



Understanding the Harappan Script in the context of its culture

Dr Mayank Vahia

1. Main Gate

2. Main Street

3. Cattle Bazaar

4. Market Square

5. Granary Square

6. Shrine Forest

7. Entry to Shrine

8. Arena

9. Upper City Gate

10. Maham's House

11. Great Bath

12. Senate

13. River Gate

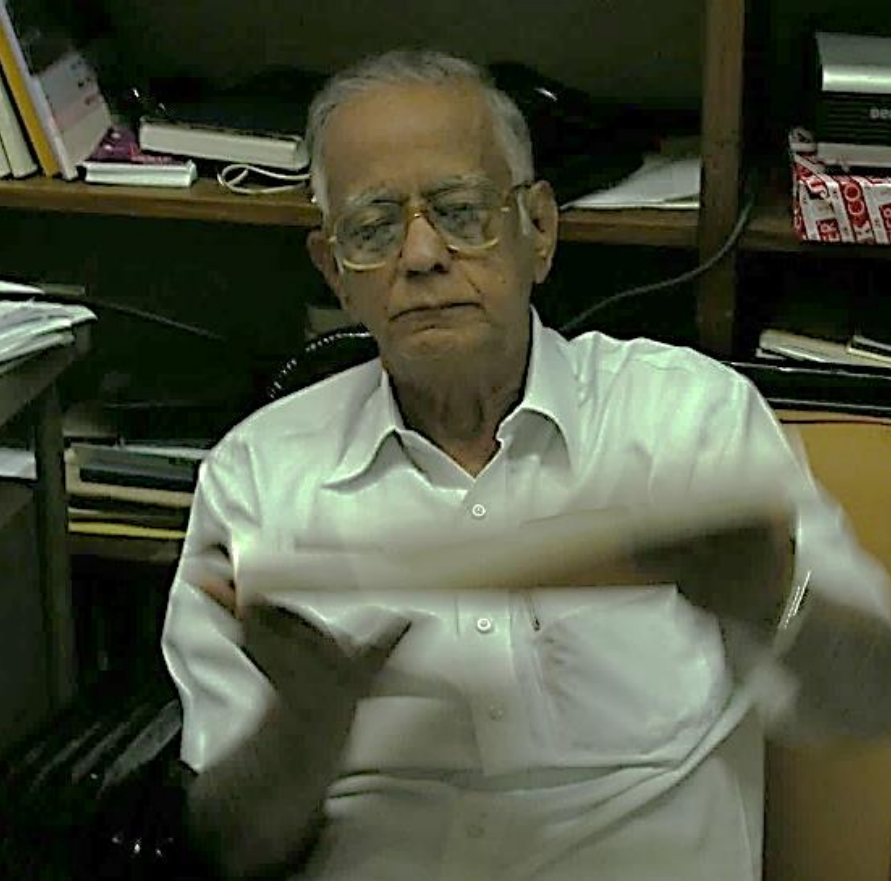
14. North Gate

THE MAP OF
MOHENJO DARO

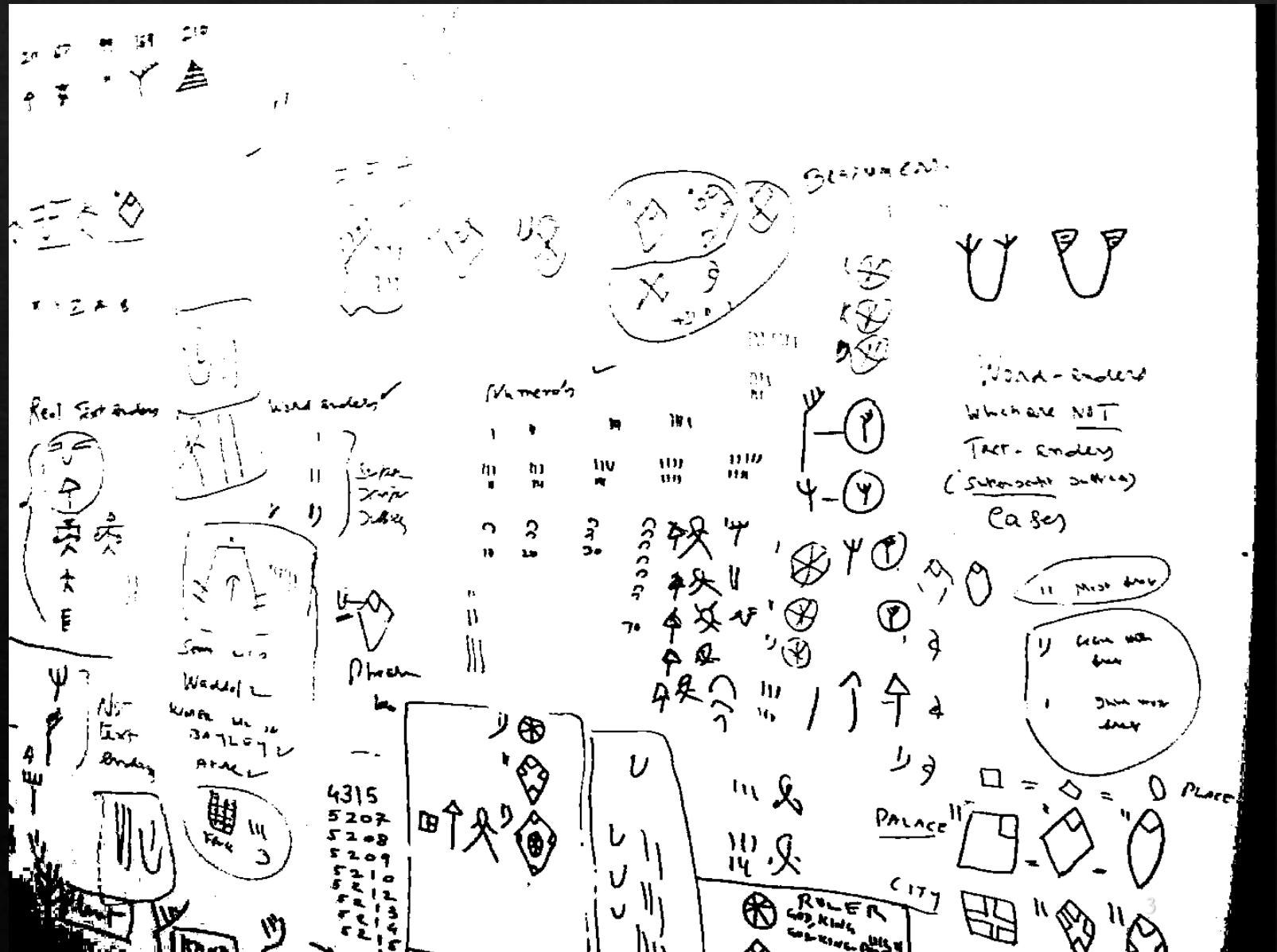


A note about the talk

- ◆ Dr Nisha Yadav, Prof Sitabra Sinha and his group have already talked about the script, its structure and grammar.
