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WHAT DO WE KNOW ABOUT THE INDUS SCRIPT?
NETI NETI ('NOT THIS NOR THAT')

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What do we know about the Indus Script? *Neti neti* ('Not this nor that').

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It is doubtful whether there is any other undeciphered script with the possible exception of the Phaistos Disk, which has drawn as much attention from would-be decipherers as the Indus Script.[1] There are presently more than forty claims of decipherment and the number is steadily increasing.[2] However as no two claims have anything in common, it is hardly surprising that scholars in general have remained sceptical of all the attempts. It is not possible within the brief span of a lecture to discuss any of these claims in depth or even refer to all of them. In any case, I shall be concerned here with methods rather than results some of which I may cite only by way of illustration.

This paper is in three parts. I begin with a brief summary of the universal features of writing as observed in the ancient Oriental scripts to provide the background to the search for possibly similar features in the contemporary Indus Script. I then proceed to a short survey of the known facts about the Indus Script and some reasonable inferences we can draw from them. This part also contains a report on the recent structural and analytical studies of the script and some significant results from such studies. In the final part, I try to look beyond the structural studies and discuss the possibility of acquiring a broad comprehension of the contents of the Indus inscriptions even before decipherment, and conclude with an assessment of future prospects in the field.

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2. Oriental Pictographic Scripts

The Indus Script is one of the seven pictographic writing systems developed in the ancient Orient during the Bronze Age (ca. 3000-1500 B.C.) (Table 1).

No.	Script	Area	Earliest occurrence (ca.)
1.	Sumerian	Mesopotamia	3100 B.C.
2.	Egyptian	Egypt	3000 B.C.
3.	Proto-Elamite	Elam	3000 B.C.
4.	Indus	Indus Valley	2500 B.C. (?)[3]
5.	Cretan	Crete	2000 B.C.
6.	Hittite	Anatolia	1500 B.C.
7.	Chinese	China	1500 B.C.

Table 1. The Seven Ancient Oriental Scripts

The Harappans had cultural and trading contacts with contemporary West Asian cultures.[4] Seals with Harappan motifs and writing have been found in Babylonian, Elamite, Persian Gulf and Central Asian sites [5] West Asian influence on the Harappan Culture is evidenced by the occurrence of imported seals as well as by many correspondences between their glyptic art (e.g. 'trefoil' motifs, Gilgamesh-like figure on the seals etc.).[6] We also know from a comparative study of the deciphered and known Oriental scripts (Sumerian, Egyptian, Hittite and Chinese) that they shared many common structural features and followed very similar lines of evolution.[7] It is therefore reasonable to begin with the working hypothesis that the Indus Script, occupying almost the middle position both spatially and temporally in this group, would also share the universal features of its contemporaries.

3. Universal Features of Writing

(1) Typology of Signs

All ancient systems of writing employed basically only three types of signs or characters, viz. **word-signs** for whole words, **syllabic** signs for phonetic syllables and **alphabetic** characters for single sounds (consonants or vowels).

(i) **Word-Signs :**

Word-signs **(logograms)** developed from pictures.[8] Pictographic writing consisted essentially of three types. At the earliest stage each sign literally represented the object pictorially depicted. Very soon word-signs were also used to represent not only the objects shown in the pictures but also any idea associated with such objects. Thus the SUN sign could also stand for 'light', 'day', etc. These two types of signs are also called **ideograms** as they convey the meanings and not the sounds of words.[9] It was soon discovered that a word-sign could also be used to represent any other word with the same sound (homonym) through the technique of **rebus writing** (phonetic transfer). Thus the SUN sign could also stand for 'son'. Word-signs used in this manner are called **phonograms.** It is this development which led to phonetic writing at the next (syllabic) stage.

(ii) **Syllabic Signs :**

A fundamental discovery in the history of writing was the use of signs to represent *sounds without meaning*. This was achieved by forming **phonetic syllables** from word-signs. Thus the SUN sign could be used in the word 'sundry' as a mere phonetic syllable. Syllabic signs could represent compound syllables (CVC), closed syllables (VC), open syllables (CV) or vowels (C = consonant: V = vowel).

(iii) **Alphabetic Characters :**

The Egyptian Script developed at a very early stage 'alphabetic' or uni-literal consonantal signs by ignoring the vowels in the corresponding syllabic words. However Egyptian continued to be mainly an ideographic script till the end. True alphabetic writing began with the Semitic consonantal scripts (ca. 1500 B.C.).[10] The vowels were added by the Greeks (ca. 800 B.C.) to complete the development of alphabetic writing. Vowels were also represented by 'diacritical' marks (as in the Semitic scripts) or by 'medial' signs attached to the consonants (as in the Indian scripts).

(iv) **Ancillary Signs**

(a) **Determinatives** are ideographic signs added to phonograms to determine the intended meaning. For example, the STAR ideogram may be added to the SUN sign to indicate that the intended meaning is 'sun'

and not 'son'. Determinatives also served to indicate the broad class or category of the words to which they were added.

(b) **Phonetic Complements** are phonetic signs added to ideograms as a guide to pronunciation where more than one reading is possible. For example, the phonetic syllable /an/ may be added to the SUN sign to indicate that the intended reading is 'sun' and not, say, 'light'.

(c) **Conventional Signs** were also employed in a few cases, for example, plural markers, word-dividers etc.

(2) **Typology of Scripts**

The ancient oriental scripts may be classified notionally into three types based on the types of signs employed by them, viz. **logographic** scripts, **syllabaries** or **alphabets,** comprising respectively logograms, syllabic signs or alphabetic characters. In fact however there were no pure systems, and even at the earliest stage, the Egyptian and the Sumerian scripts are found to be **logo-syllabic,** that is, a mixture of word-signs and phonetic syllables. The Chinese Script is unique in that it has preserved its logographic character. In general, each sign in this script is a compound of ideographic and phonetic elements.

(3) **Evolution of Writing**

Historically the Oriental scripts evolved ffom logographic to syllabic and finally to the alphabetic stages. However the scripts were conservative and retained some ideographic elements till the end even while increasingly employing phonetic syllabic signs. An important result of the transition was a sharp reduction in the total number of signs in a script. To cite one telling example: Early Pictographic Sumerian had about 2000 signs. This was reduced to about 900 in Sumerian Cuneiform and further to about 600 in Akkadian and 450 in Hittite Cuneiform (all logo-syllabic systems). The Elamite Cuneiform syllabary (with closed and open syllables) used 163 signs while in the Old Persian Cuneiform syllabary (with open syllables) the number was further reduced to 41. Finally the Ugaritic Cuneiform alphabet used only 30 signs. In general the total number of signs is specific to each type of writing within a range (Table 2).

No.	Type of Scripts	Type of Signs	Total No. of signs (ca.)	Examples
I.	LOGOGRAPHIC	Word-signs	Thousands	Chinese
II.	LOGO-SYLLABIC	Word-signs and Phonetic syllables	900-400	Sumerian, Egyptian, Hittite
III.	SYLLABIC	(A) Closed and open syllables	200-100	Elamite Cuneiform
		(B) Open syllables	100-40	Linear-B, Old Persian
IV.	ALPHABETIC	Single-sound signs	Below 40	Semitic, Ugaritic, Greek, Latin

Table 2. Types and Number of Signs in Ancient Scripts

(4) **External Developments in writing**

In course of time the pictorial signs became simplified and increasingly unrecognizable. The shape of signs was influenced by the nature of the writing surfaces (stone, clay, cloth, paper etc.) and the tools for writing (chisel, stylus, brush, pen etc.). In Mesopotamia the use of the reed stylus on soft clay transformed the Sumerian pictographic into the totally different cuneiform script. It is however important to note that there is no correlation between the internal and external developments in writing systems. The Egyptian Hieroglyphic and Demotic scripts look very different, but have the same internal structure. The Ugaritic Script is cuneiform in appearance but its internal structure is patterned after the semitic alphabets.

4. The Indus Script: Facts.

We may now turn our attention to the Indus Script and proceed to examine the nature of the script in the light of the foregoing summary of the universal features of the ancient writing systems. I shall begin with a brief

recital of the few facts that we know about this script from the archaeological context and preliminary inspection of the inscriptions.[11]

The Indus inscriptions are found only on small objects like stone seals, terracotta sealings, stone and faience tablets, pottery, copper tablets, bronze implements, ivory and bone rods and a few other miscellaneous artefacts. About 3500 inscriptions are known, mostly occurring on seals. No long inscriptions on stone, clay, papyrus or other material have so far been discovered. Nor are there any accounting tablets, so abundantly found at Babylonian and Elamite sites. The inscriptions are extremely brief, the average length being less than four signs in a line and five signs in a text. The longest inscription has only 26 signs in 3 lines occurring on the sides of two terracotta prisms (1623; 2847).

