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DECIPHERING THE INDUS SCRIPT, METHODS AND RESULTS *

From the point of view of cryptographic theory the Indus script represents a case of the most difficult type, since both the script and the language are here unknown. It thus corresponds to a code which has been deciphered, e.g. by addition¹. The purpose of such a decipherment is to make the textual repetitions invisible, and if it is done properly, e.g. by using a matrix of never repeating number groups, the ciphergram will successfully resist any technique of the cryptanalysts.

The case of the Indus script is, however, so much less difficult than that of a deciphered code that there are enough repetitions to permit statistical investigation. These again reveal the behaviour of the various signs, and from this we are able to draw conclusions regarding their function and meaning.

The about 2000 known Indus inscriptions are mostly seal texts and therefore rather monotonous. On the other hand, however, they offer us uniform material in which there are many isomorphic groups of signs which through both repetition and variance can be used as clues to an analysis. Since the total number of signs in these inscriptions is c. 10,000, the average length of texts is only c. 5 signs. The number of different signs is c. 300. The total number is, however, sufficiently high to permit a mathematical analysis by computer.

For this analysis texts were collected from publications, each inscription was coded sign by sign, and with a current number, an indication of the place of discovery and the type of object, and punched on cards. The programming was done in the machine language. In February 1965 the data processing machine (IBM 1620) prepared a list of the signs, after having arranged them

* Asko Parpola, Seppo Koskeniemi, Simo Parpola and Pentti Aalto: *Decipherment of the Proto-Dravidian Inscriptions of the Indus Civilization* (The Scandinavian Institute of Asian Studies, Special Publication No. 1), Copenhagen 1969; *Progress in the Decipherment of the Proto-Dravidian Indus Script* (Ibid. No. 2), Copenhagen 1969; *Further Progress in the Indus Script Decipherment* (Ibid. No. 3), Copenhagen 1970, Reviewed e.g. by Gerard Clauson and John Chadwick in "Antiquity" XLIII, 1969, p. 200 ff., by Arlene R. K. Zide and Kamil Zvelebil in "Indo-Iranian Journal" XII, 1970, p. 126 ff.






¹ See e.g. Cyrus H. Gordon, *Forgotten Scripts*, New York 1926, p. 6.

according to their codes, frequencies and positions in the texts. A correlation table of the most frequent signs was built on the basis of the pair-wise, or double, frequencies of these signs. This correlation matrix gives information about the relationships of the signs when their behaviour in the text is concerned. Further lists of frequencies and the behaviour of sign combinations permitted identification of variants of one and the same sign, the conjecture of missing and damaged signs, and a start on dividing the texts into "words", i.e. repeating combinations of 2 signs. The first 16 "words" were distinguished in June 1965, and the computer prepared complete statistics on them.

A detailed study of the lists also revealed the direction of the writing: it runs almost exclusively from right to left, and, by the very shortness of the repeating combinations of individual signs, they also proved it to be phonologographic, like the other contemporaneous pictographic scripts.

In October 1965 an analysis of the correlation coefficients showed 5 clearly distinct groups among the signs. The behaviour of the signs and their combinations proved further that there were none that could be interpreted as a prefix or an infix. The signs occurring as first components of recurrent combinations were shown to be independent parts of compounds or attributive Zero-genitives.

As a result of the analyses carried out on the basis of combinability and statistic frequencies and behaviour, the following signs seemed to us to function as grammatical elements, viz. suffixes.

Sign	Occurrences		
	total	final	initial
	873	627	12
	146	114	1
	55	46	3
	79	57	4
	11	9	0

The criteria were as follows:

- 1) The signs occur with very high frequency.
- 2) They occur, as a rule, at the end of the inscriptions.

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3) To a much lesser extent, they occur in the middle of inscriptions, but it is invariably possible to demonstrate that they belong to the preceding word, and that a distinct word follows them.

4) As a rule, they are never found at the beginning of inscriptions.

5) They form a satisfactory system.


6) There are no other signs with similar qualifications.

7) The correctness of this identification is corroborated by other identifications.

These hypothetical suffixes seem to form a system which in our opinion is parallel to the flexional systems in certain "agglutinative" languages. The routine of the contemporary seals shows further that the most usual case forms (besides the Nominative) are the Genitive and Dative.