- ◆ I will take up the **wider issues of writing** in the context of the Harappan Civilisation.
- ◆ I will discuss the advances in understanding the Harappan miniatures and script **in the context of the organisation** of the Harappan Civilisation.
- ◆ I will then comment on how the **context of the writing** of even an untranslated language can be understood.



My respects to the Legend



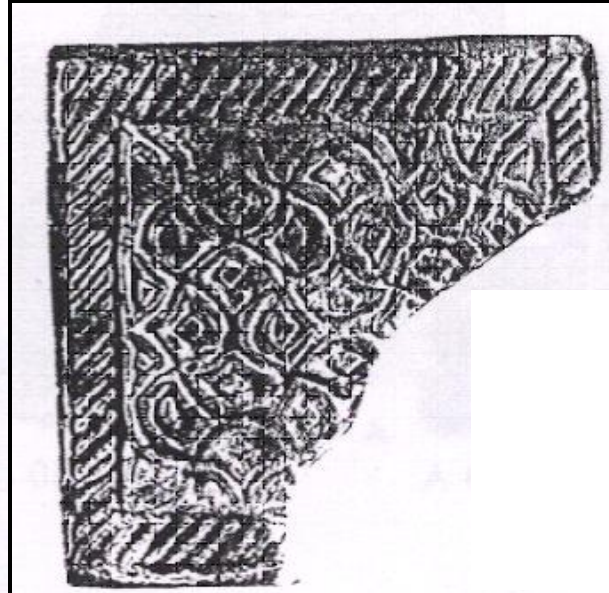
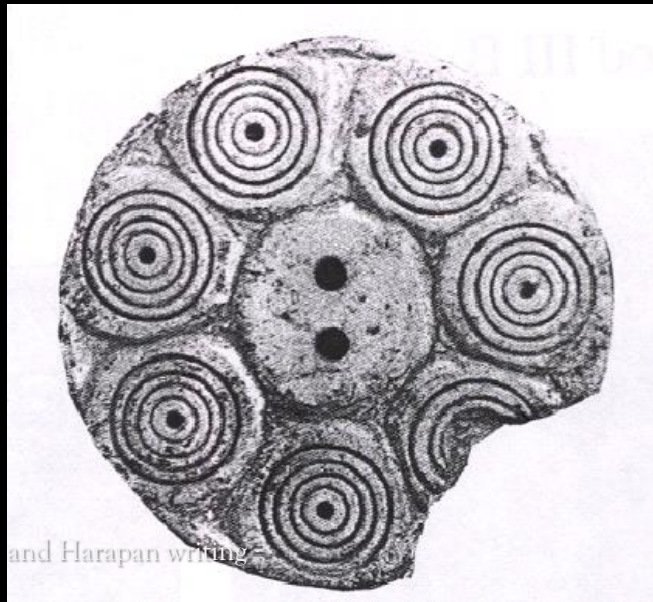
Miniatures and writing