The Indus Script is mainly pictographic in character (Pl. 1-3). Many of the signs clearly depict men, animals, insects, fish, birds, implements, structures, vessels etc. But many other signs are too stylised to be identified pictorially. Two main characteristics of the script are modification of the signs by strokes or other marks and combination of two or more signs. The number of signs in the Indus Script is about 400-450.[12] There are minor graphic variants for many of the signs.[13] However the script did not develop any cursive or linear variety, but remained 'frozen' in a standard form throughout its existence.[14]

No bi-lingual inscription has so far turned up to aid decipherment. The only external clues we have are those provided by the archaeological excavations (site, stratigraphy, associated artefacts and location of the finds), the type of objects carrying the inscriptions and, in the case of seals, sealings and copper tablets, the accompanying pictorial motifs.[15] These are mostly animals (the so-called 'unicorn', short-horned bull, humped bull, buffalo, elephant, tiger, rhinoceros, antelope, goat, gharial and mythical beasts), and religious or mythological 'scenes'. It is noteworthy that among the several animals portrayed on the seals, horse, lion and camel are absent. Preliminary inspection does not reveal any close link between the inscriptions and the pictorial motifs except in the case of the copper tablets from Mohenjodaro.[16]

5. Direction of writing:

One of the few well-established facts about the Indus script is that it is generally written from the right, though there are exceptional cases of lines

running from the left.[17] The general direction of writing has been established on the basis of many simple observations like the overflow of the last sign at the left end to a lower line, cramping of signs for want of space towards the left end, writing of a text along the top, left and bottom edges of a square seal (4254) leaving the right edge blank (as seen in impression) showing that the writing is in an anti-clockwise (that is right to left) direction etc. B.B. Lal has demonstrated from a study of overlapping incisions on pottery graffiti that the inscriptions must have been incised from the right (Pl. 4.1). I have drawn attention to pairs of identical texts occurring in single lines and also in two lines one below the other thus indicating the real sequence of signs and the direction of writing (Pl. 4.2).

It is necessary to emphasise that the value of the external evidence mentioned above is limited by the fact that the inscriptions run in either direction as seen by simple inspection. Hence the external characteristics are reversible and will lead to the wrong conclusion unless the results are controlled by the internal evidence provided by the sequence of signs. I may refer here to the curious case of the inscription on pottery from Kalibangan published by B.B. Lal.[18] The inscription (8221) is written from the right as proved by the overlapping incisions pointed out by Lal, but is to be read from the left as proved by the sign sequence (Pl. 4.1).[19]

The statistical study published in the Indian Concordance shows that about 83 percent of the lines included in the Corpus run from the right and about 7 percent from the left.[20] (The rest are single-sign lines or doubtful lines due to damage). Where there are two or three lines on a side, the normal practice is for each line to start at the right. Writing in the **boustrophedon** mode (alternate lines in opposite directions) is rare. (Only 9 examples are listed in the Concordance).[21] The evidence seems to suggest that the second or third line runs in the reversed direction only when the previous line has an incomplete sequence (e.g. 1247, 6402).

It is therefore surprising that some scholars still attempt to decipher the Indus script on the assumption that the writing is from the left.[22] Applying the test of direction of writing we can safely ignore all such attempts as not deserving serious consideration. We also come across attempts to read all the lines mechanically from the right.[23] It is a matter of simple observation that there are cases of bi-directional writing of identical texts. It is possible to recognize reversed writing by observing the following 'direction-markers (Pl. 4.3):

(a) the asymmetric signs (with respect to the vertical axis) will appear reversed (as in the case of the Egyptian Script);

(b) the most frequent right-end and left-end signs will exchange positions and orientation;

(c) the most frequent sign-groups (pairs and triplets) will appear in the reversed order.

A question may however arise whether there are not genuine cases of reversed spellings forming different words or phrases (as for example, GOD and DOG in English). It is true that there are such exceptional cases of reversed spellings in the Indus texts. There is a simple test by which we can detect such cases. Thus XY and YX are genuinely reversed spellings forming different words only if it can be shown that both spellings occur within a longer text (e.g. ABCXY and ABCYX). But a complete text, say XYZ, cannot be read as ZYX (even when the latter is in the right-to-left order) if the reversal is not found within a longer text. Uncontrolled readings of such texts by some scholars from the right or in either direction have to be disregarded as arbitrary.[24]

6. Structure of the Indus Script

(1) Number of Signs

The simplest and one of the most decisive tests for the typology of a script is just to count the number of signs in it (see Table 2). This is how Champollion concluded that the Egyptian Script with about 700 signs could not be purely logographic like the Chinese; Michael Ventris proceeded on the assumption that the Mycenaean Linear-B Script with about 90 signs could only be a syllabary of open syllables; and Virolleaud recognised instantly that the Ugaritic Script with just 30 signs could be nothing but an alphabet inspite of its deceptive cuneiform appearance. The eventual decipherments proved all them right.[25]

It is difficult to be precise about the total number of signs in an undeciphered script because it is not easy to distinguish between independent signs and mere graphic variants, or even between the signs and other pictorial motifs accompanying them. There is also the possibility that there may still be some undiscovered signs. The latest sign-lists in the Finnish Concordance and the Indian Concordance put the total number of signs in the Indus Script at 396

and 419 respectively. Combining the two lists and allowing a margin for variants and undiscovered signs, the present best estimate for the total number is 425 ± 25 signs. This number, falling in the range of the mid-hundreds, is too small for a fully logographic script (like the Chinese) and far too large for a purely alphabetic script (like the Semitic), or even for a simple open syllabary (like the Linear-B). The evidence of the sign-count is compelling that the Indus Script is, like its West Asian contemporaries, a logo-syllabic script possessing word-signs and phonetic syllables.

A legitimate question to ask is whether the number of signs in the Indus Script cannot be reduced by excluding combinations and modifications, both of which are known to occur in this script.[26] Firstly, it is exceedingly difficult to segment the signs in an unknown script, as we have nothing to go by except the external forms, and any such procedure is bound to be arbitrary and subjective.[27] Secondly, even if we can find a way to split the combinations and modifications, it would be an unprofitable exercise as we would thereby lose much of the information contained in the texts. We know from contemporary scripts that sign A + sign B may not mean AB, but C, that is, something wholly different.

e.g. MAN + BREAD = 'to eat' (Sumerian)
SKY + DROPS = 'rain' (Chinese)

Combinations of ideograms may also yield a totally different phonetic word-sign.

e.g. HAND + LEG = 'horn' (phonetic, in Egyptian)

Similarly modifications of a sign by strokes may radically alter its meaning or sound.

e.g. MOUTH + 2 strokes = 'Two-thirds' (Phonetic in Egyptian)
MOUTH + 3 strokes = 'Three-Fourths' (ibid)

Even assuming the script to be purely phonetic (for which there is no evidence) and treating the sign combination A + B as AB, the frequency-distribution characteristics of AB are likely to be quite different from those of A or B Hence the only sound approach to an unknown script is to regard each sign (separated by blank spaces on either side) as integral until we learn to distinguish its component parts after decipherment.

Another question raised in the Indian context about the significance of the sign-count may also be considered here. In Indo-Aryan we have 45 sounds (10 vowels, 2 semi-vowels and 33 consonants). If we add 396 (33 x 12) characters for consonants with attached medial vowel marks, we can easily match the sign-count in the Indus Script, even without taking into account the almost unlimited number of compound signs *(samyuktakshara)*. However structural analysis of the script disproves this possibility for the reasons summarised below.

It is a matter of common observation that a word requires more characters to write as scripts evolve from word-signs through syllabic to alphabetic stages.

e.g.	WOMAN	:	1 word-sign
	wo-man	:	2 syllables
	w-o-m-a-n	:	5 alphabetic characters

As mentioned earlier, the average length of the Indus inscriptions is less than 4 signs in a line, and less than 5 signs in a text. There are many inscriptions with just one or two signs only. It is difficult to think of a complete sentence made up of only one or two alphabetic characters. Even syllabic writing, especially with open syllables as in the Indian scripts, seems unlikely with such extreme brevity. If we look at comparable inscriptions on seals, coins or votive objects from the Historical Period in India, we find that the average number of syllables required to compose these very short legends is more than the average number of signs in an Indus inscription. It appears much more probable that the average Indus text has a few words rather than syllables, especially in the shorter inscriptions.

(2) **Segmentation of Words and Phrases**

An even more telling evidence against a simple syllabic model for the Indus Script comes from word segmentation analysis. Several analytical studies have established that it is possible to segment the Indus texts into constituent words and phrases through simple frequency-distribution analysis as well as by sophisticated cryptanalytical and computer studies.[28] They have proved that the signs of the Indus Script are mostly word-signs and cannot be regarded as phonetic units (syllabic or alphabetic). In view of the importance of this conclusion, I shall briefly summarise some of the simple techniques for word-division, which can easily be verified from the Concordances:

(i) Well-preserved and complete inscriptions with single signs constituting the whole text are compiled as these must represent single words. They are then compared with two-sign texts in which one sign is already known to be an independent word from the single-sign texts, thus proving the other sign to be independent. The search is then progressively extended to longer texts following the same procedure (Pl. 5.1).

(ii) Pairs of texts are compiled, which are identical but for the presence of one additional sign at either end, proving these to be independent words (including grammatical morphs). The procedure is then extended to cover pairs of near-identical texts varying only by the substitution of one sign by another in the other text, proving the independent character of both the signs (Pl. 5.2).

(iii) Texts which are built up by the progressive addition of one sign at a time at either end or in the middle prove the independent word-values of the signs occurring in them (Pl. 5.3).

