓜𑓝𑓞𑓟𑓠𑓡𑓢𑓣𑓤𑓥𑓦𑓧𑓨𑓩𑓪𑓫𑓬𑓭𑓮𑓯𑓰𑓱𑓲𑓳𑓴𑓵𑓶𑓷𑓸𑓹𑓺𑓻𑓼𑓽𑓾𑓿𑔀𑔁𑔂𑔃𑔄𑔅𑔆𑔇𑔈𑔉𑔊𑔋𑔌𑔍𑔎𑔏𑔐𑔑𑔒𑔓𑔔𑔕𑔖𑔗𑔘𑔙𑔚𑔛𑔜𑔝𑔞𑔟𑔠𑔡𑔢𑔣𑔤𑔥𑔦𑔧𑔨𑔩𑔪𑔫𑔬𑔭𑔮𑔯𑔰𑔱𑔲𑔳𑔴𑔵𑔶𑔷𑔸𑔹𑔺𑔻𑔼𑔽𑔾𑔿𑕀𑕁𑕂𑕃𑕄𑕅𑕆𑕇𑕈𑕉𑕊𑕋𑕌𑕍𑕎𑕏𑕐𑕑𑕒𑕓𑕔𑕕𑕖𑕗𑕘𑕙𑕚𑕛𑕜𑕝𑕞𑕟𑕠𑕡𑕢𑕣𑕤𑕥𑕦𑕧𑕨𑕩𑕪𑕫𑕬𑕭𑕮𑕯𑕰𑕱𑕲𑕳𑕴𑕵𑕶𑕷𑕸𑕹𑕺𑕻𑕼𑕽𑕾𑕿𑖀𑖁𑖂𑖃𑖄𑖅𑖆𑖇𑖈𑖉𑖊𑖋𑖌𑖍𑖎𑖏𑖐𑖑𑖒𑖓𑖔𑖕𑖖𑖗𑖘𑖙𑖚𑖛𑖜𑖝𑖞𑖟𑖠𑖡𑖢𑖣𑖤𑖥𑖦𑖧𑖨𑖩𑖪𑖫𑖬𑖭𑖮𑖯𑖰𑖱𑖲𑖳𑖴𑖵𑖶𑖷𑖸𑖹𑖺𑖻𑖼𑖽𑖾𑗀𑖿𑗁𑗂𑗃𑗄𑗅𑗆𑗇𑗈𑗉𑗊𑗋𑗌𑗍𑗎𑗏𑗐𑗑𑗒𑗓𑗔𑗕𑗖𑗗𑗘𑗙𑗚𑗛𑗜𑗝𑗞𑗟𑗠𑗡𑗢𑗣𑗤𑗥𑗦𑗧𑗨𑗩𑗪𑗫𑗬𑗭𑗮𑗯𑗰𑗱𑗲𑗳𑗴𑗵𑗶𑗷𑗸𑗹𑗺𑗻𑗼𑗽𑗾𑗿𑘀𑘁𑘂𑘃𑘄𑘅𑘆𑘇𑘈𑘉𑘊𑘋𑘌𑘍𑘎𑘏𑘐𑘑𑘒𑘓𑘔𑘕𑘖𑘗𑘘𑘙𑘚𑘛𑘜𑘝𑘞𑘟𑘠𑘡𑘢𑘣𑘤𑘥𑘦𑘧𑘨𑘩𑘪𑘫𑘬𑘭𑘮𑘯𑘰𑘱𑘲𑘳𑘴𑘵𑘶𑘷𑘸𑘹𑘺𑘻𑘼𑘽𑘾𑘿𑙀𑙁𑙂𑙃𑙄𑙅𑙆𑙇𑙈𑙉𑙊𑙋𑙌𑙍𑙎𑙏𑙐𑙑𑙒𑙓𑙔𑙕𑙖𑙗𑙘𑙙𑙚𑙛𑙜𑙝𑙞𑙟𑙠𑙡𑙢𑙣𑙤𑙥𑙦𑙧𑙨𑙩𑙪𑙫𑙬𑙭𑙮𑙯𑙰𑙱𑙲𑙳𑙴𑙵𑙶𑙷𑙸𑙹𑙺𑙻𑙼𑙽𑙾𑙿𑚀𑚁𑚂𑚃𑚄𑚅𑚆𑚇𑚈𑚉𑚊𑚋𑚌𑚍𑚎𑚏𑚐𑚑𑚒𑚓𑚔𑚕𑚖𑚗𑚘𑚙𑚚𑚛𑚜𑚝𑚞𑚟𑚠𑚡𑚢𑚣𑚤𑚥𑚦𑚧𑚨𑚩𑚪𑚫𑚬𑚭𑚮𑚯𑚰𑚱𑚲𑚳𑚴𑚵𑚷𑚶𑚸𑚹𑚺𑚻𑚼𑚽𑚾𑚿𑛀𑛁𑛂𑛃𑛄𑛅𑛆𑛇𑛈𑛉𑛊𑛋𑛌𑛍𑛎𑛏𑛐𑛑𑛒𑛓𑛔𑛕𑛖𑛗𑛘𑛙𑛚𑛛𑛜𑛝𑛞𑛟𑛠𑛡𑛢𑛣𑛤𑛥𑛦𑛧𑛨𑛩𑛪𑛫𑛬𑛭𑛮𑛯𑛰𑛱𑛲𑛳𑛴𑛵𑛶𑛷𑛸𑛹𑛺𑛻𑛼𑛽𑛾𑛿𑜀𑜁𑜂𑜃𑜄𑜅𑜆𑜇𑜈𑜉𑜊𑜋𑜌𑜍𑜎𑜏𑜐𑜑𑜒𑜓𑜔𑜕𑜖𑜗𑜘𑜙𑜚𑜛𑜜𑜝𑜞𑜟𑜠𑜡𑜢𑜣𑜤𑜥𑜦𑜧𑜨𑜩𑜪𑜫𑜬𑜭𑜮𑜯𑜰𑜱𑜲𑜳𑜴𑜵𑜶𑜷𑜸𑜹𑜺𑜻𑜼𑜽𑜾𑜿𑝀𑝁𑝂𑝃𑝄𑝅𑝆𑝇𑝈𑝉𑝊𑝋𑝌𑝍𑝎𑝏𑝐𑝑𑝒𑝓𑝔𑝕𑝖𑝗𑝘𑝙𑝚𑝛𑝜𑝝𑝞𑝟𑝠𑝡𑝢𑝣𑝤𑝥𑝦𑝧𑝨𑝩𑝪𑝫𑝬𑝭𑝮𑝯𑝰𑝱𑝲𑝳𑝴𑝵𑝶𑝷𑝸𑝹𑝺𑝻𑝼𑝽𑝾𑝿𑞀𑞁𑞂𑞃𑞄𑞅𑞆𑞇𑞈𑞉𑞊𑞋𑞌𑞍𑞎𑞏𑞐𑞑𑞒𑞓𑞔𑞕𑞖𑞗𑞘𑞙𑞚𑞛𑞜𑞝𑞞𑞟𑞠𑞡𑞢𑞣𑞤𑞥𑞦𑞧𑞨𑞩𑞪𑞫𑞬𑞭𑞮𑞯𑞰𑞱𑞲𑞳𑞴𑞵𑞶𑞷𑞸𑞹𑞺𑞻𑞼𑞽𑞾𑞿𑟀𑟁𑟂𑟃𑟄𑟅𑟆𑟇𑟈𑟉𑟊𑟋𑟌𑟍𑟎𑟏𑟐𑟑𑟒𑟓𑟔𑟕𑟖𑟗𑟘𑟙𑟚𑟛𑟜𑟝𑟞𑟟𑟠𑟡𑟢𑟣𑟤𑟥𑟦𑟧𑟨𑟩𑟪𑟫𑟬𑟭𑟮𑟯𑟰𑟱𑟲𑟳𑟴𑟵𑟶𑟷𑟸𑟹𑟺𑟻𑟼𑟽𑟾𑟿𑠀𑠁𑠂𑠃𑠄𑠅𑠆𑠇𑠈𑠉𑠊𑠋𑠌𑠍𑠎𑠏𑠐𑠑𑠒𑠓𑠔𑠕𑠖𑠗𑠘𑠙𑠚𑠛𑠜𑠝𑠞𑠟𑠠𑠡𑠢𑠣𑠤𑠥𑠦𑠧𑠨𑠩𑠪𑠫𑠬𑠭𑠮𑠯𑠰𑠱𑠲𑠳𑠴𑠵𑠶𑠷𑠸𑠺𑠹𑠻𑠼𑠽𑠾𑠿𑡀𑡁𑡂𑡃𑡄𑡅𑡆𑡇𑡈𑡉𑡊𑡋𑡌𑡍𑡎𑡏𑡐𑡑𑡒𑡓𑡔𑡕𑡖𑡗𑡘𑡙𑡚𑡛𑡜𑡝𑡞𑡟𑡠𑡡𑡢𑡣𑡤𑡥𑡦𑡧𑡨𑡩𑡪𑡫𑡬𑡭𑡮𑡯𑡰𑡱𑡲𑡳𑡴𑡵𑡶𑡷𑡸𑡹𑡺𑡻𑡼𑡽𑡾𑡿𑢀𑢁𑢂𑢃𑢄𑢅𑢆𑢇𑢈𑢉𑢊𑢋𑢌𑢍𑢎𑢏𑢐𑢑𑢒𑢓𑢔𑢕𑢖𑢗𑢘𑢙𑢚𑢛𑢜𑢝𑢞𑢟𑢠𑢡𑢢𑢣𑢤𑢥𑢦𑢧𑢨𑢩𑢪𑢫𑢬𑢭𑢮𑢯𑢰𑢱𑢲𑢳𑢴𑢵𑢶𑢷𑢸𑢹𑢺𑢻𑢼𑢽𑢾𑢿𑣀𑣁𑣂𑣃𑣄𑣅𑣆𑣇𑣈𑣉𑣊𑣋𑣌𑣍𑣎𑣏𑣐𑣑𑣒𑣓𑣔𑣕𑣖𑣗𑣘𑣙𑣚𑣛𑣜𑣝𑣞𑣟𑣠𑣡𑣢𑣣𑣤𑣥𑣦𑣧𑣨𑣩𑣪𑣫𑣬𑣭𑣮𑣯𑣰𑣱𑣲𑣳𑣴𑣵𑣶𑣷𑣸𑣹𑣺𑣻𑣼𑣽𑣾𑣿𑤀𑤁𑤂𑤃𑤄𑤅𑤆𑤇𑤈𑤉𑤊𑤋𑤌𑤍𑤎𑤏𑤐𑤑𑤒𑤓𑤔𑤕𑤖𑤗𑤘𑤙𑤚𑤛𑤜𑤝𑤞𑤟𑤠𑤡𑤢𑤣𑤤𑤥𑤦𑤧𑤨𑤩𑤪𑤫𑤬𑤭𑤮𑤯𑤰𑤱𑤲𑤳𑤴𑤵𑤶𑤷𑤸𑤹𑤺𑤻𑤼𑤽𑤾𑤿𑥀𑥁𑥂𑥃𑥄𑥅𑥆𑥇𑥈𑥉𑥊𑥋𑥌𑥍𑥎𑥏𑥐𑥑𑥒𑥓𑥔𑥕𑥖𑥗𑥘𑥙𑥚𑥛𑥜𑥝𑥞𑥟𑥠𑥡𑥢𑥣𑥤𑥥𑥦𑥧𑥨𑥩𑥪𑥫𑥬𑥭𑥮𑥯𑥰𑥱𑥲𑥳𑥴𑥵𑥶𑥷𑥸𑥹𑥺𑥻𑥼𑥽𑥾𑥿𑦀𑦁𑦂𑦃𑦄𑦅𑦆𑦇𑦈𑦉𑦊𑦋𑦌𑦍𑦎𑦏𑦐𑦑𑦒𑦓𑦔𑦕𑦖𑦗𑦘𑦙𑦚𑦛𑦜𑦝𑦞𑦟𑦠𑦡𑦢𑦣𑦤𑦥𑦦𑦧𑦨𑦩𑦪𑦫𑦬𑦭𑦮𑦯𑦰𑦱𑦲𑦳𑦴𑦵𑦶𑦷𑦸𑦹𑦺𑦻𑦼𑦽𑦾𑦿𑧀𑧁𑧂𑧃𑧄𑧅𑧆𑧇𑧈𑧉𑧊𑧋𑧌𑧍𑧎𑧏𑧐𑧑𑧒𑧓𑧔𑧕𑧖𑧗𑧘𑧙𑧚𑧛𑧜𑧝𑧞𑧟𑧠𑧡𑧢𑧣𑧤𑧥𑧦𑧧𑧨𑧩𑧪𑧫𑧬𑧭𑧮𑧯𑧰𑧱𑧲𑧳𑧴𑧵𑧶𑧷𑧸𑧹𑧺𑧻𑧼𑧽𑧾𑧿𑨀𑨁𑨂𑨃𑨄𑨅𑨆𑨇𑨈𑨉𑨊𑨋𑨌𑨍𑨎𑨏𑨐𑨑𑨒𑨓𑨔𑨕𑨖𑨗𑨘𑨙𑨚𑨛𑨜𑨝𑨞𑨟𑨠𑨡𑨢𑨣𑨤𑨥𑨦𑨧𑨨𑨩𑨪𑨫𑨬𑨭𑨮𑨯𑨰𑨱𑨲𑨳𑨴𑨵𑨶𑨷𑨸𑨹𑨺𑨻𑨼𑨽𑨾𑨿𑩀𑩁𑩂𑩃𑩄𑩅𑩆𑩇𑩈𑩉𑩊𑩋𑩌𑩍𑩎𑩏𑩐𑩑𑩒𑩓𑩔𑩕𑩖𑩗𑩘𑩙𑩚𑩛𑩜𑩝𑩞𑩟𑩠𑩡𑩢𑩣𑩤𑩥𑩦𑩧𑩨𑩩𑩪𑩫𑩬𑩭𑩮𑩯𑩰𑩱𑩲𑩳𑩴𑩵𑩶𑩷𑩸𑩹𑩺𑩻𑩼𑩽𑩾𑩿𑪀𑪁𑪂𑪃𑪄𑪅𑪆𑪇𑪈𑪉𑪊𑪋𑪌𑪍𑪎𑪏𑪐𑪑𑪒𑪓𑪔𑪕𑪖𑪗𑪘𑪙𑪚𑪛𑪜𑪝𑪞𑪟𑪠𑪡𑪢𑪣𑪤𑪥𑪦𑪧𑪨𑪩𑪪𑪫𑪬𑪭𑪮𑪯𑪰𑪱𑪲𑪳𑪴𑪵𑪶𑪷𑪸𑪹𑪺𑪻𑪼𑪽𑪾𑪿𑫀𑫁𑫂𑫃𑫄𑫅𑫆𑫇𑫈𑫉𑫊𑫋𑫌𑫍𑫎𑫏𑫐𑫑𑫒𑫓𑫔𑫕𑫖𑫗𑫘𑫙𑫚𑫛𑫜𑫝𑫞𑫟𑫠𑫡𑫢𑫣𑫤𑫥𑫦𑫧𑫨𑫩𑫪𑫫𑫬𑫭𑫮𑫯𑫰𑫱𑫲𑫳𑫴𑫵𑫶𑫷𑫸𑫹𑫺𑫻𑫼𑫽𑫾𑫿𑬀𑬁𑬂𑬃𑬄𑬅𑬆𑬇𑬈𑬉𑬊𑬋𑬌𑬍𑬎𑬏𑬐𑬑𑬒𑬓𑬔𑬕𑬖𑬗𑬘𑬙𑬚𑬛𑬜𑬝𑬞𑬟𑬠𑬡𑬢𑬣𑬤𑬥𑬦𑬧𑬨𑬩𑬪𑬫𑬬𑬭𑬮𑬯𑬰𑬱𑬲𑬳𑬴𑬵𑬶𑬷𑬸𑬹𑬺𑬻𑬼𑬽𑬾𑬿𑭀𑭁𑭂𑭃𑭄𑭅𑭆𑭇𑭈𑭉𑭊𑭋𑭌𑭍𑭎𑭏𑭐𑭑𑭒𑭓𑭔𑭕𑭖𑭗𑭘𑭙𑭚𑭛𑭜𑭝𑭞𑭟𑭠𑭡𑭢𑭣𑭤𑭥𑭦𑭧𑭨𑭩𑭪𑭫𑭬𑭭𑭮𑭯𑭰𑭱𑭲𑭳𑭴𑭵𑭶𑭷𑭸𑭹𑭺𑭻𑭼𑭽𑭾𑭿𑮀𑮁𑮂𑮃𑮄𑮅𑮆𑮇𑮈𑮉𑮊𑮋𑮌𑮍𑮎𑮏𑮐𑮑𑮒𑮓𑮔𑮕𑮖𑮗𑮘𑮙𑮚𑮛𑮜𑮝𑮞𑮟𑮠𑮡𑮢𑮣𑮤𑮥𑮦𑮧𑮨𑮩𑮪𑮫𑮬𑮭𑮮𑮯𑮰𑮱𑮲𑮳𑮴𑮵𑮶𑮷𑮸𑮹𑮺𑮻𑮼𑮽𑮾𑮿𑯀𑯁𑯂𑯃𑯄𑯅𑯆𑯇𑯈𑯉𑯊𑯋𑯌𑯍𑯎𑯏𑯐𑯑𑯒𑯓𑯔𑯕𑯖𑯗𑯘𑯙𑯚𑯛𑯜𑯝𑯞𑯟𑯠𑯡𑯢		