The Miniatures



- ♦ Harappan medium of choice for expressions is miniatures about 1.5 to 15 cm in size.
- ♦ The miniatures seem to have been used for a large variety of purposes.
- ♦ Apart from writing, one can see a large number of interesting themes on the objects.
- ♦ Almost all the written material is on the miniatures.
- ♦ Many seals have a kind of holder at the back suggesting that it could have been used as a rubber stamp or tied up in strings. But the copies are few and far apart.

But their love for miniature was far wider



Harappan miniatures, culture, history and Harapan writing

Mr-10 A

M-1657 A

Wheeler on Harappan Miniatures

“... IT WOULD BE NO EXAGGERATION TO DESCRIBE THEM AS LITTLE MASTERPIECES OF **CONTROLLED REALISM**, WITH A MONUMENTAL STRENGTH; **IN ONE SENSE OUT OF ALL PROPORTIONS TO THEIR SIZE AND IN ANOTHER ENTIRELY RELATED TO IT...**”

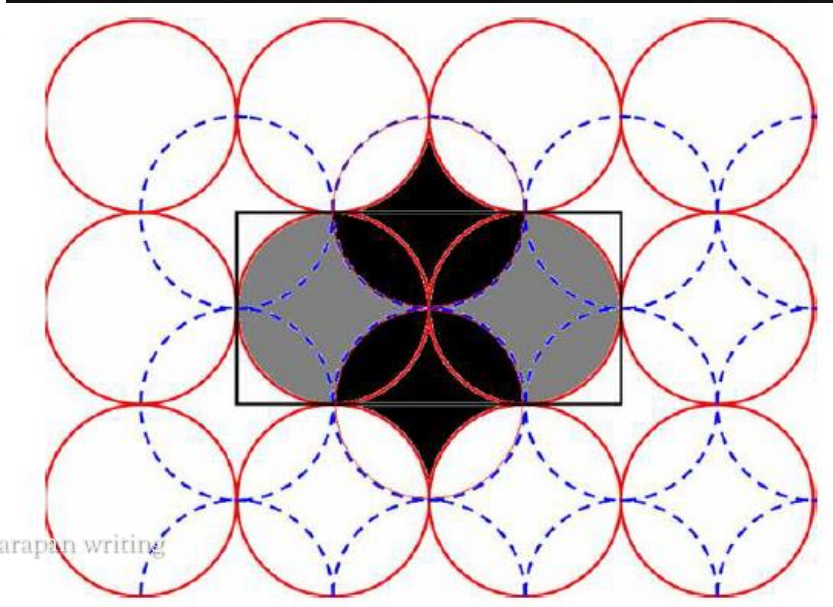
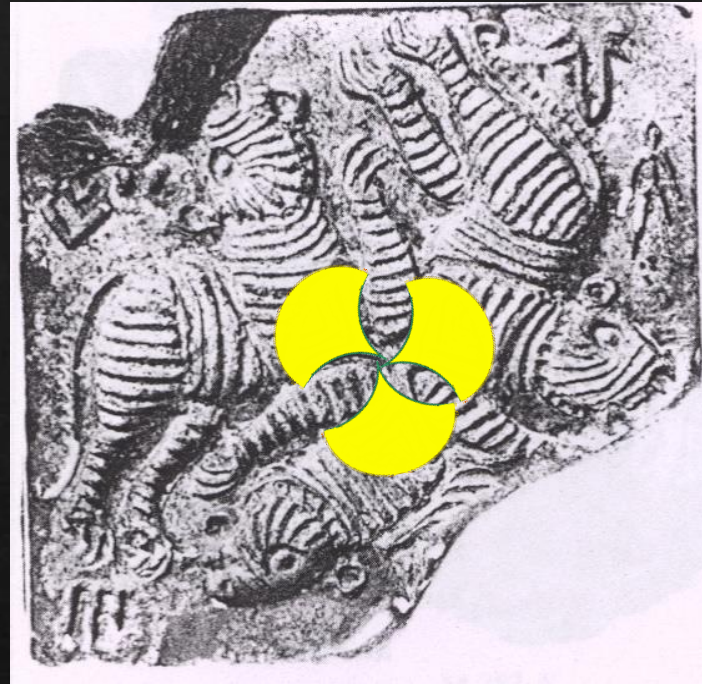
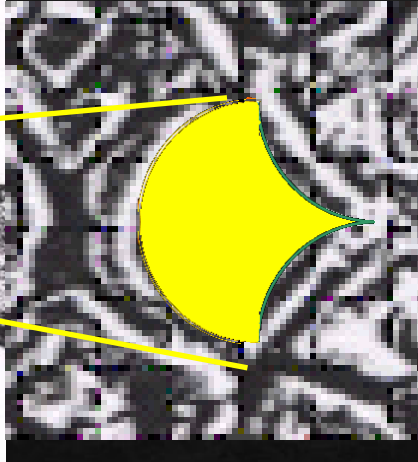
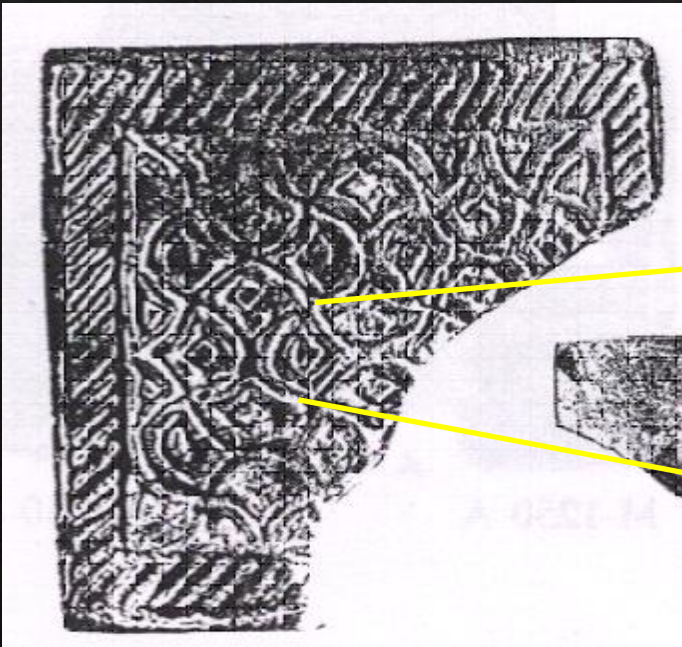
Wheeler, 1931