(iv) A longer text can be shown to consist of two or more shorter texts occurring as complete texts elsewhere indicating clearly the boundaries (Pl. 5.4).

(v) A few signs occur with very high frequencies and form stable pairs with a large number of other signs (e.g. JAR and the two-stroke superscript signs). It follows that the signs in such pairs must be separate words or grammatical morphs. This is a particularly productive method in view of the very high frequency of the terminal and the superscript signs and the large number of stable pairs formed by them (Pl. 6.1).

(vi) Comparison of the frequencies of successive adjacent pairs of signs (e.g. AB, BC, CD and DE in the text ABCDE) reveals the word boundaries at the 'weakest junctions'. By this method almost all the long texts can be segmented into constituent phrases and words (Pl. 6.2).

(vii) Numerals form a natural indicator of word-boundaries especially in two-sign texts. Thus the texts IV CUP, III CUP and II CUP occurring on the miniature tablets at Harappa show the CUP sign to be an independent word (Pl. 6.3).

These methods are overlapping and the results are cumulative, proving the essentially logographic character of the Indus Script. It has not so far been possible to identify any phonetic syllables by such analytical procedures though they do probably exist in the script. An interesting result of the segmentation analysis is that 'phrases' (by which I mean integral linguistic units consisting of more than one word) consist mostly of only two or three signs. The longest single phrase (e.g. 1013) does not seem to be more than 4 signs in length.[29]

(3). **Frequency-Distribution Analysis of Signs**

(a) **Frequency:** Frequency analysis of the Indus signs is quite instructive. The frequency statistics recorded in the Indian Concordance (with a Corpus of 2906 texts and 13,372 sign-occurrences) is summarised in Table 3.[30]

Frequency Range	No. of signs	Total sign occurrences	Percent (of total occurrences)
1000 or more	1	1395	10.43
999-500	1	649	4.85
499-100	31	6344	47.44
99-50	34	2381	17.81
49-10	86	1833	13.71
9-2	152	658	4.92
Only once	112	112	0.84
Total	417	13372	100.00

Table 3. Frequency Analysis of signs in the Indus Texts

It will be seen that only 67 signs account for over 80 percent of the sign occurrences. These signs constitute the core of the Indus Script as presently known and it is obvious that attempts to decipher the script must start with these signs. More than half the number of signs in the sign-list occur less than 10 times each and 112 of them occur only once. These low-frequency signs offer no scope for comparative study and attempts to 'decipher' them will lead us nowhere.

(b) **Distribution:** Positional or distributional analysis indicates the tendency of certain frequent signs to occur in the initial or final positions by themselves or in clusters of two or sometimes three signs. An important result of the positional analysis is that the signs occur generally in a fixed order and in

fixed positions. This is unlikely to be the case in a syllabic script in which the distribution of syllables may be expected to be much freer, subject only to certain phonological constraints in the underlying language. The observed pattern of occurrence of the Indus signs is best explained by the model of a syntactic arrangement of words.

By combining the results of frequency-distribution and segmentation analyses we can further narrow down the area of search to locate the most common words and phrases and the positions they occupy in the texts. Thus the 67 frequent signs form only about 50 frequent 2-sign 'phrases' occurring at least 25 times each, (of which only 6 occur more than 100 times and 12 others more than 50 times each). The number of stable 3-sign combinations is much less, and only one stable 4-sign combination seems to occur as an integral phrase. It is therefore profitable to concentrate on these relatively few but very frequent words and phrases and attempt to determine their probable function and meaning by relating them to their archaeological context and through ideographic parallels.

7. Some Results of Structural Studies

After the publication of the Concordance, I have been pursuing structural and analytical studies of the Indus Texts with the aim of building a model for an objective comprehension of the contents of the inscriptions even before linguistic decipherment. In structural studies involving computer application, I have had the benefit of collaboration with Mythili Ranga Rao of TIFR, Bombay. I should also acknowledge that we are indebted to many other scholars in the field pursuing similar lines of investigation, especially the Soviet and the Finnish Groups, Gift Siromoney and Abdul Huq.[31] Without going into too many details I shall briefly sum up our main conclusions.

(1) The Indus Script consists mainly of word-signs which appear to be of the following types:

(a) **Ideograms:** These are the clear, 'transparent' signs whose ideographic significance is apparent. These signs can be understood but not 'read'

e.g.

MAN, HORNED PERSON, ARCHER

(b) **Phonograms:** The 'improbable' pictograms like fish, birds, insects, animals etc., in what are most likely to be names and titles in the seal-texts, can be explained only on the basis of their being phonograms formed by rebus writing. These signs cannot be understood or read without making an assumption about the underlying language, as puns are language-specific.[32]

(c) **Conventional Signs:** These include the superscript signs, 'bracket' signs and other 'stroke' signs. While it is possible to determine their function by structural analysis, there is no method presently to discover their phonetic values.

(d) **Numeral Signs:** Numerals have been identified by their logical sequence and their use on pottery and bronze implements, obviously for enumeration. Numbers precede the objects enumerated. The system appears to be decimal. The units are represented by short strokes and the tens by inverted semi-circles, both as in the Egyptian. Numerals from 4 to 10 are also found written with two-tiered strokes. The long strokes do not seem to represent ordinary numbers (except probably on the miniature tablets from Harappa). The short superscript suffixes are certainly not numbers. The sign with 12 strokes arranged in three tiers does not function as a numeral as the number of strokes is found to be variable and the occasional zig-zag arrangement of the tiers and doubling of the sign are features not shared by the numeral signs. Numerals also appear to be used in ideographic (non-numeral) function especially when they appear as fixed numbers in set combinations (e.g) VII-CITY, III-FENCE. The largest numbers identified so far are 35 and 76 occurring on two bronze axes (6306, 2925). Signs for higher numbers, especially for 100 and 1000, may exist as still un-identified word-signs. The numerals are illustrated (in Pl. 7.1).

(e) **Phonetic syllables:** They probably do exist, as a developed writing system cannot manage without them. But structural studies have not so far helped in their identification.

(2) **Ligatures and modifications:** Compounding and modification of signs appear to be ideographic and not phonetic in character. This inference is based on the observation that in most cases the ligatured or modified signs have the same distributional pattern as the basic or unmodified signs in question. For example, any modified FISH sign can be substituted for any other sign in the

group in almost all contexts. Such a pattern is wholly inconsistent with phonetic combinations or modifications.

(3) **Words:** Word-signs appear to represent basically only two types of words (or morphs) viz., roots/stems and suffixes.

(A) **The root sign** functions either as a substantive or an attribute. The same sign can serve in either function. The vast majority of the signs belong to this category of vocabulary items in the language. Attributes precede the substantive they qualify.

B) **Suffixes** fall into two main groups.

(i) **Terminal Suffixes:** Five very frequent terminal signs (and their ligatures and combinations) appear to function as nominal suffixes (Pl. 7.2).

(ii) **Grammatical Suffixes:** Another set of six suffixes comprising three superscript and two middle-register stroke signs and a 4-stroke bracket sign appear to be grammatical morphs (Pl. 7.3):

(a) **The superscript suffixes** function like case-markers, most probably for the locative, possessive or oblique cases.

(b) The **middle-register suffixes** appear to function like conjunctions as they generally serve to join two parts of a text appearing as separate texts elsewhere. These stroke signs also appear to denote numerals 1 and 2.

(c) **Plural-marker:** The four-stroke bracket sign functions like a grammatical suffix replacing the terminal suffixes. This is probably the plural-marker as originally suggested by Heras.

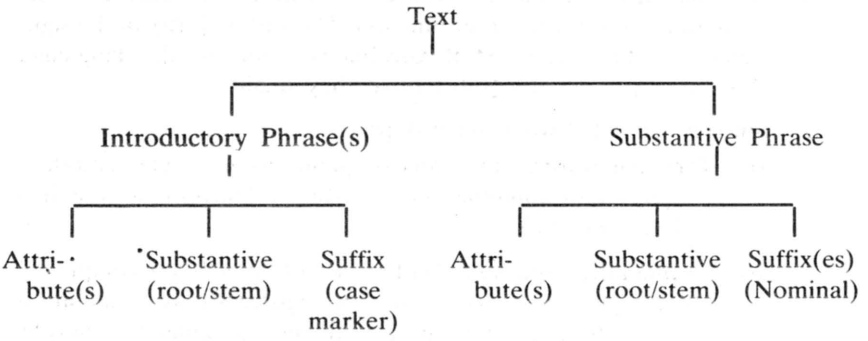
(4) **Syntactic Order in the Texts:**

(a) **Substantive Phrase:** The core of a text is the root/stem morpheme. It may be preceded optionally by one or more root/stem morphemes functioning as attributes qualifying the substantive. The substantive may be followed by one to three nominal suffixes. The whole sequence constitutes the main or substantive phrase of the text.