	Sign	Variant		Seal-ID	Inscription	Sanskrit	Translation
64	ॐ	ॐ	र	K-18	ॐ ॐ ॐ ॐ	तद् विरल	so[AV] scarce[MBh]
65	ॐ	ॐ	आर	M-713	ॐ ॐ ॐ ॐ	अ रवि दशनमन	ten[RV] salutes[MārkaP], O[T] Roarer(Shiva)[√रु]
66	ॐ	ॐ	रा	M-84	ॐ ॐ ॐ ॐ	धनामरान्	prize[RV] of immortals[ŚBr]
67	ॐ	ॐ	चर	C-13	ॐ ॐ ॐ ॐ	चरम् वमम्	moving[MBh] emitter[वम्]
68	ॐ	ॐ	तर	H-1192	ॐ ॐ ॐ ॐ	तमत्राणि	dark[RV] and protected[MBh]
69	ॐ	ॐ	त्र	M-360	ॐ ॐ ॐ ॐ	अमत्रदान	powerful[RV] gift[RV]
70	ॐ	ॐ	रक्त	M-1759	ॐ ॐ ॐ ॐ	रक्तविदवन्	O red[Br] wise one[RV]
71	ॐ	ॐ	रस्	H-598	ॐ ॐ ॐ ॐ	रसम् अविमताम्	milk[MBh] of sheep[RV]
72	ॐ	ॐ	र	H-510	ॐ ॐ ॐ ॐ	रमवरम्	delightful boon[RV]
73	ॐ	ॐ	पर	M-83	ॐ ॐ ॐ ॐ	प्रसर	stream[BhP]
74	ॐ	ॐ	ध	M-1793	ॐ ॐ ॐ ॐ	दमवनमन्	saluting the powerful subdued[ŚBr]
75	ॐ	ॐ	रक	M-120	ॐ ॐ ॐ ॐ	मदनबाण रख	go, O cupid's[MBh] arrow[RV]
76	ॐ	ॐ	रण	M-1771	ॐ ॐ ॐ ॐ	रणं भां	delightful[RV] lustre[MBh]
77	ॐ	ॐ	रर	M-1154	ॐ ॐ ॐ ॐ	पासमानि रर	Give[√रा], O protectors of all[RV]
78	ॐ	ॐ	री	H-1033	ॐ ॐ ॐ ॐ	वरीविनि आम्	verily, within[RV] rivers[Naigh]
79	ॐ	ॐ	रर	H-405	ॐ ॐ ॐ ॐ	रर विहनाम न	give, sans mark[RV] of the sky[RV]
80	ॐ	ॐ	ईरि	M-151	ॐ ॐ ॐ ॐ	ईरिणम्	desert[MBh]
81	ॐ	ॐ	र	L-48↔	ॐ ॐ ॐ ॐ	रणवनमन् रख	go[√रख] joyously[TS] praying[√नम्]
82	ॐ	ॐ	र	H-299	ॐ ॐ ॐ ॐ	रण्व	delightful[RV]
83	ॐ	ॐ	रि	M-918	ॐ ॐ ॐ ॐ	रवि रीर	O Roarer[√रु], O Shiva[Cat]
84	ॐ	ॐ	र	M-1424→	ॐ ॐ ॐ ॐ	रणभाद	O pleasing[RV] lightgiver[MBh]
85	ॐ	ॐ	र	H-2214→	ॐ ॐ ॐ ॐ	रवमय	O roarer[रव:RV]
86	ॐ	ॐ	अश्	M-243	ॐ ॐ ॐ ॐ	दत्ताश्वद	given[RV] by horsegiver[Mn]
87	ॐ	ॐ	अ	H-792	ॐ ॐ ॐ ॐ	अयि	(vocative particle)
88	ॐ	ॐ	अ	M-73	ॐ ॐ ॐ ॐ	अनी	the living one[√अन्+अच्+णिनि]
89	ॐ	ॐ	अ	M-210	ॐ ॐ ॐ ॐ	अरण	distant[RV]
90	ॐ	ॐ	न	M-1277	ॐ ॐ ॐ ॐ	नव	new[RV]
91	ॐ	ॐ	जस्	Ns-4	ॐ ॐ ॐ ॐ	यजस्	sacrifice[RV]
92	ॐ	ॐ	य	C-39	ॐ ॐ ॐ ॐ	दद्य	condemn[√द्यै]
93	ॐ	ॐ	सक्ष	M-1342	ॐ ॐ ॐ ॐ	सभासक्षं	powerful[TS] council[RV]
94	ॐ	ॐ	नाशन	M-975	ॐ ॐ ॐ ॐ	नशनानलसक्ष	loss[BhP] by intense fire[Subh]
95	ॐ	ॐ	सात	H-325	ॐ ॐ ॐ ॐ	सातं	gains[RV]
96	ॐ	ॐ	न	M-747	ॐ ॐ ॐ ॐ	न नाशं	no loss[MBh]
97	ॐ	ॐ	अरवि	M-1105	ॐ ॐ ॐ ॐ	अ रवि	O Roarer[√रु]
98	ॐ	ॐ	आप	H-413	ॐ ॐ ॐ ॐ	आप	vedic deity(Vasus)[MBh]
99	ॐ	ॐ	अम	M-18	ॐ ॐ ॐ ॐ	जनम्	people[RV]
100	ॐ	ॐ	अम	M-954	ॐ ॐ ॐ ॐ	मम अन्नम्	my[RV] food[RV]
101	ॐ	ॐ	अश्	H-1049	ॐ ॐ ॐ ॐ	अश्विचर	O mover[MBh] on horses[RV]