	Turkish	Tibetan	Tamil
ZERO	er 'man'	lus 'body'	manei 'house'
	er-in	lus-kyi	manei-y-ōtu
	er-e	lus-la	manei-kku
	er-ler	lus-rnams	manei-kal
	er-ler-in	lus-rnams-kyi	manei-kal-ōtu
	er-ler-e	lus-rnams-la	manei-kal-u-kku

The general principle of the pictographic writings contemporary with the Indus script is that of homophony: If we are consequently able to identify the objects whose pictures are used to express the grammatical elements referred to above, we can try to find a language in which the name of the object in question and an appropriate grammatical element are homophonous.

The figure identified hypothetically as a plural suffix is obviously a man carrying loads with ropes hung on a pole over his shoulders. For this instrument the DED gives two words 1193 *kā* and 1155 *karai*. In addition to the plural suffixes *-kal* ~ *-kāl* ~ *-kalai*, *-n-gā* ~ *-s-kā* given by Caldwell (p. 244 f.) we find in the DED 1178 *karrai* 'collection, bundle' and 1144 *kari* 'much'. This surprising coincidence was tested with the aid of a sign  supposed to be WOMAN ~ FEMININE in order to see whether Dravidian could offer a word with this meaning and explaining at the same time the appearance of the sign in question. One of the Dravidian words for 'woman' DED 3608 *pen*, *penṭi*

turned out to have a near homophone — probably a derivation — **penṭika* ‘comb’: there might hardly be any difference of opinion about this being a most adequate explanation of the figure in question. This result seemed so encouraging that the comparison was continued along the same lines. The probable case suffix supposed to express the Dative was thus compared with DED 1704 *koṭi* ~ *koṭu* ‘peak, top’ and 1708 *koṭu* ‘to give’ and then with the Dravidian Dative suffix, the oldest form of which according to Zvelebil was *-ko*. The pictograph representing the other suffix, supposed to be that of the Genitive, was less easy to identify. On the basis of a Mesopotamian seal picture from Uruk attributed to the Jamdet-Nasr period², and of a design on a Harappan burial urn it was hypothetically identified as representing a ship. The corresponding word DED 876 *ōṭa* seems to be homophonous with the suffix *-oṭu* ~ *-ōṭu* of the so-called Comitative, which often has the function of a Genitive, and with DED 510 *uṭai* ‘possession’, *uṭaya* ‘possessing’, *uṭayavan* ‘owner’, etc.: the hieroglyphic scriptures in general permit great variations in the marking of the vowels.

It might be regarded as a further remarkable coincidence that every one of these pictographs thus seems to have the phonetic value of a suitable case suffix, but to express at the same time the very idea of the same case.

As the work progressed the sign \times was identified with DED 2510* *tam-pata* ‘a drum’ homophonous with 2513 *tampi* ~ *nampi* ‘a younger brother, an inferior priest’; the same sign also occurs obviously ligaturated with the above sign for ‘woman’ \times , and this was conjectured to correspond to *tankei* ~ *nankei* ‘lady, younger sister, priestess’ (cf. further Caldwell, p. 399 f., Subrahmanian Index, p. 477 *nambi* ‘a hero among men’, *nangei* ‘a heroine’). Special attention was paid to partially identical signs which could be used in testing the hypothesis. Such a series is, e.g.

\times DED 423 *ilai* ‘leaf, petal’, 421 *ila* ‘Bombax Malabaricum’ = 420 *il* ‘house’

\times *kō-il* ‘palace, temple’

\times DED 73 *aṭai* ~ *aṭṭai* ‘crosswise, obstacle’, 83 *aṭṭa* ‘tower’

\times *kō-(a)ṭṭai* ‘fort, castle, palace’, *kōṭṭu* ‘granary’.

According to this interpretation the signs in these combinations would be used almost as in a syllabic script.