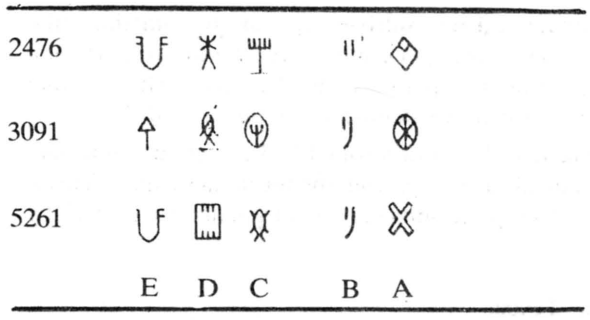
(b) **Introductory Phrase:** The substantive phrase may be preceded (optionally) by one (or more) 'introductory' phrases qualifying the

substantive phrase. The introductory phrase consists of a root/stem as the substantive, preceded (optionally) by one or more attributes qualifying the substantive, and followed by a superscript case-marker suffix.

The following diagram illustrates the general syntax of an Indus Text:



A provisional analysis of three specimen texts is given below to illustrate the syntactical pattern of the Indus Texts:



AB : Introductory (Attributive) Phrase
A : Substantive
B : Suffix (case-marker)
CDE : Main (Substantive) Phrase
C : Attribute
D : Substantive
E : Suffix (nominal)

8. Methods to test the validity of decipherment:

Though none of the claims of decipherment has received general acceptance, it would be unwise to ignore them or dismiss them out of hand. At least some of the attempts are based on years of serious study and may provide valuable clues or insights even if they are not successful. It is therefore necessary to evolve some objective criteria to assess the various claims of decipherment. The foregoing discussions lead us to three simple but decisive tests for a preliminary screening of the claims.[33]

(1) Test of Direction[34]

The general direction of reading the Indus inscriptions from the right is now so well established that we can safely leave out of serious consideration any attempt to read the script generally from the left. A claim for decipherment will also be suspect if the decipherer mechanically reads all the lines from the right and is unable to identify the occasional reversal of direction in the inscriptions, which can be done quite easily in most cases with the help of the sign sequences.

(2) Test of word segmentation[35]

As a result of the analytical and structural studies, we can now confidently demarcate word boundaries in the Indus inscriptions. A proposed reading is suspect if it does not match word boundaries indicated by segmentation analysis. For example, if a text ABCDEF is segmented as AB/CD/EF by structural analysis, a linguistic reading ABC/DEF will be unacceptable. If several such cases of mismatch occur in a decipherment model, the whole claim is suspect.

(3) Test based on Frequency-Distribution analysis[36]

Since we know the frequency-distribution pattern of the signs in the Indus inscriptions, we can match the data with those for the sounds in the language proposed by a would-be decipherer. The readings are suspect if there is no reasonable match. For example, the phonetic values *a/a* proposed for the JAR sign do not seem to be possible since the vowel signs are expected to occur initially in a syllabary of open syllables while the JAR sign avoids the initial position altogether.[37] Another value proposed viz. *sa* has a better fit, especially because, as a gramatical morph, it is both final and a separable suffix like the JAR sign.[38] But since the JAR sign never occurs initially, a different sign for *sa* has to be postulated for this position, which is unlikely in the phonetic script assumed by the model.[39]

The tests mentioned above are of general applicability. In other words, any proposed decipherment will have to satisfy these criteria irrespective of the methods adopted. However the tests are negative in character. They can invalidate a claim as not being consistent with the criteria, but they cannot prove that a proposed decipherment which passes the tests must necessarily be correct. It can only be said that such a decipherment appears to be *prima facie* sound and deserves serious study. The results of the tests can therefore be summed up as *neti neti* ('not this nor that'). However they do serve to warn us of the pitfalls ahead and to point towards the likely direction of fruitful research.

9. Beyond the structural studies:

Alphabetic and syllabic phonetic scripts can be deciphered without bi-lingual records provided sufficient material for analysis is available, as proved by the spectacular success of Michael Ventris in deciphering the Linear-B Script. A mainly logographic system like the Indus Script is unlikely to yield its secrets in this manner. In the absence of bi-lingual records the possibility of a complete decipherment of the Indus Script is quite remote. In fact even a bi-lingual text may not help in determining the phonetic values of word-signs not present in that record. As far as I can see at present, further progress in understanding the Indus Script beyond the structural studies can come only through a study of the ideograms in the Indus Script utilising —

(1) The archaeological context,
(2) Parallels from contemporary pictographic scripts, and
(3) Parallels from survivals of the Indus traditions in the later Historical Period in India.

The purpose of such a study is not to 'read' the script but to achieve a broad comprehension of the contents of the inscriptions through 'the context of situation'

(1) Archaeological Context

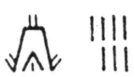
Attempts to decipher the Indus Script have been based mostly on linguistic and analytical techniques, and very little attention has been paid to the archaeological context of the inscriptions. This is unfortunate as analysis of the inscriptions with reference to the archaeological context is likely to yield valuable clues to their contents, even before the script is deciphered. For example, the starting point of Virolleaud's decipherment of the Ugaritic Script was the discovery of the words for 'axe' and 'owner' found on a series of small bronze axes.[40] Before one tries to read an unknown inscription, one must

surely know where it comes from, on what type of object it is inscribed and what other clues are available from the circumstances of its discovery. A good example of the use of archaeological context is the recognition of the HORNED PERSON sign (No. 8) as an ideogram representing a divine, priestly or noble personage by comparing it with the horned personages depicted in the Harappan pictorial motifs (e.g. 2420, 2430). This interpretation is corroborated by another sign (No. 171) which often precedes this ideogram and is identical in shape to the Sumerian sign for 'great'.

Unfortunately the stratigraphic data for Mohenjodaro and Harappa cannot be easily interpreted or related to the inscriptions. The other sites (except for Lothal and Daimabad recently) lack full publication. I hope that with the publication of the original Fieldbooks of Mohenjodaro now being undertaken by the German 'Project Mohenjodaro' and fuller publication of data from other sites, researchers will turn their attention more to the archaeological context of the Indus inscriptions.[41] By way of illustration, I have reproduced here our study of the distribution of the most frequent 'phrases' at Mohenjodaro with reference to locations (Pl. 8).[42]

(2) **Parallels from Contemporary Pictographic Scripts**

The Indus Script appears to be an independent invention, judging from the distinctive character of its signs. The invention must have come from the diffusion of the idea of writing rather than direct borrowings.[43] However given the nature of pictographic writing, it is not unlikely that such scripts may have similar signs with similar meanings (but not similar sounds). Langdon, Hunter and Heras have published lists of correspondences between the Indus and the Sumerian, Egyptian and Proto-Elamite scripts.[44] However it should be emphasised that similarity in form does not guarantee similarity in meaning as we know that the same meaning was expressed by different ideograms in various scripts and that the same ideogram may have different meanings. Notwithstanding these limitations, ideographic parallels from contemporary scripts may provide valuable clues provided they are supported by contextual and other evidence. I shall illustrate the possibilities with an example.

'SEVEN CITIES' 

The interpretation of a pair of Indus signs as SEVEN CITIES has gained wide acceptance from scholars. Waddel (1925) was the first scholar to identify the pair with the Sumerian equivalents *imina bara* and to suggest the

meaning 'Heavenly House' (by alloting the SEVEN sign, not the numeral but an ideographic value).[45] He was followed by F W. Thomas (1932) who pointed out that the Indus ideogram in question is "too similar to the Sumerian sign for CITY WALL and at the same time too complex to be otherwise than identical with it."[46]

After a long interval waddel's almost-forgotten theory of 'Indo-Sumerian' has been resurrected by Kinnier Wilson (1974) in a more sophisticated attempt.[47] Kinnier Wilson equates the Indus sign-pair with Sumerian *imin bad* meaning 'Seven (walled) Cities'. He has drawn attention to the occurrence of the phrase *bad imin* in a Sumerian epic as the name of a place to the east of Sumer. Bailey (1975) pointed out the apparent equivalence of Sumerian *bad imin* with *sapta sindhavas* in the Rigveda and *hapta hindu* in the Avesta.[48] He also suggested that *sapta sindhavas* could be interpreted as 'Seven High Places', probably the Harappan name for the Indus region, which was later adopted by the incoming Aryans into their language. Mitchiner (1978) and Atre (1983) have also supported this identification.[49]

This example is quite instructive. What has made the identification attractive and acceptable is the independent corroboration it has received from the near-identical signs in the Sumerian Pictographic Script as well as attestation of the name from ancient Sumerian, Vedic and Avestan sources. The example also illustrates how Harappan names can be recovered from survivals in the later Indian tradition if only we know where to look for them.

(3) **Bi-lingual Parallels from Indian Historical Tradition**

The example cited above leaves one question unanswered. As pointed out by Bailey *sapta sindhavas* could not have been the original name of the Indus region in the Harappan times. The linguistic diversity of the Sumerian, Vedic and Avestan names shows them up to be no more than loan translations. What was the original name then?