	Sign	Variant		Seal-ID	Inscription	Sanskrit	Translation
102			क	H-66		कामनन्	misremembering[Pāṇ,√म्ना]
103			क	H-513		क्षण	moment[Śak]
104			अश्	H-1513		अशन	voracious[RV]
105			अश्	M-821		अशम्	eating[ŚBr]
106			क	H-74		वदाकवि	wise speaker[RV]
107			आभा	M-742		अ भामवरा	O gift[RV] of light[RV]
108			अदा	Ad-6		तद्धनदाम	giver of that wealth[RV,RV,RV]
109			द	H2048		मद	excitement[RV]
110			वा	H-2192		दवामतं	honored[RV 10.68.7] fire[BhP]
111			द	M-777		असमामनिद	unequalled[RV] path[Uṇ] giver
112			न	M-986		नरं	man[TS]
113			म	M-1367		मर	death[AV]
114			रल	K-122		रर लता	grant[√रा] lightning
115			अन्	M-89		अमवान् उन्न	powerful[RV] wet one[KātyŚr]
116			न	H-228		नायी	guiding [nms. नायिन्]
117			म	M-899		मय्य	(name of a Brahmin)
118			त	H-142		कम् तथा तान	thus reciting[KātyŚr] well[TS]
119			श	M-207		शद	revenue[Gaut]
120			त	K-11		अत्यदं	excessive[RV] eating
121			मद	C-8		मदं महं	abundant[RV] joy[RV]
122			व उष	M-1106		नव उषद	new[RV] dawn[RV] giver(Sun)
123			बत	Frm-1329		भट	warrior[MBh]
124			क	M-68↔		दमं सन काम	serve[√सन्] the home, O Kama
125			लल	M-751A		ललक	little delight[√लल]
126			प	H-1024		मव पण	bind[√मव] the wager[MBh]
127			व	MS-5062		अवभस	shine forth[अवभास्:MBh]
128			धी	M-605		धी	devotion[RV]
129			रक	K-15/2		अकारि	reached[√ऋ] the Sun[RV]
130			त	M-1792		अन्तं मरं	end[RV] of death[RV]
131			म	Louvre		आमज्ज अयतस्	unrestrained[RV] ascent[RV]

Table 17: Variants and Composite signs

## 7. Very Short Inscriptions

	Seal-Id	Inscription	Translation		Seal-Id	Inscription	Translation
1	Bhirrana	𑀓𑀭𑀸𑀓	to fix[TS]	2	M-1203	𑀓𑀭𑀸𑀓	to fix[TS]
3	H-367	𑀓𑀭𑀸𑀓	to fix[TS]	4	L-106	𑀓𑀭𑀸𑀓	shine![√अस्]
5	M-842	𑀓𑀭𑀸𑀓	sword[RV]	6	M-1198	𑀓𑀭𑀸𑀓	(vocative)[T]
7	M-1905	𑀓𑀭𑀸𑀓	(vocative)[T]	8	H-481	𑀓𑀭𑀸𑀓	(vocative)[Pāṇ]
9	C-52	𑀓𑀭𑀸𑀓	O mother[Pāṇ]	10	M-1105	𑀓𑀭𑀸𑀓	O Roarer[√रु]
11	H-1113	𑀓𑀭𑀸𑀓	(interj)[Pāṇ]	12	M-597	𑀓𑀭𑀸𑀓	O Shiva[MBh]
13	K-464	𑀓𑀭𑀸𑀓	dawn[RV]	14	M-949	𑀓𑀭𑀸𑀓	joy[Nir]
15	H-1113	𑀓𑀭𑀸𑀓	joy[Nir]	16	H-1833	𑀓𑀭𑀸𑀓	also[Pāṇ]
17	M-607	𑀓𑀭𑀸𑀓	also[Pāṇ]	18	M-262	𑀓𑀭𑀸𑀓	and[RV] also[Pāṇ]
19	M-331	𑀓𑀭𑀸𑀓	born[Mn]	20	M-85-5	𑀓𑀭𑀸𑀓	him[RV]
21	D-50318	𑀓𑀭𑀸𑀓	him[RV]	22	L-66	𑀓𑀭𑀸𑀓	him[RV]
23	H-94	𑀓𑀭𑀸𑀓	them[MS]	24	M-996	𑀓𑀭𑀸𑀓	next[षोड VPrāt]
25	M-326	𑀓𑀭𑀸𑀓	next[षोड VPrāt]	26	M-470	𑀓𑀭𑀸𑀓	next[षोड VPrāt]
27	H-1514	𑀓𑀭𑀸𑀓	next[षोड VPrāt]	28	H-1011	𑀓𑀭𑀸𑀓	next[षोड VPrāt]
29	K-476	𑀓𑀭𑀸𑀓	gift[MBh]	30	M-605	𑀓𑀭𑀸𑀓	prayer[RV]
31	M-326	𑀓𑀭𑀸𑀓	praised[प्रस्तुत TS]	32	M-1118	𑀓𑀭𑀸𑀓	bow[MārḥP]
33	M-1084	𑀓𑀭𑀸𑀓	sign[RV]	34	D-48576	𑀓𑀭𑀸𑀓	praising[Nalod]
35	K-53	𑀓𑀭𑀸𑀓	bound[RV]	36	M-273	𑀓𑀭𑀸𑀓	O star[Sūryas]
37	K-67	𑀓𑀭𑀸𑀓	O star[Sūryas]	38	L-105	𑀓𑀭𑀸𑀓	shining[√भा]
39	M-1465	𑀓𑀭𑀸𑀓	protection	40	M-410	𑀓𑀭𑀸𑀓	to me[माम्]
41	M-1898	𑀓𑀭𑀸𑀓	to me[माम्]	42	K-462	𑀓𑀭𑀸𑀓	to me[माम्]
43	L-54	𑀓𑀭𑀸𑀓	to me[माम्]	44	M-516	𑀓𑀭𑀸𑀓	to me[माम्]
45	Blk-5	𑀓𑀭𑀸𑀓	him[यद्]	46	M-1162	𑀓𑀭𑀸𑀓	him[यद्]
47	Lakhanjo	𑀓𑀭𑀸𑀓	him[यद्]	48	K-446	𑀓𑀭𑀸𑀓	him[यद्]
49	C-94	𑀓𑀭𑀸𑀓	him[यद्]	50	M-1563	𑀓𑀭𑀸𑀓	possessing[Naiṣ]
51	M-604	𑀓𑀭𑀸𑀓	possessing[Naiṣ]	52	B-12	𑀓𑀭𑀸𑀓	possessing[Naiṣ]
53	M-1641	𑀓𑀭𑀸𑀓	possessing[Naiṣ]	54	M-1205	𑀓𑀭𑀸𑀓	possessing[Naiṣ]
55	M-1233	𑀓𑀭𑀸𑀓	possessing[Naiṣ]	56	M-593	𑀓𑀭𑀸𑀓	possessing[Naiṣ]
57	M-599	𑀓𑀭𑀸𑀓	possessing[Naiṣ]	58	D-17490	𑀓𑀭𑀸𑀓	powerful
59	M-1642	𑀓𑀭𑀸𑀓	two[RV]	60	K-458	𑀓𑀭𑀸𑀓	blessing[शम् RV]
61	L-66	𑀓𑀭𑀸𑀓	blessing[शम् RV]	62	B-10	𑀓𑀭𑀸𑀓	blessing[शम् RV]
63	Bhirrana	𑀓𑀭𑀸𑀓	blessing[शम् RV]	64	H-1016	𑀓𑀭𑀸𑀓	blessing[शम् RV]

Table 18: Very short inscriptions

## 389 8. Derivation

390 8.1.  $\cup$  अन् ।अं *from* अनुतर्ष *drinking vessel*

Seal-Id	Inscription	Sanskrit	Translation
H-764 B	$\cup\cup\cup$	अननं	the living[Nir]
Dmd-1	$\cup$	अन्	O soul[RV]
(Many)	$\cup^*$	*अं	(terminal अनुस्वार)

$$\cup = \text{अन्} \quad (1)$$

391 8.2.  $|$  अ *from* आजनि *stick*

Seal-Id	Inscription	Sanskrit	Translation
Harappa	$\cup\cup\cup $	आननम्	face[R]
H-1550	$  \cup$	अना	indeed[RV]
H-1919	$\cup $	आम्	verily[MaitrS]

$$| = \text{अ from } 1 \quad (2)$$

392 8.3.  $\mathbb{D}$  द *from* दण्डार *bow*

Seal-Id	Inscription	Sanskrit	Translation
C-80	$\mathbb{D}\cup$	अन्ध	O Soma[RV]
H-1919	$\cup\mathbb{D}$	धन	wealth, prize[RV]
H-1545	$\mathbb{D}\mathbb{D}$	ददा	give[RV]

$$\mathbb{D} = \text{द from } 1, 2 \quad (3)$$

393 8.4.  $\text{†}$  अ *from* आयु *man*

394 The regular expression used for M-191 is  $/\text{^\text{[dD]} (.+)\text{\1\$}}/$

Seal-Id	Inscription	Sanskrit	Translation
M-191	$\text{†}\text{†}\mathbb{D}$	धा	to place[RV, कर्णे करं धा]
H-346	$\cup\text{†}$	आम्	verily[MaitrS]

$$\text{†} = \text{अ from } 1, 3 \quad (4)$$

395 8.5. 𑀓 इ from इषीक stalk of grain

Seal-Id	Inscription	Sanskrit	Translation
M-87A	𑀓𑀭𑀮	अधि	above[RV]
H-2244B	𑀓𑀭	इद्	(affirmation)[Ved]

$$\text{𑀓} = \text{इ from 3, 4} \quad (5)$$

396 8.6. 𑀧 द from दण्डार variant of bow 𑀧

Seal-Id	Inscription	Sanskrit	Translation
C-15a	𑀧𑀭𑀮	अधीन	belonging to[R]

$$\text{𑀧} = \text{द from 1, 2, 5} \quad (6)$$

397 8.7. 𑀧 त from त tail

Seal-Id	Inscription	Sanskrit	Translation
B-8	𑀧𑀭	तन	offspring[AV]
H-150	𑀧𑀭𑀮𑀮𑀮	दददान्त	Given[RV 1.39.9] by pacified one[√दम् + क्त]

$$\text{𑀧} = \text{त from 1, 6} \quad (7)$$

398 8.8. 𑀧 श from शुक्र seed

399 Regular expression used to capture the repeat sequence followed by 𑀧 in seal  
400 M-916 is `/^(.+)\a?\1i$/`.

Seal-Id	Inscription	Sanskrit	Translation
M-916A	𑀧𑀭𑀮𑀮	शशी	the Moon[ŚvetUp]
M-482A	𑀧𑀭𑀮	शनि	Saturn[R]

$$\text{𑀧} = \text{श from 1, 5} \quad (8)$$



401 8.9.  $\text{𑀧}$  न from नाल stalk

Seal-Id	Inscription	Sanskrit	Translation
M-922a	$\text{𑀧𑀭}$	अशन	reaching across[Nir]
M-812a	$\text{𑀧𑀭}$	अनान्	breathing[ŚBr]

$\text{𑀧}$  = न from 1, 2, 8 (9)

402 8.10.  $\text{𑀧𑀭}$  ई from इइ

Seal-Id	Inscription	Sanskrit	Translation
M-1132a	$\text{𑀧𑀭𑀭}$	नी	leader/guide[वशं नी]

$\text{𑀧𑀭}$  = ई from 5, 9 (10)

403 8.11.  $\text{𑀭𑀭𑀭}$  ज from झर waterfall; cascade

Seal-Id	Inscription	Sanskrit	Translation
H-246B	$\text{𑀭𑀭𑀭𑀭}$	जनधा	supporter of people[RV,RV]

$\text{𑀭𑀭𑀭}$  = ज from 1, 3, 4 (11)