The combinations of \times \circ ~ \diamond with the above *il* ‘house’ seem to be synonymous with *kō-il*. The behaviour of these components suggests that they are titles. We have thus identified \circ \diamond — once drawn as a naturalistic conch — as representing the conch of Viṣṇu DED 4319 *valampuri* as the homophone of 4317 *vala* ‘powerful man, authority’. Very interesting is \times , which according to the archaeologists cannot represent a spoked wheel,

² Werner Speiser, *Vorderasiatische Kunst*, Berlin 1952, Table 10.

since this was brought to India by the Aryans, who might also have invented it. Subrahmanian points out (p. 83) that the Saṅgam Tamils used *āli* 'the potter's wheel' as the emblem of the king, *āli* is again nearly homophonous with DED 341 *āl* 'to rule', *āli* ~ *ālan* ~ *ālvōn*, etc. 'ruler'. The double wheel might perhaps be read *āl-v-ār*. An original meaning like 'the potter's wheel' could also account for the later expression *cakravartin*: the potter's wheel was obviously the only wheel set in motion by man.

The sign Υ , which occurs ligaturated with these two 'king' pictographs, might be interpreted from the basic meaning 'extended hands' to be like DED 3910 *manu* 'petition' and homophonous with 3909 *man* 'king, lord'. Subrahmanian's studies on the Saṅgam-period of the Tamils show that at that time they had several titles for 'king', the mutual relations of which seem to be unexplained.

One of the most striking features in the inscriptions is the great number of pictographs representing a fish. It goes without saying that 'fish' can not be meant. We must therefore look for a language where the word for 'fish' has a homophone with a meaning suitable for seal and amulet texts. In the Dravidian languages there is one and the same word *mīn* (DED 3994 and 3999) for 'fish' and 'star'. It is furthermore a priori probable that even the stars occur here as divine beings and not as astronomical bodies. The early Danish missionaries of Tranquebar speak in their report in 1726 of the Tamil astronomy: "Einen ieden Stern a part nennen sie Mīn, das ist Fisch, als schwimmen gleichsam die Sterne in der Luft wie Wümmingöl oder Luft-Fische" (p. 2513). The traditional Tamil astronomy described by these missionaries as well as later by Le Gentil and Warren (treated afresh by Neugebauer in *Osiris* X) obviously reflects very old traditions. On the other hand, astrology is still today an integral part of popular religion in India. The bathing ceremonies are always connected with celestial phenomena like solar eclipses, etc., and since the baths are so prominent a feature among the remains of the Indus culture, we may deduce that similar astral aspects were already of importance in the religion of the Indus people. There are further certain details in the traditional Indian religion since Vedic times which seem to be easily explained as reflections of pre-Aryan astral beliefs, e.g. Rudra's epithets 'the red boar of the sky' (RV 1, 114, 5) and 'the Asura of the great sky' (RV 2, 1, 6 and 7, 20, 17).

Among all the fish signs the six 𑀓 , 𑀔 , 𑀕 , 𑀖 , 𑀗 , 𑀘 form a clearly distinguishable group. An investigation of the behaviour of these shows that 𑀓 behaves in the same way as 𑀓 , being thus probably a variant of the latter. We have consequently a group of five signs, and these seem to be identified with the planets proper. We must then try to find out any possible connections between these 5 FISH signs and the Dravidian names of the 5 planets, and we believe that we have arrived at satisfactory results.

Śiva, the main god of the present Dravidians, is obviously to be identified with Mars, which is called "The Red Star": the behaviour of the block 𑀓

fits into the concept of that leading divinity. The Dravidian name of that planet *Cey-mīn* contains the adjective**ceva* (DED 1607) 'red' which is also the name of the tree *Ixora coccinea*, *Ixora* being besides obviously a Spanish form of Sanskrit *īśvara*, a name for Śiva. It therefore seems possible to interpret 𑌕 as a picture of that tree having the meaning 'red'. Saturn is in Dravidian *Mai-mīn* 'The Dark Star'. The additional sign in the block 𑌕 might be regarded as a picture of a thatched roof DED 4552**mēy* and homophonous with DED 3918 *mā* and 4187 *mai* 'black'.

The sign 𑌕 can be interpreted as a ligature of the common FISH and of a sign for "crossroads" DED 4526 *veḷi*, and thus be DED 4524 *velli* 'Venus'.

The planet Jupiter is in Sanskrit called *Bṛhaspati*, which is one of the names for the god Brahma. *Bṛhaspati* is traditionally connected with yellow or a golden colour, and in Dravidian Jupiter is called 'The Golden Star': the near homophony of DED 3732 *poṇ* 'gold' and DED 3506 *puṇ* 'wound, scratch' might account for the additional stroke in the pictograph 𑌕 .