The Indian historical tradition has come down to us in two main linguistic streams, viz., Indo-Aryan and Dravidian. It is likely that due to prolonged bi-lingualism and racial fusion in the Indian sub-continent, Harappan names passed into the Indo-Aryan as loan-words and translations. It is therefore useful to search for bi-lingual parallels from both Indo-Aryan and Dravidian sources while attempting to interpret the ideographic signs. The advantage of the method of bi-lingual parallels is that it is not necessary to make any *a priori* assumption about the linguistic affinity of the Harappan language, even while hoping that accumulation of evidence would ultimately help to resolve this question.[50]

These theoretical considerations led me to look for a Dravidian parallel for the SEVEN CITY ideograms of the Indus Script. To my pleasant surprise I found an exact equivalent, viz., *ēḷ-eyil* meaning 'Seven (walled) City' occuring in *Pura-nanuru* (33:8), a compilation of bardic poetry dating from about the beginning of the Christian Era, but probably incorporating much earlier traditions. (cf. *eyil:* fortification, wall, city, town; *DEDR* 808).[51] The poem praises the valour of a Chola prince who sacked the Pandyan city of El-eyil after breaking through the city gates *(kadavam).*[52] Further search turned up another variant *ēḷ-il,* meaning 'Seven House', a name which appears to be equally ancient and occurs seven times in five anthologies of old Tamil Sangam poetry belonging to the same age.[53] El-il is identified (*Narr.*, 391:6-7) as a city situated on a hill in the Konkan region to the north-west of the Tamil Country. (It is significant that Tamil tradition refers to the migration of Tamil tribes from the Konkan and Tulu regions and further north-west, suggesting that the name is a dimly-remembered tradition ante-dating the migration).[54] Another interesting point is that since the place-names occur in the singular in the Old Tamil sources, it appears likely that *ēḷ-/eḷu* was not used in the literal numerical sense of 'seven' (*DEDR.* 910), but as a homonym meaning 'high, elevated' (cf. *eḷu-*: height, elevation, eminence etc. *DEDR.* 851), reminding us of Bailey's 'High Places'. And finally, the availability of two similar, but not identical, names even within the Dravidian tradition should caution us against regarding either of them as the actual 'reading' of the Indus ideograms.

10. **Future Prospects**

Even though no attempt to decipher the Indus Script has succeeded so far, I feel that there is no cause for undue pessimism. More textual material is being continually added from fresh excavations. Publication of the critical editions of the Texts, computerised Concordances and statistical data has laid a firm foundation for further progress in the study of the script. In particular the two Concordances, Finnish and Indian, have triggered a spate of analytical and structural studies which are rapidly advancing our understanding of the script. The recent publication of the first volume of the Corpus of Indus Seals and Inscriptions (Joshi and Parpola 1987) with excellent reproductions of both the original seals and impressions from the Indian collections is most welcome, and I look forward to the quick publication of the next two volumes comprising the material available in Pakistan and elsewhere. I have no doubt that with the availability of this magnificent edition of the originals and the two Concordances, studies on the Indus Script would gain greater momentum in days to come.

NOTES AND REFERENCES

1. A clay disc from Phaistos in Crete dated to ca. 17 Cent. B.C. It is stamped on both sides with pictographic signs in a spiral arrangement. The script is still undeciphered. A.J. Evans, *Scripta Minoa,* vol. I, Oxford, 1909, pl. xii.

2. The more recent studies on the Indus Script (including claims of decipherment and their reviews) are listed in —
I. Mahadevan and Mythili Ranga Rao, 'The Indus Script and Related Subjects: A Bibliography of Recent Studies (1960-86)', *Tamil Civilization,* vol. 4, no. 3-4, 1986, pp. 214-37.
Four other claims of decipherment have appeared subsequently:
Subhash C. Kak, 'The Study of the Indus Script: General Considerations', *Cryptologia,* vol. XI, no. 3, 1987, pp. 182-191; and 'A Frequency Analysis of the Indus Script', *Cryptologia,* vol. XII, no. 3, 1988, pp. 129-142;
B.V. Subbarayappa, 'Indus Script: the Womb of Numbers', *Qty. Jl. of the Mythic Society,* vol. LXXVIII, no. 1 & 2, 1987, pp. 126-63;
S. Kalyanaraman, 'The Indus Script: An Economic Chronicle', (Papers 1-6; unpubl.), 1988, Asian Development Bank, Manila;
K.K. Raman, 'Key to Harappan Script', *The Week,* Cochin, Apr. 3 1988, pp. 34-38.
This list does not include the most recent analytical or descriptive studies not claiming to be decipherments.

3. This is the conventional dating (after Wheeler). However the chronology of the Indus Civilization is still a matter of debate. The most recent estimates based on Radio-carbon dating are: ca. 2900-2100 B.C. for the Early Indus, 2200-1800 B.C. for the Mature Indus and 1800-1300 B.C. for the Late Indus Periods. Applying the MASCA correction, the date range for Early and Mature Indus periods are ca. 3200-2200 B.C. and 2700-2100 B.C. respectively. K.S. Ramachandran, 'Dating the Indus Civilization', *Frontiers of the Indus Civilization,* ed. B.B. Lal and S.P. Gupta, New Delhi, 1984, pp. 538-39. Recent excavations, especially at Mehrgarh, Pakistan, have added a new dimension to the prehistoric sequence of the Greater Indus area, progressively extending the beginning of settled life to the commencement of the 7th Mill. B.C. J.F. Jarrige, 'Chronology of the Earlier Periods of the Greater Indus as seen from Mehrgarh, Pakistan', *South Asian Archaeology 1981,* Cambridge, 1984, pp. 21-28.

4. S.P. Asthana, *History and Archaeology of India's contacts with other countries from earliest Times to 300 B.C.,* Delhi, 1976;
Shereen Ratnagar, *Encounters: The Westerly Trade of the Harappa Civilization,* New Delhi, 1981;
C.C. Lamberg-Karlovsky, 'Trade Mechanisms in Indus-Mesopotamian Interrelations', *JAOS,* 92, 1972, pp. 222-229.

5. Scattered notices on the occurrence of Indus seals in West and Central Asian sites are brought together and discussed in D.K. Chakrabarti, 'Seals as an evidence of Indus-West Asia Interrelations', *History and Society*, Essays in honour of Prof. Niharranjan Ray, ed. D.P. Chattopadhyaya, Calcutta, 1978, pp. 93-116.
Unpublished as well as more recent finds are listed in R.H. Brunswig Jr. , Asko parpola and Daniel Potts, 'New Indus Type and Related Seals from the Near East', *Dilmun: New Studies in the Archaeology and Early History of Bahrain*, ed. D.T. Potts, Berlin, 1983, pp. 101-115;
V.M. Masson, 'Seals of a Pro-Indian Type from Altyn-depe', *The Bronze-Age Civilization of Central Asia: Recent Soviet Discoveries*, ed. P.L. Kohl, New York, 1981, pp. 149-162.

6. Seals imported from West Asian region into the Indus are discussed in D.K. Chakrabarti (see n. 5) and, J.P. Joshi and Asko Parpola, *Corpus of Indus Seals and Inscriptions*, vol. I, Helsinki and New Delhi, 1987, pp. xii-xv. The authors suggest that the stepped-type and T-shape seals found at Harappa (H-165-66 in this vol.) and a cylinder seal from Mohenjodaro (M-419) show NE Iranian influence. They suggest that "there are weighty reasons to assume that the NE Iranians represent the first wave of Aryan-speaking immigrants in South Asia"
For cultural contacts and interrelationship between the Indus and West Asian regions see —
E.C.L. During Caspers, 'Some motifs as evidence for maritime contact between Sumer and the Indus Valley', *Persica*, 5, 1971, pp. 107-18, pl. viii-xi; and 'Sumer, Coastal Arabia and the Indus Valley in Proto-literate and Early Dynastic Eras: Supporting Evidence for a cultural linkage', *JESHO*, 22, 1979, pp. 121-35;
S. Parpola, A. Parpola and R.H. Brunswig Jr., 'The Meluhha Village, Evidence of acculturation of Harappan Traders in Third Millennium Mesopotamia?', *JESHO*, 20, 1977, pp. 129-165;
Asko Parpola, 'New Correspondences between Harappan and Near-Eastern Glyptic Art', *South Asian Archaeology 1981*, ed. B. Allchin, Cambridge, 1984, pp. 176-195;
Asko Parpola, *The Sky-garment* (A study of the Harappan religion and its relation to the Mesopotamian and later religions), Helsinki, 1985. The 'trefoil' pattern decorating the robe of the priest-king statue from Mohenjodaro is identified with Mesopotamian 'sky-garment' motifs (with astral significance), and the 'tarpya' garment of the Vedic ritual.

7. I.J. Gelb, *A Study of Writing*, (revised ed.), Chicago, 1963. The best introduction to the theory of writing.
Two other works (more descriptive) which may be usefully consulted are —
David Diringer, *The Alphabet* (2 vols.), London, 1968;
Hans Jensen, *Sign, Symbol and Script*, tr. from German. George Unwin, London, 1970.

8 For an alternative theory that writing originated from reckoning, see Denise Schamandt-Besserat, 'Reckoning before writing', *Archaeology*, 32:3, 1979, pp. 23-31. Her theory that writing originated from Neolithic clay tokens used for reckoning is persuasive; but these may be regarded as complementing pictures as sources for the development of writing.

9. Gelb (n. 7 above) prefers the term 'logogram'. In my view 'ideogram' should be retained as a useful word to connote *sense-signs* as distinguished from *sound-signs* (phonograms) formed by rebus, both of which are included in the term 'logogram'. The term 'pictographic' refers to the *external* pictorial aspect while 'ideographic' refers to the *internal* structure of a script.