404 8.12.  $\text{𑀭𑀭}$  र from रथ chariot

Seal-Id	Inscription	Sanskrit	Translation
H-842	$\text{𑀭𑀭𑀭𑀭}$	ऋणी	debtor[BG]
H-923	$\text{𑀭𑀭𑀭}$	जर	aging[RV]
H-305B	$\text{𑀭𑀭𑀭𑀭}$	अरज	dustless (pure)[R]

$\text{𑀭𑀭}$  = र from 1, 2, 5, 11 (12)

405 8.13. र from रथर्वी multi/split snake

Seal-Id	Inscription	Sanskrit	Translation
H-1745A	𑀓𑀮𑀭	रज	pollen[Prasaṅgābh]
H-585A	𑀮𑀓𑀭	जर	aging[RV]
M-1170A	𑀮𑀭	ईर	move[ईर् लोट् RV]

$$\text{𑀮} = \text{र from 5, 11} \quad (13)$$

406 8.14. च from चतुर four

Seal-Id	Inscription	Sanskrit	Translation
D-33544	𑀮𑀮𑀮𑀮	चरी	(a name)[Pravar]
M-749A	𑀮𑀮𑀮	चर	move[MBh]
H-215B	𑀮𑀮𑀮	चण	chickpea[MBh]

$$\text{𑀮} = \text{च from 1, 13} \quad (14)$$

407 8.15. ढ अ from अज horn

Seal-Id	Inscription	Sanskrit	Translation
L-20a	𑀮𑀮𑀮𑀮	अचर	immovable[RV]
H-70a	𑀮𑀮𑀮	अजर	undecaying[RV]
H-2173	𑀮𑀮𑀮	अरणि	kindling wood[RV]

$$\text{𑀮} = \text{अ from 1, 5, 11, 12, 13, 14} \quad (15)$$

408 8.16. म from मत्स्य fish

Seal-Id	Inscription	Sanskrit	Translation
M-238a	𑀮𑀮𑀮	मसन	transformation[मस् + ल्युट्]
M-1344A	𑀮𑀮𑀮	मरण	death[MBh]
H-1192A	𑀮𑀮𑀮	चमन्	eating[चम् + शतृ]

$$\text{𑀮} = \text{म from 1, 8, 13, 14} \quad (16)$$

409 8.17. " वि from वि two

Seal-Id	Inscription	Sanskrit	Translation
H-292A	"◊	रवि	the Sun[MBh]
H-651a	◊"	अवीर	having no sons[RV]
M-982a	ॐ◊"	विरण	recovery[RV]
M-1297A	ॐ"◊	रवीश	the Sun lord[MBh, MBh]

" = वि from 1, 2, 8, 12 (17)

410 8.18. ⊗ र from रथार chariot wheel

Seal-Id	Inscription	Sanskrit	Translation
M-1119a	ॐ⊗"⊗ॐ	अंशवीर	betting man[RV, RV]
H-829a	◊"⊗	अवीर	having no sons[RV]

⊗ = र from 1, 4, 8, 17 (18)

411 8.19. □ ब|भ from भक्षपत्र betel leaf

Seal-Id	Inscription	Sanskrit	Translation
M-311A	ॐ"┐□	भानवी	a kind of pace[Samgīt]

□ = ब from 5, 9, 17 (19)

412 8.20. 𑀮 य from यवश्रेष्ठि grain merchant

413 This symbol also occurs as 𑀮 𑀮.

Seal-Id	Inscription	Sanskrit	Translation
H-81A	𑀮 III	जय	victory[AV]
M-209A	𑀮 ॐ𑀮	मान्य	respected[MBh]

𑀮 = य from 1, 11, 16 (20)

414 8.21. \* अ from अयु variant of ऋ

Seal-Id	Inscription	Sanskrit	Translation
L-38	𑀮𑀭𑀭𑀭	माय	illusion[MBh]
M-1654	𑀮𑀭𑀭	आन	nose[RV]

$$* = \text{अ from 1, 2, 16, 20} \quad (21)$$

415 8.22. 𑀮 नि|णि from अणि point of arrow; nail

416 The word शमनी is attested as both 𑀮𑀭𑀭 and 𑀮𑀭𑀭 (M-1781a) illustrating that  
 417 long vowels may be written as short when unambiguous. Usage in 𑀮𑀭 मणि is illus-  
 418 trates that retroflex usage is implied in context.

Seal-Id	Inscription	Sanskrit	Translation
M-1781A	𑀮𑀭𑀭	शमनी	soothing[MBh]
H-1879A	𑀮𑀭𑀭	जज्ञि	germinating[TS]

$$𑀮 = \text{नि|णि from 8, 11, 16} \quad (22)$$

419 8.23. 𑀮 अस्|अश् from अष्टापद eight legged; spider

Seal-Id	Inscription	Sanskrit	Translation
H-1513	𑀮𑀭	अश्न	voracious[RV]
B-1A	𑀮𑀭𑀭𑀭𑀭𑀭𑀭𑀭	रस्नविमान	Giving[Śis] object[Uṇ] traversing the sky[RV]

$$𑀮 = \text{अस्|अश् from 1, 4, 9, 16, 17, 18} \quad (23)$$

420 8.24. 𑀮 अम from अङ्क + मत्स्य composite curve + fish

421 The symbol ) placed rotated above 𑀭. This vertical assembly occurs with other  
 422 symbols as well.

Seal-Id	Inscription	Sanskrit	Translation
M-686a	𑀓𑀭𑀮𑀭	शमनी	soothing[MBh]
M-748a	𑀭𑀮𑀭𑀮	अमसि	helping[√अम्]

𑀭 = अम from 5, 8, 22, 23 (24)

423 8.25. 𑀭 न from नळ reed

Seal-Id	Inscription	Sanskrit	Translation
H-59A	𑀭𑀮𑀭𑀮	अश्नं	a stone[RV]
M-1118A	𑀭𑀮𑀭	नमन	salute[Mār̥kP]

𑀭 = न from 1, 16, 23 (25)

424 8.26. 𑀭 न from नाव boat

Seal-Id	Inscription	Sanskrit	Translation
H-550	𑀭𑀮𑀮𑀮𑀮	आञ्जनी	collyrium[R]
M-928a	𑀭𑀮𑀮	आनम्	subdue[RV]

𑀭 = न from 2, 11, 22, 24 (26)

425 8.27. 𑀭 य from यव+आजनि composite barley + stick

Seal-Id	Inscription	Sanskrit	Translation
H-1953A	𑀭𑀮𑀮𑀮𑀮𑀮	स्मयमानि	patronym of स्मयमानः[√स्मि + शानच्]

𑀭 = य from 8, 16, 22 (27)

426 8.28. || व from वण्ड spear

Seal-Id	Inscription	Sanskrit	Translation
H-586A	ॐॐ	वरण	choosing[MBh]
M-137A	ॐ	न रवण	no[RV] yelling[Bhatt]
M-999A	ॐ	वमनम् न	no[RV] vomiting[√वम् + ल्युट्]
M-514B	ॐ	अञ्जव	fast mental impulse[RV]

|| = व from 1, 11, 12, 16, 18, 25, 26 (28)

427 8.29. ॐ क from कट wood

Seal-Id	Inscription	Sanskrit	Translation
H-300B	ॐॐॐ	रणक	delights in battle(name)[BhP]
M-134A	ॐॐॐ	कवर	braid[Pan, BhP]

ॐ = क from 9, 12, 28 (29)

428 8.30. ) अ from अङ्क curve

Seal-Id	Inscription	Sanskrit	Translation
H-1520	ॐॐॐ)	अजक	name of king[Mbh]
M-511	□)ॐॐॐ	जनाभ	appearing like[R] person[RV]

) = अ from 1, 11, 19, 29 (30)

429 8.31. ॐ अ from अङ्क boldface variant of curve )

430 Regular expressions used were /S(.+)n/, /m(.+)n/, /j(.+)n/. Boldface vari-  
431 ants all symbols are seen to be identical to their regular versions.

Seal-Id	Inscription	Sanskrit	Translation
M-917a	ॐॐॐॐ	सान	destruction[√सो+ल्युट्]
M-945a	ॐॐॐॐ	मान	destruction[√मी+ल्युट्]
M-1482a	ॐॐॐॐॐ	आव्रजान	indeed[MaitrS] decay[√जै+ल्युट्]

ॐ = आ from 1, 8, 11, 16, 26 (31)

432 8.32. )) आ from अङ्क variant of curve )

Seal-Id	Inscription	Sanskrit	Translation
H-1897A	ॐॐ))	मानि	measure[√मा]
H-240A	ॐ))ॐॐ	शम् अवान	happy[RV] and untroubled[RV]
L-111a	ॐ))ॐॐ	अममान	powerful[RV] appearance[RV]

) = आ from 1, 5, 8, 16, 24, 28 (32)

433 8.33. ॐ अ from अङ्क variant of curve )

Seal-Id	Inscription	Sanskrit	Translation
M-951	ॐॐॐॐ	अमान्	many powers[RV]
M-2021	ॐॐॐॐ	अना	indeed[RV]

ॐ = आ from 1, 2, 4, 16 (33)

434 8.34. ॐ म from मदर मस्त variant of elephant head ॐ

Seal-Id	Inscription	Sanskrit	Translation
H-665a	ॐॐॐॐॐ	कम् चर	move[MBh] well[TS]
H-2090B	ॐॐॐॐ	रमर	possessing[Naiṣ] death
H-2040	ॐॐॐॐॐ	आसमसन	transforming[√मस् + लयुट्] to ashes[AV]

ॐ = म from 1, 8, 12, 13, 14, 18, 23, 29 (34)

435 8.35. ॐ म from मय variant of horse ॐ

Seal-Id	Inscription	Sanskrit	Translation
M-1989b	ॐॐॐॐॐ	मानक	measure[Hcat]
M-624	ॐॐॐॐॐ	मदाश	joy[RV] of food[ŚBr]
M-1233a	ॐॐॐॐॐ	मणि	gem[RV]

ॐ = म from 1, 3, 4, 5, 30, 23, 29 (35)

436 8.36. 𑀓 न from नाल time card

Seal-Id	Inscription	Sanskrit	Translation
M-382A	𑀓𑀓𑀓𑀓	आनन	mouth[R]
H-1682	𑀓𑀓𑀓𑀓𑀓𑀓	जननजय	creator[RV] of victory[AV]

𑀓 = न from 4, 11, 20 (36)

437 8.37. 𑀓 व from वरण्ड lamp wick

Seal-Id	Inscription	Sanskrit	Translation
M-925A	𑀓𑀓𑀓	नवन	praising[Nalod]
M-1689a	𑀓𑀓𑀓𑀓	वश्य	dutiful[MBh]

𑀓 = व from 8, 25, 20 (37)

438 8.38. 𑀓 श from शाखर squirrel

Seal-Id	Inscription	Sanskrit	Translation
H-1080a	𑀓𑀓𑀓	शाण	hempen[ŚBr]
M-1829a	𑀓𑀓	शनि	Saturn[R]
H-1830a	𑀓𑀓	शय	sleeping[Dhātup]
L-35A	𑀓𑀓𑀓	मसन	transformation[√मस्+त्युट]

𑀓 = श from 1, 16, 21, 22, 20 (38)

439 8.39. 𑀓 म from मन्दिर dwelling

Seal-Id	Inscription	Sanskrit	Translation
M-832a	𑀓𑀓𑀓	शमन	soothing[MBh]
H-892B	𑀓𑀓𑀓	शमनी	soothing[MBh]
M-1115a	𑀓𑀓𑀓𑀓	रविम् मान	honor[√मान् लोट] the Sun[MBh]