As to the identification of the fifth planet and the fifth FISH sign 𑌕 , the stroke dividing the pictograph seems to connect with DED 3247 *pay* 'to divide, half-', etc., which is homophonous with DED 3161 *pay*, the epithet of the planet Mercury 'The Green Star'. Mercury is identical with the god Ganeśa, in whose name the word *gaṇa* is probably of Dravidian origin.

A verification of some of our readings was unexpectedly detected while comparing the inscription and the picture of certain more detailed seals — our starting point was originally a complete independency of the text and picture of the seals. In the so-called "Paśupati seal", however, the hitherto interpreted signs give us a text "Servant of the Star (= Red Star = Śiva), the Lord of...", which seems to be in accordance with the interpretation of the picture of the seal by almost all the scholars who have treated it. In seal No. 2430 where the various details of the picture, e.g. the attributes of the god, the *Aśvattha* or Pipal tree, the seven persons wearing the *jaṭā*-hairdress of the ascetics and seers (= The Seven Ṛṣis of the Great Bear, and the seven tributaries of the Indus?) point to the myths connected with the god Brahma, the inscription says "Servant of the Golden Star (= *Bṛhaspati* = Brahma), Lord of...". In both seals the closer qualifier of the epithet is as yet undeciphered.

As to extra-linguistic evidence, there seems to be hardly anything which would contradict the possibility of the original identity of at least one layer of the Indus culture population with the "Proto-Dravidians". The position of the Brahuis, the late archaeological dating of the arrival of the Dravidians in South India, the old Dravidian loan words in Sanskrit, the spread of the cerebrals in the Aryan languages, similarities between the numerical and weight and measuring systems of the Indus culture and those of the Dravidians, further even old popular legends, all combine to speak in favour of the Dravidian hypothesis. It seems further to offer explanations to several problematic

details in the later Indian religion and culture. As such might be considered, e.g. the importance of the bathing and purification ceremonies, the development of many divinities of clearly non-Indo-European origin, certain emblems and symbols (the Bull, the Wheel, the Trident, etc.). Surprisingly little attention has been paid to the later Indian seals which, however, seem to continue faithfully the tradition originating in the Indus culture. This is in our opinion proved by several archaeological reports summarized recently in the *Prācī-Jyoti*³.

I hope that these glimpses give an idea of our endeavour to carry on the decipherment in accordance with a unified theory of the character of the script, and to analyze the material classified as far as possible according to the common features of the behaviour of the signs and sign combinations.

The decipherment of a code might be compared to the solutions of a crossword puzzle: every word always affects several others. The more inscriptions we are able to interpret from the beginning to the end, the more possibility of a cross-verification of the deciphered signs there is. The revision of one wrong solution generally implies checking the meanings attributed to all the other signs occurring in the same contexts.

On the other hand I do not regard a single error as fatal as does Walther Hinz, who states categorically (*Das Reich Elam*, Urban Bücher 82, Stuttgart 1964, p. 30), that "if one in the beginning of the decipherment establishes only one single sign wrongly, one goes irremediably astray". In my experience, erroneous interpretations before long betray themselves by stopping the progress of the decipherment and call for revision. The behaviour of a sign is in itself already a means of verification, which should at least reduce the danger of more fatal errors. The homophony principle, which is our working hypothesis, is of course applicable only in one language. The number of cases by now established seems to exclude the possibility of their being mere coincidences.

(September, 1970)

Quoted Literature

Robert Caldwell, *A Comparative Grammar of the Dravidian or South-Indian Family of Languages*, 3rd. Ed., Madras 1961.

DED = T. Burrow and M. B. Emeneau, *A Dravidian Etymological Dictionary*, Oxford 1961; *Supplement*, Oxford 1968.

N. Subrahmanian, *Saṅgam Polity*, Madras 1966; *Pre-Pallavan Tamil Index* (Madras University Historical Series No. 23), Madras 1966.

Der Königlichen Dänischen Missionarien aus Ostindien eingesandter ausführlichen Berichte II Theil, Halle 1712-1726.

³ See, e.g. vol. V, pp. 29, 73, 297, 356, 378: the last seal treated is, according to the publisher, Sircar, inscribed *Sri-Rakta mṛttika(mā)havaiharik-aryabhikṣu saṅgha-sya*, i.e. with a genitive like many of the Indus seals according to our interpretation.