10. G.R. Driver, *Semitic Writing*, rev. 3rd ed. by S.A. Hopkins, London, 1976;
Joseph Naveh, *Early History of the Alphabet: An Introduction to West Semitic Epigraphy and Paleography*, Leiden, 1982;
J.D. Hawkins, 'The origin and dissemination of writing in Western Asia', *The Origin of Civilization*, ed. P.R.S. Moorey, London, 1978.

11. The best sources for facts about the Indus Script are still the original excavation reports, especially —
J. Marshall, *Mohenjodaro and the Indus Civilization*, 3 vols., London, 1931;
E.J.H. Mackay, *Further Excavations at Mohenjodaro*, 2 vols., New Delhi, 1937-38;
M.S. Vats, *Excavations at Harappa*, 2 vols., Calcutta, 1940.
For scattered and later finds, the introduction and documentation in the following works may be consulted:
I. Mahadevan, *The Indus Script: Texts, Concordance and Tables*, New Delhi, 1977 (cited as the Indian Concordance). References to sign and text numbers are from this volume;
Kimmo Koskenniemi, and Asko Parpola, *A Concordance to the Texts in the Indus Script*, Helsinki, 1982 (cited as the Finnish Concordance);
J.P. Joshi and Asko Parpola, *Corpus of Indus Seals and Inscriptions*, vol. I., Helsinki and New Delhi, 1987.

12. The earlier sign lists have been superceded by the comprehensive lists published in the Indian Concordance (pp. 32-35) and the Finnish Concordance (pp. 20-21). For further discussion on the signs see para 6(1) below.

13. Out of 419 signs listed in the Indian Concordance, 179 signs have variants totalling 641 forms recorded separately in the List of Sign Variants (Appendix I, pp. 785-792). The criticism that the Concordances which use 'normalized' signary may result in loss of data for further research is based on a misunderstanding of the purpose of a concordance, which is a reference tool to locate readily the occurrences of each sign in every context. The serious researcher should have no difficulty in looking up the actual forms in the originals especially now with the availability of the photographic edition of the originals (Joshi and Parpola 1987).

14. I do not accept S.R. Rao's claim about the evolution of a Late Harappan linear and alphabetic script of 20 signs occurring in graffiti on pottery. For a discussion on this question, see S.R. Rao, *The Decipherment of the Indus Script*, Bombay, 1982; and I. Mahadevan, 'S.R. Rao's Decipherment of the Indus Script', *The Indian Historical Review*, vol. 8, no. 1-2, 1981-82, pp. 58-73.

15. The object-types and pictorial motifs are catalogued and illustrated in the Indian Concordance (App. II-III, pp. 793-813).

16. There are two good studies on the copper tablets from Mohenjodaro:
B.M. Pande, 'Inscribed Copper Tablets from Mohenjodaro: A Preliminary analysis', *Radiocarbon and Indian Archaeology*, TIFR, Bombay, 1973, pp. 305-322;
Asko Parpola, 'Tasks, Methods and Results in the Study of the Indus Script', *JRAS*, 1975, pp. 178-209.

17. Important studies on the direction of the Indus Script include:
J. Marshall, 1931, pp. 409, 427-28;
G.R. Hunter, *The Script of Harappa and Mohenjodaro*, London, 1934, pp. 37-43;
A.S.C. Ross, 'The Direction of the Mohenjodaro Script', *New Indian Antiquary*, 2, 1939-40, pp. 554-558;
B.B. Lal, 'The direction of writing in the Harappan Script', *Antiquity*, 40, 1966, pp. 52-55;
G.V. Alekseev, 'The characteristics of the Proto-Indian Script', *Preliminary Report on the Investigation of the Proto-Indian Texts* (in Russian), ed. Y.V. Knorozov, tr. by A.R.K. Zide and K.V. Zvelebil in *The Soviet Decipherment of the Indus Valley Script*, Mouton, 1976, pp. 17-20;
Indian Concordance, pp. 10-14.

18. B.B. Lal, 'A Further Note on the Direction of Writing in the Harappan Script, *Puratattva*, vol. 1, 1968, pp. 15-16, pl. 1.

19. I. Mahadevan, 'Recent Advances in the study of the Indus Script', *Puratattva*, no. 9, 1980, pp. 34-42. As mentioned here, Text 8221 has been copied in the wrong direction in the Indian Concordance erroneously. It has to be corrected and read from the left for reasons discussed in the cited paper.

20. Indian Concordance, p. 14.

21. Ibid, p. 26, n. 16;
H. Heras, *Studies in Proto-Indo-Mediterranean Culture*, vol. I, Bombay, 1953. He attempted to read all the second lines from the left in the *boustrophedon* mode, while most of them have to be read from the right (pp. 98, 104, 106, 107).

22. E.g. Clyde Ahmad Winters, 'The Harappan Script', *Jl. of Tamil Studies*, 30, 1986, pp. 89-111. He states that the inscriptions should be read from right to left, but proceeds to do so from the *original* seals (not from the impressions), thus reading the inscriptions in effect from the left. It is not perhaps surprising that he should find the signs to have the sound values of the African Manding Script!

23. E.g. S.R. Rao, *The Decipherment of the Indus Script*, 1982, Figs. 17.44, 17B.66, 17C.107, etc.

24. E.g. S.R. Rao, ibid, Figs. 14.1 and 2; 23C.65 and 73; 26.14 and 15 etc., where he reads the same texts in either direction.

25. Maurice Pope, *The Story of Decipherment from Egyptian Hieroglyphic to Linear B*, London, 1975;
E.J.W. Barber, *Archaeological Decipherment: A Handbook*, Princeton, 1974.

26. S.R. Rao advocates segmentation of signs on this basis into basic signs and auxiliary marks (S.R. Rao, 1982, Figs. 47-61).

27. See my criticism of this technique in the review article cited in n.14 above.

28. Sydney Smith (in Marshall, 1931), pp. 415-422;
Papers by M.A. Probst, A.M. Kondratov and Y.V. Knorozov in *Soviet Decipherment*, pp. 23-29;
Seppo Koskenniemi, Asko Parpola and Simo Parpola, 'A Method to classify characters of Unknown Ancient Script', *Linguistics*, 61, 1970, pp. 65-91;
W.A. Fairservis Jr., *Excavations at Allahdino III: The Graffiti, A model in the Decipherment of the Harappan Script*, papers of the Allahdino Expedition, New York, 1977, Fig. 1 (the grid);
I. Mahadevan, 'Recent Advances in the Study of the Indus Script', *Puratattva*, 9, 1980, pp. 34-42;
Kimmo Koskenniemi, 'Syntactic Methods in the Study of the Indus Script', *Studia Orientalia*, 50, 1981, pp. 125-136;
I. Mahadevan, 'Towards a Grammar of the Indus Texts: Intelligible to the eye, if not to the ears', *Tamil Civilization*, vol. 4, no. 3-4, 1986, pp. 15-30;
Gift Siromoney and Abdul Huq, 'Segmentation of Indus Texts: A Dynamic Programming Approach', *Computers and Humanities*, 22, 1988, pp. 11-21;
Abdul Huq, *Computer Analysis of the Indus Script*, Madras, 1988, (unpubl. Ph.D. thesis).

29. Even this 'phrase' can be further segmented. See 8001 for the last two signs of this phrase as a complete text, 4334 in which the first three signs of the phrase can be isolated as a segment, and 2549 in which the first two signs of the phrase can be segmented, ultimately leading to the conclusion that each of the 4 signs is a word forming integral phrases with 2, 3 or 4 signs.

30. Indian Concordance, p. 17.

31. See references in n. 28 above; However I am responsible for the interpretation of the results of the analyses.

32. E.g. the famous suggestion of Heras that the FISH sign, *min* in Dravidian, stands for 'star, planet' from a homonym.

33. I. Mahadevan, 'Claims of decipherment of the Indus Script: Some objective methods to test their validity', SAARC Workshop on Epigraphy, Mysore, 1985 (unpubl.).

34. See para 5 and notes 17-24 above.

35. See para 6(2) and notes 28-29 above.

36. See para 6(3) above.

37. S.R. Rao, 1982, p. 32.

38. John E. Mitchiner, *Studies in the Indus Valley Inscriptions*, New Delhi, 1978, p. 76, Table 7;
Subhash C. Kak, 1987, p. 191, Table 3.

39. Subhash Kak (1988) makes an interesting comparison between the ten most frequent signs of the Indus Script and the most frequent sounds of Indo-Aryan as recorded in the Brahmi script. In my view the attempt is not successful because (1) It is an established rule in the field of decipherment that comparisons of the external shapes of signs between two scripts, one of them being unknown, will be misleading as similarity in form may not mean similarity of sound. For, after all, linear scripts can all be made up by a combination of a few elements like circle, square, triangle and curve. This rule applies even to scripts close to each other in time like the Cypriote, Linear A and B Scripts (Gelb, 1963, p. 144; Barber, 1974, pp. 97-98); (2) Kak's list excludes some out of the ten most frequent signs and includes others much less frequent. As a result of this, there is no convincing match between the Indus signs and the Brahmi letters and their sounds in Indo-Aryan; (3) Many of the comparisons of shape are far-fetched, e.f. MAN with *ta*, JAR with *sa* etc.