𑀓 = म from 1, 5, 12, 16, 17, 38 (39)



440 8.40. ು र from रथ *Dalbergia tree*

Seal-Id	Inscription	Sanskrit	Translation
H-1975A	ॐॐॐॐॐ	कम् तरन्	swimming[√तृ + शर्त्तु] well[TS]
M-1908a	ॐॐ	रण	pleasure[RV]
H-289A	ॐॐॐॐ	चरण	feet[MBh]
M-2024a	ॐॐॐॐ	समरण	war[RV]

$$\text{ॐ} = \text{र from } 1, 7, 8, 14, 29, 34, 39 \quad (40)$$

441 8.41. द from दुन्दम *hourglass drum*

Seal-Id	Inscription	Sanskrit	Translation
H-1740	दद	दद	given[√दा लिट]
M-1088	ॐदॐ	रविदान	gift[RV] of the Sun[MBh]
L-112	ॐॐॐॐॐ	वद विनरान्	speak[√वद् लोट्] to dispersed[RV] men[MBh]

$$\text{द} = \text{द from } 1, 9, 17, 18, 37, 40 \quad (41)$$

442 8.42. अ from अयुग *one*

443 The regular expression used for M-865a is  $\text{/}\sim\text{r}(.*)\text{ma}.*\text{\$/}$ .

Seal-Id	Inscription	Sanskrit	Translation
M-865a	ॐॐॐॐॐ	राममान	pleasing[MBh] respect[MBh]
M-1177A	ॐॐॐॐॐ	रवि आरम्	I have reached[√ऋ लुङ्], O Ravin[√रु + अच् + इन्]

$$\text{ॐ} = \text{अ from } 1, 4, 12, 16, 17, 18, 24, 40 \quad (42)$$

444 8.43. र from रथर्वी *multi/split snake*

Seal-Id	Inscription	Sanskrit	Translation
D-9093	ॐॐॐॐॐ	शं अविचर	bless us[RV], O unwavering one[MBh]
M'daro 84-2	ॐॐ	वीर	hero[RV]
M-361	ॐॐॐॐ	अरर	door[Mcar]

$$\text{ॐ} = \text{र from } 1, 4, 14, 17, 18, 38, 42 \quad (43)$$

445 8.44. य from यव barley

Seal-Id	Inscription	Sanskrit	Translation
D-16261	य य ' य य	आवियाजय	worship[यज् लोट्] for pain[TS]
M-218A	य य	यमी	(Yama's) twin sister[RV]
H-48A	य य	जय	victory[AV]
M-1322a	य य	अजय	undefeated[RV]

य = य from 2, 4, 5, 11, 15, 16, 17, 42 (44)

446 8.45. द from दुन्दुम variant of hourglass drum द

Seal-Id	Inscription	Sanskrit	Translation
M-619A	द	दव	heat[Car]
H-844A	द	विदन्	knowing[विद् शतृ]
M-190	द	वधवय	weave[वे लोट्], O destroyer[RV]

द = द|ड from 1, 11, 17, 20, 28 (45)

447 8.46. त from ताडुल्य drum

Seal-Id	Inscription	Sanskrit	Translation
M-228A	त	मथन	churn[MBh]
M-459A	त	तन	offspring[AV]
M-2079A	त	तद्	there[AV]

त = त from 1, 16, 45 (46)

448 8.47. म from मदारमस्त elephant head

Seal-Id	Inscription	Sanskrit	Translation
M-286a	म	नमन	saluting[Śis]
M-100a	म	रविनमन	Sun[MBh] salutation[Śis]
H-921A	म	तमन	desire[तम् + ल्युट्]

म = म from 1, 4, 7, 12, 16, 17, 26 (47)

449 8.48. ✱ त from ताडुल fighter

Seal-Id	Inscription	Sanskrit	Translation
M-1743A	ॐ✱ॐ	शान्तधर	tranquil[MBh] bearer[MBh]
H-1666A	ॐॐॐॐ	तनाय	gain[MBh] of offspring[AV]

✱ = त from 1, 2, 4, 13, 20, 38, 45 (48)

450 8.49. ॐ स from सप्त seven

Seal-Id	Inscription	Sanskrit	Translation
M-673	ॐ	सर	move[√सृ लोट्]
Krs-2	ॐॐ	समन्	keeping calm[√सम् + शर्त्तु]
H-9	ॐ	सम	equal[RV]
H-296	ॐॐॐॐॐॐ	दासमानि	patronym दासमानः[√दास् + शानच्]

ॐ = स from 1, 5, 6, 13, 16, 35, 42 (49)

451 8.50. ○ र from रथपद variant of wheel ⊗

Seal-Id	Inscription	Sanskrit	Translation
H-668A	ॐ○	रण	joy[RV]
H-841A	ॐॐ○	ऋणी	debtor[BG]
H-1951A	ॐॐॐॐॐॐ○	रजसाशनन्	eating[√अश् + शर्त्तु] unclean[AV]

○ = र from 1, 5, 11, 23, 36 (50)

452 8.51. ॐ श from शाखर variant of squirrel ॐ

Seal-Id	Inscription	Sanskrit	Translation
M-1202A	ॐॐॐॐॐॐॐॐ	दशरण्यान्	ten[RV] delights[RV]
H-771	ॐॐॐ	वशद	wish[RV] giver[MBh]

ॐ = श from 1, 21, 27, 28, 45, 50 (51)

453 8.52. 𑀧 प|फ from पाणि hand

Seal-Id	Inscription	Sanskrit	Translation
H-443A	𑀧𑀭𑀭𑀭	अमपन	powerful[RV] wager[MBh]
H-758A	𑀧𑀭𑀭𑀭	पान	drink[RV]
M-967A	𑀧𑀭𑀭𑀭𑀭	(अ)मपरी	attain[AV] power[RV]
H-101a	𑀧𑀭𑀭𑀭	पारण	accomplishing[MBh]
D-19655	𑀧𑀭𑀭𑀭𑀭	यजपर	pleaser[√पृ + अच्] of the sacrifice[ŚBr]

$$𑀧 = प \text{ from } 1, 2, 5, 9, 11, 12, 16, 21, 40, 44 \quad (52)$$

454 8.53. 𑀭 द from दन्त teeth

Seal-Id	Inscription	Sanskrit	Translation
M-326c	𑀭𑀭𑀭𑀭	दधद्	wearing[√धा + शतृ]
H-2336	𑀭𑀭𑀭𑀭𑀭	मादन	exhilarating[RV]
H-86a	𑀭𑀭𑀭𑀭	अदनि	should eat[√अद् लोट्]

$$𑀭 = द \text{ from } 1, 2, 15, 16, 22, 45 \quad (53)$$

455 8.54. 𑀭 म from मय horse

Seal-Id	Inscription	Sanskrit	Translation
M-1444B	𑀭𑀭𑀭𑀭	मख	festival[RV]
M-1955	𑀭𑀭𑀭𑀭𑀭𑀭𑀭𑀭	रविसमादर	Respected[Pañcat] like[RV] Sun[MBh]

$$𑀭 = म \text{ from } 6, 8, 13, 17, 18, 29 \quad (54)$$

456 8.55. 𑀭 म from मय variant of horse 𑀭

Seal-Id	Inscription	Sanskrit	Translation
L-52a	𑀭𑀭𑀭𑀭	आशम्	food[ŚBr]
M-965a	𑀭𑀭𑀭𑀭𑀭𑀭	मन्ववरं	Wise[RV] favor[RV] boon[RV]




$$𑀭 = म \text{ from } 1, 13, 23, 28, 37 \quad (55)$$

457 8.56. † अ *from आजनि variant of stick* |

<b>Seal-Id</b>	<b>Inscription</b>	<b>Sanskrit</b>	<b>Translation</b>
M-950a	𑀧𑁆𑀭𑀸𑀓𑀢𑀺𑀲𑀻𑀓	माखं	festival[RV]
M-97A	𑀕𑀸𑀓𑀢𑀺𑀲𑀻𑀓	माय	illusion[MBh]
M-189a	𑀧𑀸𑀓𑀢𑀺𑀲𑀻𑀓	सान	destruction[√सो + ल्युट्]
L-11a	𑀧𑀸𑀓𑀢𑀺𑀲𑀻𑀓𑀸𑀓𑀢𑀺𑀲𑀻𑀓𑀸𑀓𑀢𑀺𑀲𑀻𑀓𑀸𑀓𑀢𑀺𑀲𑀻𑀓	रविः रमानव	Sun[MBh] is beloved[W] and beneficent[RV]

𑀸 = अ from 1, 17, 18, 23, 26, 20, 29, 37, 38, 47 (56)

458 8.57. ॥ ल *from* लता *lightning; lash of whip*

Seal-Id	Inscription	Sanskrit	Translation
M-13a		दालन	decay[Suśr]
H-390a		अमलरम	pleasing[MBh] purity[AV]
M-183A		लं मानि	pleasing[SBr 5.3.2.3] and honored[MBh]

𑀭 = ल from 3, 4, 9, 16, 18, 22, 24, 34, 55


(57)

459 8.58.  त *from* ताल *small cymbal*

Seal-Id	Inscription	Sanskrit	Translation
M-1097A	𑀮𑀺𑀭𑀸𑀓	तमत	desirous[Un]
M-831A	𑀮𑀺𑀭𑀸𑀓	यत	restrained/governed[RV]
M-150a	𑀮𑀺𑀭𑀸𑀓	तन	offspring[AV]

𑀮 = त from 1, 7, 27, 54

(58)

460 8.59.  अन् from अनुत्ष variant of drinking vessel 

Seal-Id	Inscription	Sanskrit	Translation
H-450a	𑀧𑁆𑀭𑀸𑀓𑀢𑀺𑀲𑀻𑀣𑀼	जानन् मान	knowing[√ज्ञा + शर्तृ] honor[MBh]
M-1787a	𑀧𑀸𑀓𑀢𑀺𑀲𑀻𑀣𑀼	अन्वितं	connected[BG]

𑀶 = अन् from 1, 7, 11, 15, 16, 17, 21, 30

461 8.60.  $\mathbb{A}$  अ from अग mountain

Seal-Id	Inscription	Sanskrit	Translation
H-139A	𑀧𑀭𑀮	अरण	foreign[RV]
H-157A	𑀧𑀭𑀮𑀭	आनय	leading to[T]
M-1307a	𑀧𑀭𑀮𑀭	अदन	eating[√अद् + ल्युट्]

$$\mathbb{A} = \text{अ from 1, 9, 12, 20, 36, 53} \quad (60)$$

462 8.61.  $\mathbb{B}$  भ from भक्षत्र oven

Seal-Id	Inscription	Sanskrit	Translation
H-136A	𑀧𑀭𑀮𑀭𑀮𑀭	माञ्जाभर	dont[RV] carry[RV] quickly[RV]
M-742A	𑀧𑀭𑀮𑀭𑀮𑀭	आभाम् वरा	splendorous[RV] choice[MBh]
M-1777a	𑀧𑀭𑀮𑀭𑀮𑀭	सभाम्	council[RV]
M-492A	𑀧𑀭𑀮𑀭𑀮𑀭	मसभान	measured[W] evidence[Vedāntas]

$$\mathbb{B} = \text{भ from 1, 2, 4, 8, 11, 12, 13, 16, 30, 26, 28, 34, 49} \quad (61)$$

463 8.62.  $\mathbb{C}$  ष from षष् six

Seal-Id	Inscription	Sanskrit	Translation
H-98A	𑀧𑀭𑀮𑀭𑀮𑀭	समानि धर	support[√धृ लोट्] of all[RV]
M-1314A	𑀧𑀭𑀮𑀭𑀮𑀭	अना शर	move[√स् लोट्] indeed[RV]
H-514a	𑀧𑀭𑀮𑀭𑀮𑀭	रविसमय	solar[MBh] time[MBh]

$$\mathbb{C} = \text{ष from 1, 6, 12, 13, 16, 17, 18, 30, 22, 20, 42} \quad (62)$$

464 8.63.  $\mathbb{D}$  श from शुक्र chitraka flower  $\mathbb{D}$

Seal-Id	Inscription	Sanskrit	Translation
M-2033A	𑀧𑀭𑀮𑀭𑀮𑀭	दशरथ्य	ten[RV] chariot horses[RV]
M-1095a	𑀧𑀭𑀮𑀭𑀮𑀭	अमम् शं	powerful[RV] blessing[RV]

$$\mathbb{D} = \text{श from 1, 6, 12, 16, 24, 20, 48} \quad (63)$$

465 8.64. ङ उ from उद्यम coil of rope

Seal-Id	Inscription	Sanskrit	Translation
M-1773A	उउमङ	उदरं	belly[RV]
Ad-5A	उमङ	उदय	sunrise[ŚBr]

ङ = उ from 1, 20, 40, 53 (64)

466 8.65. ळ स from शिखर mountaintop

Seal-Id	Inscription	Sanskrit	Translation
H-441a	उमऴ	समं	level[RV]
H-201A	उमऴऴ	मसरं	measurer[W,RV]

ऴ = स from 1, 16, 39, 40 (65)

467 8.66. ऴ ह from ह स = ह

Seal-Id	Inscription	Sanskrit	Translation
M-1705	उऴऴ	आमहं	to[RV] might[RV]
M-1845	उऴऴ	आमहं	to[RV] might[RV]
M-445	उऴऴ	आमहं	to[RV] might[RV]
H-474	उ)ऴऴ)	असहाम्	impatient[Kathās]

ऴ = ह from 1, 8, 30, 23, 24, 38, 65 (66)

468 8.67. ऩ इ from इषीक variant of stalk of grain ॥

Seal-Id	Inscription	Sanskrit	Translation
H-1511	३ऴ	अहि	Vrta[RV]
M-1632	ऴऴऴ	ईम्य	his[RV ईम् = एनम्] protector[RV]
H-2102	३ऴ	अइ	vocative particle
Luristan	३ऴऴऴऴ	आदिः	the beginning[ChandUp]

३ = इ from 4, 8, 16, 23, 45, 52 (67)

469 8.68. व from वरट wasp

Seal-Id	Inscription	Sanskrit	Translation
M-212A	॥ ॥ ॥ ॥	वाणिज	merchant[YV] (Shiva)
M-948A	॥ ॥ ॥ ॥	अवविजय	desiring[RV] victory[RV]

व = व from 1, 2, 11, 17, 44, 67 (68)

470 8.69. क from खट axe; plough

Seal-Id	Inscription	Sanskrit	Translation
H-3a	॥ ॥ ॥ ॥	अङ्कविसभां	mark of the council[RV]
M-56A	॥ ॥ ॥ ॥	ढक्कः माम् वरन्	The temple[Rājat] is enclosing[√वृ + शतृ] me
H-1076a	॥ ॥ ॥ ॥	रविनखम्	Ravin's fingernails[RV]
D-signboard	॥ ॥ ॥ ॥	रक्वराक अररस्	"gem of chosen gems" entrance[Mcar]

क = क from 1,2,12, 17,18,23,24, 26,28,29,34, 36,45,49,50, 61,59,68 (69)

471 8.70. क from खट variant of axe; plough क

Seal-Id	Inscription	Sanskrit	Translation
M-1889A	॥ ॥ ॥ ॥	कान्दर	from a valley[R]
H-1987A	॥ ॥ ॥ ॥	वङ्कश्चर	move[√चर] about roaming[Bhadrab]
M-1684a	॥ ॥ ॥ ॥	अक्र	banner[RV]



क = क from 1, 2, 13, 14, 37, 45, 63 (70)

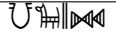
472 8.71. प from पञ्चन् five

Seal-Id	Inscription	Sanskrit	Translation
M-1909A	॥ ॥ ॥ ॥	अश्वविपण	horse[RV] wager[MBh]
M-1202C	॥ ॥ ॥ ॥	आदप	protector[RV] of eating[Samyutta]

प = प from 2, 4, 9, 17, 30, 37, 45, 63 (71)


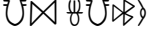





473 8.72.  द from दुन्दम variant of hourglass drum 


Seal-Id	Inscription	Sanskrit	Translation
M-78		धवमान	decorating[ $\sqrt{\text{धू}} + \text{शानच्}$ ]




 = ध from 1, 28, 54 (72)


474 8.73.  छ from छत्र mushroom


Seal-Id	Inscription	Sanskrit	Translation
H-1148		छन्न	covered[MBh]
M-1129		दशाज्चदान	ten[RV] gifts[RV] quickly[RV]
H-530a		अछिन्नि	undivided[छिद् + क्त + इन्]
H-642		जटधाचला	O[T] immovable[BG] Shiva[Hariv, RV]


 = छ from 1, 2, 3, 4, 5, 6, 11, 22, 36, 41, 42, 57, 58, 63 (73)

475 8.74.  भ from भक्षपत्र betel leaf

Seal-Id	Inscription	Sanskrit	Translation
H-1850A		भरणी	N. stellar mansion[AV]
M-213A		मरविभां	dying[RV] shining[RV]
H-5a		नट दवभसानद	dance[ $\sqrt{\text{नट लोट्}}$ giver[Pāṇ] of heat[Car] and shine[ $\sqrt{\text{भस्}} + \text{ल्युट्}$ ]

 = भ from 1, 5, 6, 9, 13, 17, 23, 26, 28, 40, 48, 54 (74)

476 8.75. (  अ from अङ्क variant of curve )

Seal-Id	Inscription	Sanskrit	Translation
M-331		अभाषा	speechless[MBh]

( = अ from 65, 74 (75)

477 8.76. 𑀩 त from तरु tree; ladles

Seal-Id	Inscription	Sanskrit	Translation
M-1913	𑀩 " 𑀭	रविट	possessing[Nais] house[Gal]
M-741A	𑀩𑀭	तय	bull[Mn]

𑀩 = त from 12, 17, 20 (76)

478 8.77. 𑀧 म from मदार मस्त variant of elephant head 𑀧

Seal-Id	Inscription	Sanskrit	Translation
M-1826a	𑀧𑀧𑀭	दमनी	subdued[MBh]
M-1961a	𑀧𑀧 " 𑀭	रविमर	possessing[Nais] immortality[RV]

𑀧 = म from 6, 12, 13, 17, 22 (77)

479 8.78. 𑀭 क from खट variant of axe; plough 𑀭

Seal-Id	Inscription	Sanskrit	Translation
H-152a	𑀭𑀭𑀭𑀭	क्षय	dominion[RV]
H-146	𑀭𑀭𑀭𑀭𑀭	अक्षय	undecaying[BG]
M-1419	𑀭𑀭𑀭𑀭𑀭	क्षयी	consumptive[MBh]

𑀭 = क from 2, 5, 8, 20 (78)

480 8.79. 𑀭 ध from धात्र receptacle

Seal-Id	Inscription	Sanskrit	Translation
Ch-5A	𑀭𑀭𑀭𑀭𑀭𑀭	अनलविदथं	fire[GaragS] knowledge[RV]
BM-123208	𑀭𑀭𑀭𑀭𑀭𑀭	छदाशय	covered[MBh] resting place[ŚBr]

𑀭 = ध from 1, 8, 17, 27, 42, 48, 57, 73 (79)

481 8.80. 𑀓𑀓𑀓𑀓 𑀓𑀓 from 𑀓𑀓 rain and wind

Seal-Id	Inscription	Sanskrit	Translation
M-1308a	𑀓𑀓𑀓𑀓 𑀓𑀓𑀓𑀓	चराजवं	moving[MBh] swiftly[AV]
H-57a	𑀓𑀓𑀓𑀓)	अजय	undefeated[RV]
M-836A	𑀓𑀓𑀓𑀓	जनि	woman/wife[RV]
M-1848a	𑀓𑀓𑀓𑀓	जव	speed[AV]

𑀓𑀓𑀓𑀓 = 𑀓𑀓 from 1, 5, 9, 13, 14, 30, 20, 28, 42 (80)

482 8.81. 𑀓𑀓𑀓 from 𑀓𑀓𑀓 variant of horse 𑀓𑀓𑀓

Seal-Id	Inscription	Sanskrit	Translation
M-648A	𑀓𑀓𑀓𑀓𑀓𑀓𑀓𑀓)	आमानवमान	to[RV]wish[RV] for men's benefit[RV]
H-1706A	𑀓𑀓𑀓 𑀓𑀓𑀓𑀓𑀓	मल्लविजर	strong[MBh] and ageless[RV]
H-6A	𑀓𑀓𑀓 𑀓𑀓𑀓𑀓𑀓	भारवादम	burden[RV] of powerful self-restraint[ŚBr]
K-40A	𑀓𑀓𑀓 𑀓𑀓𑀓𑀓𑀓𑀓𑀓	दमदरवि आर	I go[√ꣳꣳꣳ लोट्] (to you) O Sun[MBh], giver[MBh] of self-restraint[ŚBr]

𑀓𑀓𑀓 = 𑀓𑀓 from 1,3,4, 2,11,12, 13,16,17, 19,21,30, 28,40,42, 45,57,79 (81)

483 8.82. 𑀓𑀓𑀓 from 𑀓𑀓𑀓 Indian blackbird

Seal-Id	Inscription	Sanskrit	Translation
M-1204	𑀓𑀓𑀓𑀓𑀓𑀓	मम अथा	mine certainly[Ved]
M-214	𑀓𑀓𑀓𑀓𑀓𑀓	रात अइ	O bestowed[RV]
M-1896	𑀓𑀓𑀓𑀓𑀓	ततर	that one of two[Pan]

𑀓𑀓𑀓 = 𑀓𑀓 from 5, 12, 18, 30, 47, 75, 81 (82)

484 8.83. 𑀓𑀓𑀓 from 𑀓𑀓𑀓 variant of 𑀓𑀓𑀓

Seal-Id	Inscription	Sanskrit	Translation
H-1410	𑀓𑀓𑀓𑀓𑀓	मव्य	bind

𑀓𑀓𑀓 = 𑀓𑀓 from 16, 68 (83)

485 8.84. ು म from मदरमस्त variant of elephant head 𑂣

Seal-Id	Inscription	Sanskrit	Translation
M-810a	𑂣𑂣𑂣	आमन	affection[TS]
M-308A	𑂣𑂣𑂣𑂣𑂣	मम विमानि	my specially respected[MBh]

𑂣 = म from 1, 16, 17, 30, 22, 81 (84)

486 S

487 8.85. 𑂣 म from मन्दिर dwelling

Seal-Id	Inscription	Sanskrit	Translation
D-24795	𑂣𑂣𑂣	उन्नम्	moist[KātyŚr]

𑂣 = म from 1, 64 (85)

488 8.86. ' त from त्र three

Seal-Id	Inscription	Sanskrit	Translation
H-1711	𑂣𑂣𑂣𑂣𑂣	कान्तदान	delightful[GargaS] gift[RV]
H-1713	𑂣𑂣𑂣𑂣𑂣	रतजय	pleasing[BhP] victory[RV]
H-351	𑂣𑂣𑂣𑂣𑂣	तमवाणि	voice[RV] in the darkness[RV]

' = त from 1, 2, 5, 11, 12, 28, 34, 44, 45, 70 (86)