40. For an account of the decipherment of the Ugaritic Script, see Pope, 1975, pp. 117-22.

41. M. Jansen and G. Urban (ed.), *Interim Reports*, vol. 1, Reports on field work carried out at Mohenjo-Daro, Pakistan, by the ISMEO-Aachen University Mission, 1982-83, Aachen, 1983.

42. Reproduced from I. Mahadevan and Mythili Ranga Rao, 'Archaeological Context of Indus Texts at Mohenjodaro', *Jl. of the Institute of Asian Studies*, vol. 4, no. 2, 1987, pp. 25-56.

43. It is becoming increasingly clear from recent studies that the Indus Script is an indigenous invention with a long period of gestation and growth as revealed by pre-Harappan pottery graffiti from many sites, especially Rehman Dheri in Pakistan. This of course does not exclude similar pictographic signs with similar meanings in contemporary scripts, derived probably from a common stock from Neolithic times.
Recent studies include:
B.B. Lal, 'From the Megalithic to the Harappa: Tracing back the graffiti on pottery', *Ancient India*, 16, 1960, pp. 4-24;
W.C. Brice, 'The structure of Linear A, with some Proto-Elamite and Proto-Indic Comparisons', *Europa: Festschrift Ernst Grumach*, Berlin, 1967, pp. 32-44;
Farzand Ali Durrani, 'Indus Civilization: Evidence West of Indus', *Indus Civilization: New Perspectives*, ed. A.H. Dani, Islamabad, 1981, pp. 133-37, (esp. pl. xvii-xix of a seal and pottery graffiti from Rehman Dheri);
D. Potts, 'The potter's marks of Tepe Yahya', *Paleorient*, vol. 7, no. 1, 1981, pp. 107-122;
D. Potts, 'The Role of the Indo-Iranian Borderlands in the formation of the Harappan Writing System', *Annali dell' Istituto Orientale di Napoli*, vol. 42, 1982, pp. 513-519.

44. Langdon (in Marshall 1931) pp. 434-455;
G.R. Hunter, 1934, pp. 203-210;
H. Heras, 1953, pp. 248-278.

45. L.A. Waddel, *Indo-Sumerian Seals Deciphered*, 1925, Reprint (Delhi, 1972), pp. 92, 95, 98.

46. F.W. Thomas, Review of *Mohenjodaro and the Indus Civilization* by Marshall, *JRAS*, 1932, pp. 453-66.

47. J.V. Kinnier Wilson, *Indo-Sumerian: A New Approach to the problems of the Indus Script*, Oxford, 1974, pp. 3-5.

48. H.W. Bailey, 'Indian *Sindhu*, Iranian *Hindu*', *BSOAS*, vol. 38, no. 3, 1975, pp. 610-611.

49. John E. Mitchiner, 1978, pp. 19-33;
Shubhangana Atre, '*Bad-imin:* the Union of Indus Cities', *Bull. Deccan College Research Institute*, vol. 42, 1983, pp. 18-24.

50. I. Mahadevan, 'Study of the Indus Script through Bi-lingual Parallels', *Procds. II Ann. Confce. of Dr. Linguists (1972)*, Trivandrum, 1975; (Reprinted in) *Ancient Cities of the Indus*, ed. G. Possehl, New Delhi, 1979, pp. 261-267;
I. Mahadevan, 'Study of the Indus Script: A Bi-lingual Approach', *South Asian Languages: Structure, Convergence and Diglossia*, Hyderabad, 1986, pp. 114-119.
Implicit in the search for Dravidian parallels for the Indus ideograms is the hypothesis that the Harappan language, not being Indo-Aryan, could only be Dravidian. The Indo-Aryan hypothesis seems to be ruled out on the basis of (a) chronological considerations, as the incoming Aryans reached the Indus Region only when the Mature Phase of the Indus Civilization was ending around the beginning of the 2nd Mill B.C. (b) difference in culture, as the Indus Civilization was largely urban while the Aryans were nomadic and pastoral; and (c) the absence of the horse and the chariot with spoked wheels in the Harappan glyptic art. Thus Harappan parallels in Indo-Aryan culture is best explained by the substratum Dravidian influence after the fusion of the two cultures.
Also see I. Mahadevan, 'Dravidian Models of Decipherment of the Indus Script: A Case Study', *Tamil Civilization*, vol. 4, no. 3-4, 1986, pp. 133-143.

51. T. Burrow and M.B. Emeneau, *A Dravidian Etymological Dictionary*, 2nd rev. edn., Oxford, 1984 *(DEDR)*.

52. The city has not been identified. It is likely that the bard's praise is conventional, recalling a past exploit of the prince's ancestors. cf. praise of Cheral Atan, a Chera prince, for feeding both the armies during the Bharata War *(Puram. 2)*.

53. *Akam:* 152, 345, 349; *Puram:* 166; *Kurunt.:* 138; *Narr.:* 391; *Porun:* 63.

54. M. Raghava Ayyangar, *Velir Varalaru* (in Tamil), 1913, 3rd edn., Madras, 1964, pp. 1-37. His main thesis is that the Velir, a land-owning agricultural Tamil community, led by their Chief Agastya, migrated from Dvaraka to the Tamil country, passing through the Konkan and Tulu regions, many centuries before the Sangam Age. The Velir shared several myths and traditions with the Yadavas of the North and the Chalukyas, Hoysalas and other Dynasties of the Deccan.
See also I. Mahadevan, 'Agastya and the Indus Civilization', *Jl. of Tamil Studies*, 30, 1986, pp. 24-37.

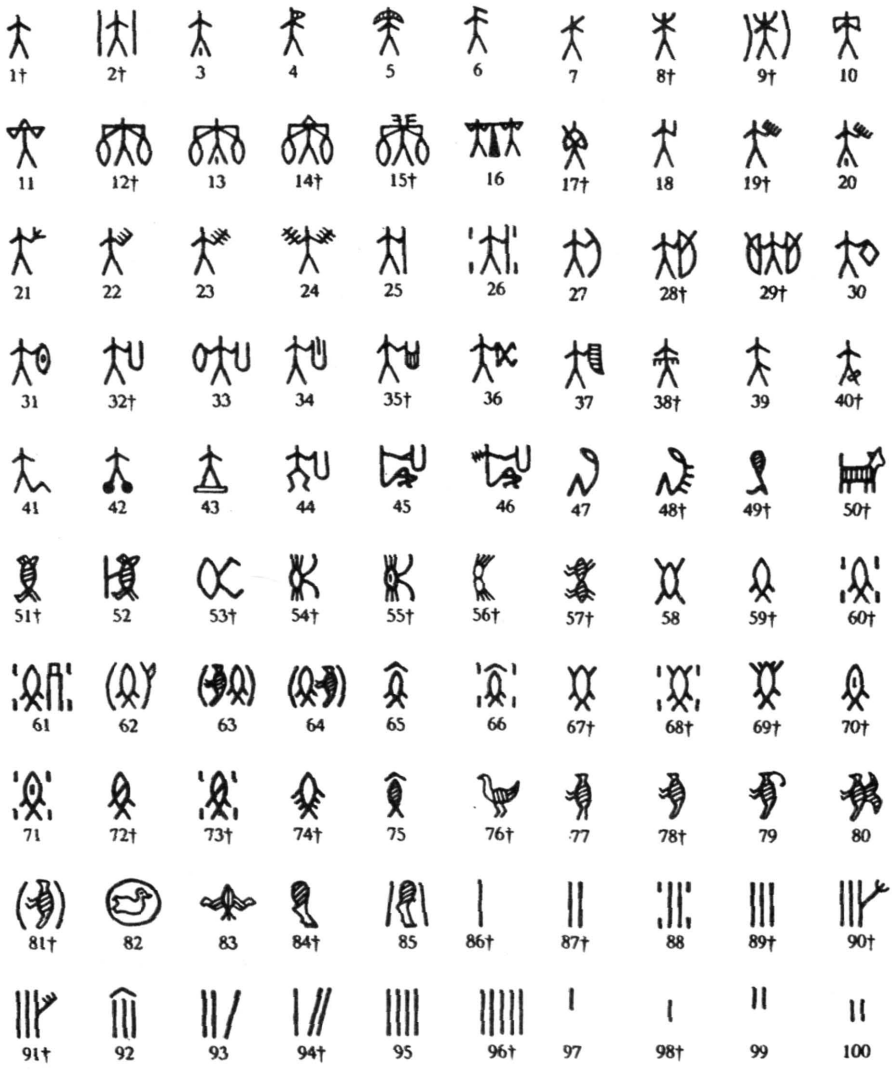


Plate 1. Signs of the Indus Script

(Source: Signs 1-100, Sign List, Indian Concordance, p.32)