489 8.87. 𑂣 उ from उद्धट tortoise

Seal-Id	Inscription	Sanskrit	Translation
M-1923	𑂣𑂣𑂣𑂣𑂣	शु अपरम्	the future[RV] quickly[Naigh]
M-1224	𑂣𑂣𑂣𑂣𑂣	उ श्री	also[RV] radiance[RV]
Unknown	𑂣𑂣𑂣𑂣𑂣	उज्झमतं मानि	may I limit[√मा लोट्] abandoned[Mn] thoughts[RV]

𑂣 = उ from 1, 4, 5, 11, 13, 16, 22, 40, 47, 52, 58, 62, 77 (87)



495 8.92. 𑀓 र from रथ variant of chariot 𑀓

Seal-Id	Inscription	Sanskrit	Translation
H-24a	𑀓𑀓𑀓𑀓𑀓𑀓	मनजशरण	protecting[RV] thoughts[RV,MBH]
M-255a	𑀓𑀓𑀓	मरण	death[MBh]
M-1366A	𑀓𑀓𑀓𑀓𑀓	तर शतम्	with[Bhp] a hundred[RV]

$$\text{𑀓} = \text{र from 1, 7, 8, 11, 16, 26, 38} \quad (92)$$

496 8.93. 𑀓 य from यष्टि pearl necklace

Seal-Id	Inscription	Sanskrit	Translation
H-465A	𑀓𑀓	आयान	arrival[RV]
M-324b	𑀓𑀓	यान	leading[RV]
M-99A	𑀓𑀓𑀓𑀓𑀓𑀓	राणवियान	royal leadership[RV]

$$\text{𑀓} = \text{य from 1, 2, 4, 9, 12, 17} \quad (93)$$

497 8.94. 𑀓 य from यष्टि twig; arm

Seal-Id	Inscription	Sanskrit	Translation
H-1922	𑀓𑀓𑀓𑀓𑀓𑀓𑀓	अहम् अममयानि	I am Amamayani[√मय् + शानच्]
M-290a	𑀓𑀓𑀓	यमी	(Yama's) twin sister[RV]

$$\text{𑀓} = \text{य from 1, 5, 16, 23, 24, 54} \quad (94)$$

498 8.95. 𑀓 क from खट variant of axe; plough 𑀓

Seal-Id	Inscription	Sanskrit	Translation
H-90A	𑀓𑀓𑀓𑀓𑀓	पश्य नाक	observe[Up] the heavens[RV]
C-6	𑀓𑀓𑀓𑀓𑀓𑀓𑀓𑀓𑀓	आवि आमानककर	protection[√अव् लोट्], to[RV] honorable[MBh] kakara bird[SBr]

$$\text{𑀓} = \text{क from 1, 2, 4, 9, 16, 17, 18, 30, 23, 52, 60, 75, 94} \quad (95)$$







507 8.104. त from तण्डुल rice plant

Seal-Id	Inscription	Sanskrit	Translation
B-28	तण्डुल	चलत	move[चल् लोट्]
D-26514	तण्डुल	यत ना	unrestrained[RV, RV]

$$त = त from 1, 4, 20, 57, 73 \quad (104)$$

508 8.105. श|स from शिखर mountaintop

Seal-Id	Inscription	Sanskrit	Translation
Ns-79	श स	विश्व	universal[RV]
M-2063	श स	शाण	hempen[ŚBr]

$$श|स = श|स from 1, 4, 17, 28 \quad (105)$$

509 8.106. श|स from शिखर variant of mountaintop

Seal-Id	Inscription	Sanskrit	Translation
M-264a	श स	शशम्	hare[RV]
L-98A	श स	शशयमानि	abundantly[RV] respected[MBh]
M-1709a	श स	रविमसम्	solar[MBh] month[RV]


$$श|स = श|स from 1, 12, 16, 17, 22, 27, 85 \quad (106)$$



510 8.107. ल from लता creeper


Seal-Id	Inscription	Sanskrit	Translation
M-751A	ललक	ललक	playful[W] happiness[ChUp]
Dholavira	ललक	कमलास्र	red[TS] blood[Ragh]


$$ल = ल from 13, 23, 29, 34 \quad (107)$$

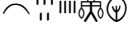


515 8.112.  स *from शशाद falcon*



Seal-Id	Inscription	Sanskrit	Translation
M-222a		मयस्	delight[RV]
M-6		सन्नर	existing[√अस् + शर्तु] door[Mcar]


 = स from 9, 12, 18, 47, 94 (112)


516 8.113.  ट *from ट hollowed coconut*


Seal-Id	Inscription	Sanskrit	Translation
M-2118		शय च पट	bed[RV] and sheet[MBh]


 = ट from 8, 14, 20, 71 (113)

517 8.114.  अस् | अश् *from अष्टापद variant of spider* 



Seal-Id	Inscription	Sanskrit	Translation
M-976		रणाक्ष	eye[RV] of joy[RV]


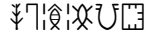
 = अस् from 9, 12, 29, 42 (114)


518 8.115.  ओ *from ओपश tuft of hair*

Seal-Id	Inscription	Sanskrit	Translation
H-1924		ओजस्	vigour[RV]

 = ओ from 11, 23 (115)

519 8.116.  र *from रथ variant of Dalbergia* 

Seal-Id	Inscription	Sanskrit	Translation
H-1522		रर	possessing[Nais] love and desire
L-45		तनमनं अनपर	sole[ŚBr] desire[RV] for children[RV]

 = र from 1, 16, 25, 24, 46, 52 (116)

## 9. Derivation Sequence

	Indus	Sanskrit	Name	
1		अन्	अनुतर्ष	drinking vessel
2		अ	आजनि	stick
3		ध	दण्डार	bow
4		अ	आयु	man
5		इ	इषीक	stalk of grain
6		द	दण्डार	variant of bow ८
7		त	त	tail
8		श	शुक्र	seed
9		न	नाल	stalk
10		ई	इ + इ	composite
11		ज	झर	waterfall; cascade
12		र	रथ	chariot
13		र	रथर्वी	split snake
14		च	चतुर	four
15		अ	अज	horn
16		म	मत्स्य	fish
17		वि	वि	two
18		र	रथार	chariot wheel
19		ब भ	भक्षपत्र	betel leaf
20		य	यवश्रेष्ठि	grain merchant
21		अ	अयु	variant of ४
22		नि णि	अणि	point of arrow; nail
23		अष्ट अश्	अष्टापद	eight legged; spider
24		अम	अङ्क + मत्स्य	composite curve + fish
25		न	नळ	reed
26		न	नाव	boat
27		य	यव	barley
28		व	वण्ड	spear
29		क	कट	wood
30		अ	अङ्क	curve
31		अ	अङ्क	boldface variant of curve )
32		आ	अङ्क	variant of curve )
33		अ	अङ्क	variant of curve )
34		म	मदारमस्त	variant of elephant head ३
35		म	मय	variant of horse ३
36		न	नाल	time card
37		व	वरण्ड	lamp wick
38		श	शाखर	squirrel

	Indus	Sanskrit	Name	
39		म	मन्दिर	dwelling; temple
40		र	रथ	Dalbergia
41		द	दुन्दम	hourglass drum
42		अ	अयुग	one
43		र	रथर्वी	split snake
44		य	यव्य	barley field
45		द	दुन्दम	variant of hourglass drum 
46		त	ताडुल	drum
47		म	मदारमस्त	elephant head
48		त	ताडुल	fighter
49		स	सप्त	seven
50		र	रथार	chariot wheel
51		श	शाखर	variant of squirrel 
52		प	पाणि	hand
53		द	दन्त	teeth
54		म	मय	horse
55		म	मय	variant of horse 
56		अ	आजनि	variant of stick
57		ल	लता	lightning; lash of whip
58		त	ताल	small cymbal
59		अन्	अनुतर्ष	variant of drinking vessel 
60		अ	अग	mountain
61		भ	भक्षत्र	oven
62		ष	षष्	six
63		श	शुक्र	chitraka flower 
64		उ	उद्यम	coil of rope
65		स	शिखर	mountaintop
66		ह	ह	स = ह
67		इ	इषीक	variant of stalk of grain 
68		व	वरट	wasp
69		क	खट	axe; plough
70		क	खट	variant of axe; plough 
71		प	पञ्चन्	five
72		द	दुन्दम	variant of hourglass drum 
73		छ	छत्र	mushroom
74		भ	भक्षपत्र	betel leaf
75		अ	अङ्क	variant of curve )
76		त	तरु	tree; ladles
77		म	मदार मस्त	variant of elephant head 
78		क	खट	variant of axe; plough 
79		ध	धात्र	receptacle

	Indus	Sanskrit	Name	
80	𑀩𑀭𑀮𑀭	झ	झ	rain and wind
81	𑀭𑀮	म	मय	variant of horse 𑀭𑀮
82	𑀭𑀮	त	तर्द	Indian blackbird
83	𑀭𑀮	य	यष्टि	variant of 𑀭𑀮
84	𑀭𑀮	म	मदारमस्त	variant of elephant head 𑀭𑀮
85	𑀭𑀮	म	मन्दिर	dwelling
86	𑀭𑀮	त्र	त्र	three
87	𑀭𑀮	उ	उद्धट	tortoise
88	𑀭𑀮	उ	उद्धट	variant of tortoise 𑀭𑀮
89	𑀭𑀮	अ ए	अइक एक	one
90	𑀭𑀮	अष्ट अश्	अष्टम	eight
91	𑀭𑀮	न	नव	nine
92	𑀭𑀮	र	रथ	variant of chariot 𑀭𑀮
93	𑀭𑀮	य	यष्टि	pearl necklace
94	𑀭𑀮	य	यष्टि	twig; arm
95	𑀭𑀮	क	खट	variant of axe; plough 𑀭𑀮
96	𑀭𑀮	झ	झ	variant of rain; waterfall 𑀭𑀮
97	𑀭𑀮	ग घ	गडुर गडु	bent; spear
98	𑀭𑀮	म	मदारमस्त	boar head
99	𑀭𑀮	द	दण्डार	variant of bow 𑀭𑀮
100	𑀭𑀮	द	दण्डार	variant of bow 𑀭𑀮
101	𑀭𑀮	म	मन्दार	hibiscus flower
102	𑀭𑀮	श स ष	शस	repeating
103	𑀭𑀮	उष्ट उश्	उद्धट + अष्टापद	composite turtle + spider
104	𑀭𑀮	त	तण्डुल	rice plant
105	𑀭𑀮	श स	शिखर	mountaintop
106	𑀭𑀮	श स	शिखर	variant of mountaintop 𑀭𑀮
107	𑀭𑀮	ल	लता	creeper
108	𑀭𑀮	श	शुक्र	variant of chitraka flower 𑀭𑀮
109	𑀭𑀮	म	मदारमस्त	variant of elephant head 𑀭𑀮
110	𑀭𑀮	व	वट	banyan tree
111	𑀭𑀮	र	रथ	variant of Dalbergia 𑀭𑀮
112	𑀭𑀮	स	शशाद	falcon
113	𑀭𑀮	ट	ट	hollowed coconut
114	𑀭𑀮	अष्ट अश्	अष्टापद	variant of spider 𑀭𑀮
115	𑀭𑀮	ओ	ओपश	tuft of hair
116	𑀭𑀮	र	रथ	variant of Dalbergia 𑀭𑀮

## 521 10. Proof of unique solutions to long cryptograms

522 We present a proof for the long-held belief that long cryptograms have unique  
523 solutions and only in the language of the puzzle.