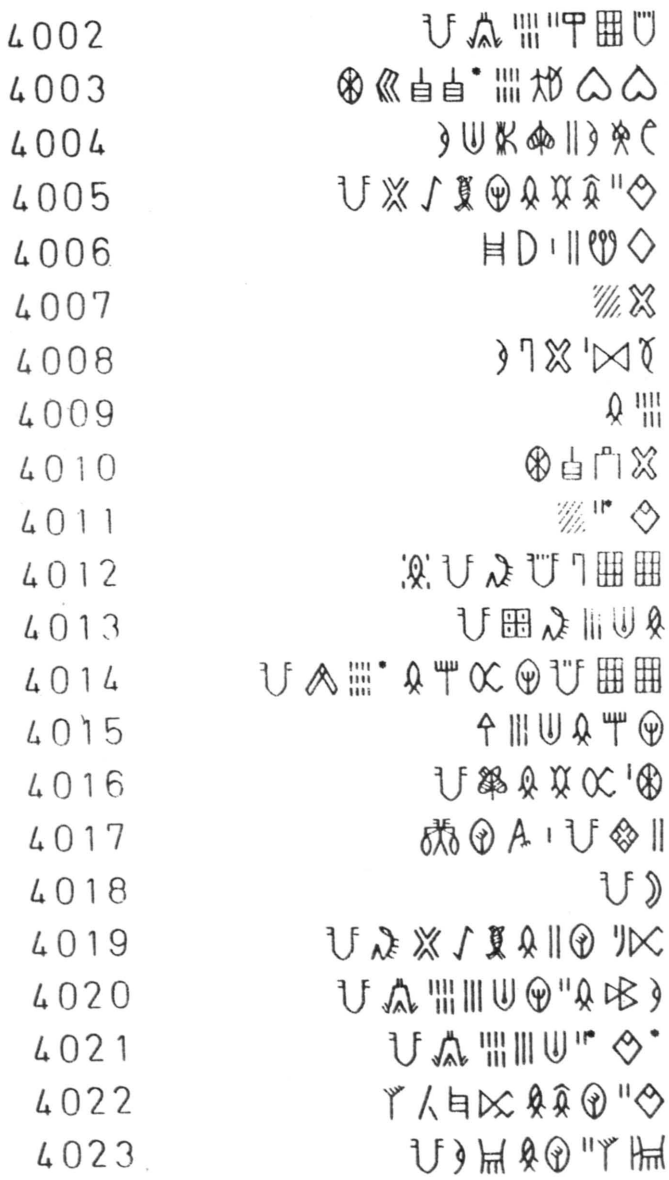


Plate 2. Texts in the Indus Script

(Source: Texts from Harappa, Indian Concordance, p.98)

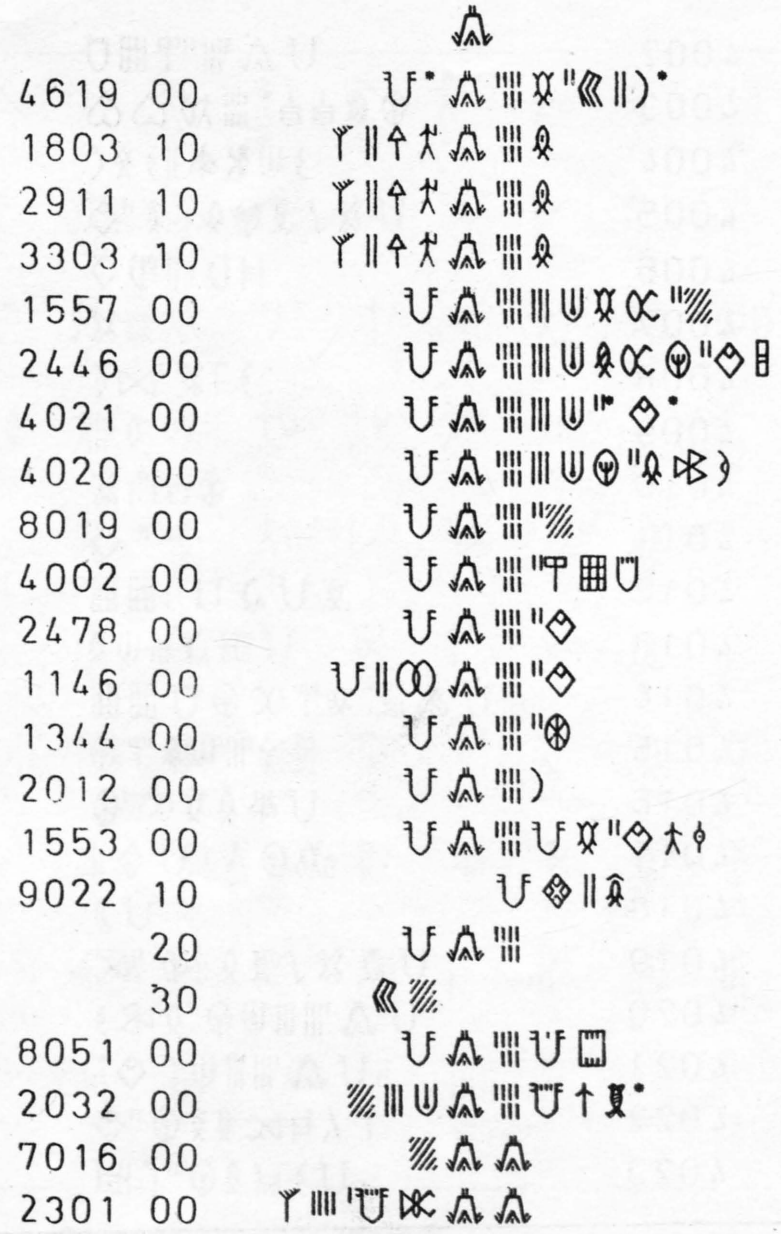
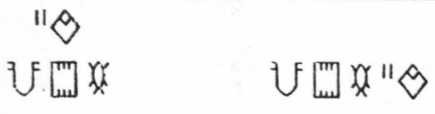


Plate 3. Concordance of Indus Texts

(Source: Indian Concordance, p.454)

8221
(as in the original)

1. Unique pottery graffiti from Kalibangan incised from R., but to be read from L.



6112 2618

2. 'Split sequence' indicating Direction

(a) Normal orientation of signs

Reversed orientation

(b) Frequent Right-end sign-pairs

Frequent Left-end sign-pairs

(c) Frequent sign-pairs

Their reversed order

3. 'Direction-Markers' in the Indus Texts.

Plate 4. Direction of the Indus Texts.

1. 3157

5477

1177

2. 4289

4143

3103

2183

3. 4632

6122

2380

2444

4325

4. 2461

1437

2039

4254

2371

2015

2605

Plate 5. Procedures for Word Segmentation — I

1. 2476 

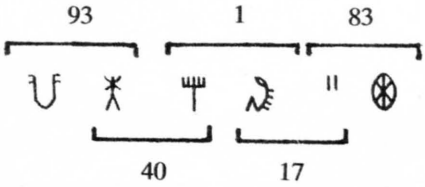
2168

5069 

2201

5031 

2.



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3 1411 

2008

1422 

1243

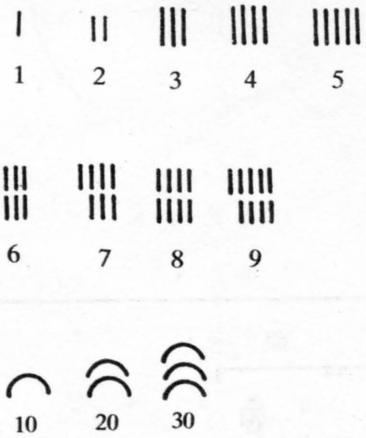
1025 

4548 

4387 

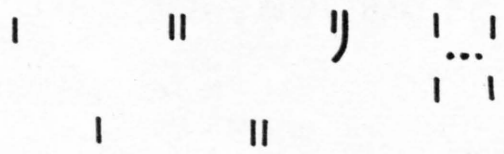
4508 

Plate 6. Procedures for Word Segmentation — II



1. Numerals in the Indus Script (Variants not shown)

2. Terminal suffixes in the Indus Texts



3. Grammatical suffixes in the Indus Texts

Plate 7. Numerals and Suffixes in the Indus Script

FREQ. PAIRS		CITADEL SD (ML)	CITADEL SD (MY)	CITADEL L	LOWER CITY HR	LOWER CITY VS	LOWER CITY DK (ML)	OTH DK (MY)	OTH MD	TOTAL CORP	%
		4	0	1	21	15	28	101	7	177	291	60.82
		1	0	0	4	0	2	17	2	26	184	14.13
		4	0	2	9	11	15	46	7	94	126	74.60
		0	0	0	0	0	1	3	0	4	124	3.23
		1	0	0	4	4	6	25	2	42	114	36.84
		2	0	0	6	1	9	43	4	65	110	59.09
		1	0	0	12	4	9	34	2	62	93	66.67
		0	1	1	3	1	7	34	4	51	87	58.62
		1	0	1	8	2	8	29	3	52	83	62.65
		0	0	0	0	0	0	0	0	0	78	0.00
		1	1	0	5	1	10	20	3	41	76	53.95
		0	1	1	4	4	6	23	8	47	70	67.14
		0	1	0	8	1	5	26	5	46	67	68.66
		0	1	1	3	2	4	12	3	26	58	44.83
		0	0	0	0	1	0	3	0	4	58	6.90
		0	1	0	5	5	6	14	1	32	55	58.18
		0	0	0	4	1	6	14	0	25	54	46.30
		0	0	1	4	4	6	19	2	36	54	66.67
TOTAL		15	6	8	100	57	128	463	53	830	1782	46.58

Plate 8. Distribution of Frequent 'Phrases' at Mohenjodaro
(I. Mahadevan and Mythili Ranga Rao, 1987, p.51)