524 **Theorem 1** (Cryptogram theorem). *A corpus of text  $C_1$  in language  $L_1$  written*  
525 *using script  $Z$  is unreadable as language  $L_2$ .*

526 *Proof.* Let  $P_i$  be the set of phonemes of Language  $L_i$

$$P_i = \{p_{i_1}, p_{i_2}, \dots\} \quad (117)$$

527 Let  $\Pi P_i$  be union of cartesian products of phonemes in  $P_i$

$$\Pi P_i = P_i \cup (P_i \times P_i) \cup (P_i \times P_i \times P_i) \cup \dots \quad (118)$$

528 Let  $S_i$  be the set of n-tuples of  $P_i$  representing syllables in  $L_i$

$$S_i \subset \Pi P_i = \{s_{i_1}, s_{i_2}, \dots\} = \{(p_{i_1}, p_{i_2}, \dots), (p_{i_3}, p_{i_4}, \dots) \dots\} \quad (119)$$

529 Let  $\Pi S_i$  be the union of cartesian products of syllables in  $S_i$

$$\Pi S_i = S_{L_i} \cup (S_i \times S_i) \cup (S_i \times S_i \times S_i) \cup \dots \quad (120)$$

530 Let  $W_i$  be the set of n-tuples representing words in  $L_i$

$$W_i \subset \Pi S_i \subset \Pi P_{L_i} = \{w_{i_1}, w_{i_2}, \dots\} = \{(s_{i_1}, s_{i_2} \dots), (s_{i_3}, s_{i_4} \dots) \dots\} \quad (121)$$

531 Let  $Z$  be a set of signs representing a script with allographs folded into a single  $z_j$ .

$$Z = \{z_1, z_2, z_3, \dots\} \quad (122)$$

532 Let  $f_i^P(P_i)$  and  $f_i^S(S_i)$  be a functions with domain  $P_i$  and range  $Z$  representing al-  
533 phabetic and syllabic scripts for  $L_i$ . These functions above may be represented as  
534 matrix multiplication of vector of code-points representing the input string to the en-  
535 coding matrix of phonemes or syllables resulting in an inscription in  $L_i$  rendered in  $Z$ .

536

$$\begin{bmatrix} s_{i_1} & s_{i_2} & \dots & s_{i_n} \end{bmatrix} \times \begin{bmatrix} z_1/s_{i_1} & z_2/s_{i_2} & \dots & z_n/s_{i_n} \\ 0 & 0 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & 0 \end{bmatrix} = \begin{bmatrix} z_1 & z_2 & \dots & z_n \end{bmatrix} \quad (123)$$

537 For brevity, we denote the above as  $w_i \times T_i = c_i$  where  $T_i$  is the transformation  
538 matrix converting the word  $w_i$  to inscription  $C_i$ .

539 Let  $C_i$  be the corpus of inscriptions of  $L_i$  in  $Z$ .

$$C_i = \{f_i^S(w_{i_1}), f_i^S(w_{i_2}) \dots\} = \{w_{i_1} \times T, w_{i_2} \times T, \dots\} = \{c_{i_1}, c_{i_2} \dots\} \quad (124)$$

540 For a corpus in language  $L_1$  to be readable in  $L_2$  requires all rendered words in  $C_1$   
 541 to be in  $C_2$ .

$$C_1 \subset C_2 \quad (125)$$

542 Substituting in above, we get

$$\{w_{1_1} \times T, w_{1_2} \times T, \dots\} \subset \{w_{2_1} \times T, w_{2_2} \times T, \dots\} \quad (126)$$

543 Since  $|W_i| \ll |\Pi S_i|$ , the chances of every (or even most) word string in  $L_1$  being  
 544 found in  $L_2$  is negligible and therefore are readability-equivalent to random strings.  
 545 A 1:1 mapping would run into unattested syllables like *jhe, h, ghai* in Sanskrit. In  
 546 addition, of the possible  $260100 C_1 V_1 C_2 V_2$  less than one percent are attested stems  
 547 or words. The only way to get a compliant subset is to use a degenerate  $T$  such that  
 548 the output can only generate attested words, i.e.,  $T$  needs to create an output set  
 549 which has only legitimate words in  $L_2$ .

550 Let  $\zeta_i$  be syllables in  $L_i$  that are stand-alone non-spurious words that are also  
 551 legal words on reduplication. Let  $\Pi \zeta_i$  be the cartesian product of  $\zeta_i$ .

552 To enable reading words in  $L_1$  as legal words in  $L_2$  (not necessarily grammati-  
 553 cally correct), reading identical-adjacent signs and inscriptions of both even and odd  
 554 lengths,  $T$  must only produce syllables in  $\zeta_2$ . In addition, to enable reading any  
 555 potential permutation of signs, all members of  $\Pi \zeta_2$  must be legal words.

556 Most languages have a sparse  $\zeta_i$  and only tiny  $\Pi \zeta_i$  of a dozen or less words are  
 557 possible. Therefore, it's not possible to read a script written in language  $L_1$  as  
 558 language  $L_2$ .  $\square$

### 559 10.1. Verifying Sanskrit

560 Let  $\zeta_{Skt}$  be the set of non-spurious single syllable word/stem (e.g. *śa ta*) also  
 561 present as a reduplicated syllable word (e.g. *śaśa tata*).

$$\zeta_{Skt} = \{cu, da, dī, hā, hī, hi, hu, ja, khi, la, nā, rā, ru, śa, sa, ta, thai, thū, va\} \quad (127)$$

562 However, most words in its cartesian product are not legal words. For full cartesian  
 563 readability, we define a subset that does have full cartesian membership (using *sa*  
 564 for all sibilants). Let  $\zeta'_{Skt} \subset \zeta_{Skt}$  whose full cartesian product are legal words.

$$\zeta'_{Skt} = \{da, ra, va, sa\} \quad (128)$$

565

$$\Pi \zeta'_{Skt} = \begin{pmatrix} dada, & dara, & dava, & dasa, \\ rada, & rara, & rava, & rasa, \\ vada, & vara, & vava, & vasa, \\ sada, & sara, & sava, & sasa \end{pmatrix} \quad (129)$$



566 *10.2. Verifying English*

567 While English has a few words that when reduplicated form legal words, it has  
568 no subset whose full cartesian product are legal words.

$$\zeta_{Eng} = \{agar, boo, bye, can, do, ha, hush, is, pa, paw, put, so, tar\} \quad (130)$$

$$\Pi\zeta_{Eng} = \phi \quad (131)$$

569 Absent a tripled syllable word, deriving Indus script as English would not proceed  
570 beyond one sign. The jar sign can be derived as *do*, with the inscription H-764 read  
571 (somewhat facetiously) as *dododo*. However, further signs would be impossible to  
572 decipher.

573 *10.3. Other degenerate cases*

574 In addition to a degenerate T, other possible degenerate cases exist, which enable  
575 reading a corpus in one language in another language.

576 *10.3.1. Single word corpus*

577 This is readable if a word of the same length and pattern exists in  $L_2$ . This  
578 essentially degenerates  $W_1$  to a single member set.

579 *10.3.2. Tiny corpus*

580 This is an extension of the above, where  $W_1$  is small enough that its probable to  
581 find them all in  $C_2$ . The coverage of words in  $\Pi S_i$  decreases sharply with the length  
582 of words, so even with a handful of long words, reading in  $L_2$  becomes improbable.

583 *10.3.3. Single syllable words*

584 Degenerating  $W_i$  to  $S_i$  makes every sign a single syllable word. This is essentially  
585 reading the corpus as a logographic script.

586 *10.3.4. Summary*

587 In practical terms, what this means is that reading a script in a language it wasn't  
588 originally written is possible for short texts only and almost certainly requires reading  
589 most words as single-syllable/single-sign words. This is before meaning, syntax,  
590 declensions are taken into account.

591 **Corollary 1.1.** *A sufficiently long cryptogram has only a unique solution.*

592 *Proof.* The subset requirement in equation (126) to create a degenerate  $T$  to trans-  
593 form  $W_1$  to  $W_2$  exists within a single language as well. With a sufficiently large  
594 corpus, the cartesian products will not be subsets and no valid reading is possi-  
595 ble. □

## 596 References

- 597 [1] Tyler Atkins. Cryptogram solver, 2017.
- 598 [2] N. R. Banerjee and Soundara K. V. Rajan. Sanur 1950, 1952: A megalithic site  
599 in district Chingleput. *Ancient India*, 15:2–28, 1960.
- 600 [3] S. K. Bhatt. *Nishka-the Rig Vedic Money*. Academy of Indian Numismatics and  
601 Sigillography, 1998.
- 602 [4] CoinIndia. The coin galleries: Mauryan empire, 2010.
- 603 [5] EducationDiary. BHU’s young numismatist clinches prestigious INSA project  
604 to study 2800 year old coins, 2022.
- 605 [6] goibhniu. Perl uses for cryptograms - part 1: One-liners and word patterns,  
606 2007.
- 607 [7] E Hultzsch. *Inscriptions of Asoka*. Clarendon Press, 1925.
- 608 [8] R. P. Kulkarni. *Layout and construction of cities*. Bhandarkar Oriental Research  
609 Institute, 1987.
- 610 [9] Jamal Lahafian. Rock art in kurdistan iran, 2013.
- 611 [10] B. B. Lal. From the megalithic to the Harappa: tracing back the grafitti on the  
612 pottery. *Ancient India*, 16:4–24, 1960.
- 613 [11] Iravatham Mahadevan. Akam and puram : ‘address’ signs of the indus script,  
614 2010.
- 615 [12] Iravatham Mahadevan. Interpreting the indus script: The dravidian solution,  
616 2015.
- 617 [13] Marsha Lynn Moreno. Frequency analysis in light of language innovation, 2005.
- 618 [14] BBC News. ‘Earliest writing’ found, 1999. Last accessed 18 March 2022.
- 619 [15] Asko Parpola. *Deciphering the Indus script*. Cambridge University Press, 1994.
- 620 [16] S. R. Rao. Indus script and language. *Annals of the Bhandarkar Oriental*  
621 *Research Institute*, 61:157–188, 1980.
- 622 [17] Unpinder Singh. *Delhi: Ancient History*. Berghahn Books, 2006.

- 623 [18] Richard Solomon. *Indian Epigraphy*. Oxford University Press, 1998.
- 624 [19] T. S. Subrahmanian. Tamil brahmi potsherds found at urn burial site, 2010.
- 625 [20] Sue Sullivan. *Indus script dictionary*. Sullivan, Sue, 2011.
- 626 [21] Tamil Nadu Tourism. Keeladi: Tracing the roots of Tamil culture, 2020.

	300 BC	Ashoka 265 - 232 BC	Maurya 321 - 185 BC	Bhatiprolu	Sunga 187 - 75 BC	2° BC - 1° AD	Kushana 1° BC - 3° AD	1° - 3° AD	Kshatrapa 2° - 3° AD	Gupta 320 - 540 AD	rock writing	other
a	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀	𑀀
i	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁	𑀁
u	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂	𑀂
e	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃	𑀃
o	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄	𑀄
kā	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅	𑀅
kha	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆	𑀆
ga	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇	𑀇
gha	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈	𑀈
ṇa	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉	𑀉
ca	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊	𑀊
cha	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋	𑀋
ja	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌	𑀌
jha	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍	𑀍
ṇa	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎	𑀎
ta	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏	𑀏
tha	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐	𑀐
dā	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑	𑀑
dha	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒	𑀒
ṇa	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓	𑀓
tā	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔	𑀔
tha	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕	𑀕
dā	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖	𑀖
ṇa	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗	𑀗
pā	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘	𑀘
phā	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙	𑀙
bā	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚	𑀚
bha	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛	𑀛
mā	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜	𑀜
yā	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝	𑀝
rā	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞	𑀞
lā	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟	𑀟
vā	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠	𑀠
sā	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡	𑀡
sā	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢	𑀢
hā	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣	𑀣