About the seals

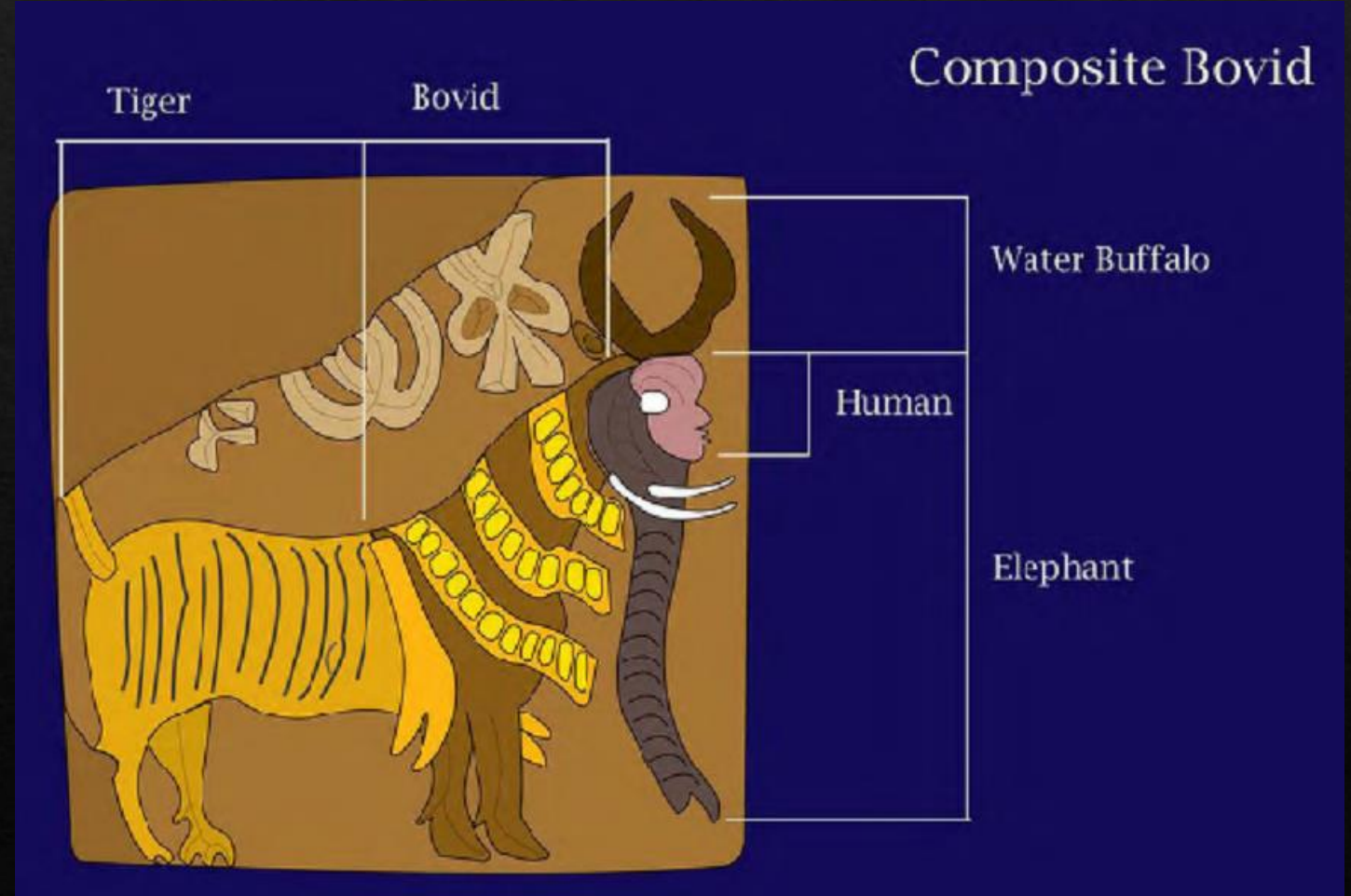
- ◇ The seals are a masterful combination of:
 - ◇ Artistic imagination
 - ◇ High degree of precision
 - ◇ Creative technology
 - ◇ Objective clarity
 - ◇ A fascinating ability to express themselves almost exclusively on this medium.
 - ◇ Nowhere in the entire human race do you find this obsession with miniatures.
- ◇ Mesopotamia does have rotating miniature seals that predate the Harappan Seals but the two seem to be parallel developments.

Complex designs



Sitabra Sinha et al.

Pieces that don't fit – 2: Unusual animals



Why seals?

- ◆ These miniatures have several advantages
 - ◆ They are easy to carry
 - ◆ They are easy to make under expert training.
 - ◆ They are largely tamper-proof.
 - ◆ They are difficult to recreate or replicate except with extensive training.
- ◆ THEY ARE EXPLICIT PROOF OF CENTRALISED TRAINING AND ADMINISTRATION.
- ◆ But in the absence of evidence of standing armies, such a course must have been developed by consensus.
- ◆ That itself speaks a lot about the Harappan Civilisation.

Seals with writing



Harappan miniatures, culture, history and Harappan writing

Script

- ◊ Writing is something that *encounters* language FROM THE OUTSIDE rather than flowing directly out of language.
- ◊ A formal Script *formally* encodes information.
- ◊ A writing system can code multiple languages.
- ◊ Writing was probably invented to aid memory, mark ownership etc.
- ◊ It was not invented to express ideas in and thereby not bound to a specific form of language.
- ◊ This is most evident when one considers the most modern of human languages – Mathematics.
- ◊ Its use to express ideas is a later and important evolution.

Why write?

- ◆ “The practice of writing and the development of a coherent system of signs, a script, is something which is seen only in complex societies... **Writing ... is a feature of civilisations.**” - Colin Renfrew (Archaeology and Language, 1857)

- ◆ We write for 3 reasons

- ◆ To aid memory and mark ownership over short and long-term memory

- ◆ communicate over long distances.

- ◆ For Trading arithmetic.

Harappan miniatures, culture, history and Harappan writing

Speculations on the Harappan writing

- ◊ In the context of the Harappan, it could have served the following purpose:
 - ◊ Tags for securing goods/storage rooms in trade
 - ◊ Identification mechanism for material/ manufacturers/ individuals/ quantity.
 - ◊ Tokens as primitive coinage for the exchange of goods and administration of labour – a more sophisticated barter but pre-currency system.
 - ◊ Religious purposes such as amulets for protection
- ◊ The medium they used was temper-proof and durable.
- ◊ Harappan clearly did not have a monolithic usage.

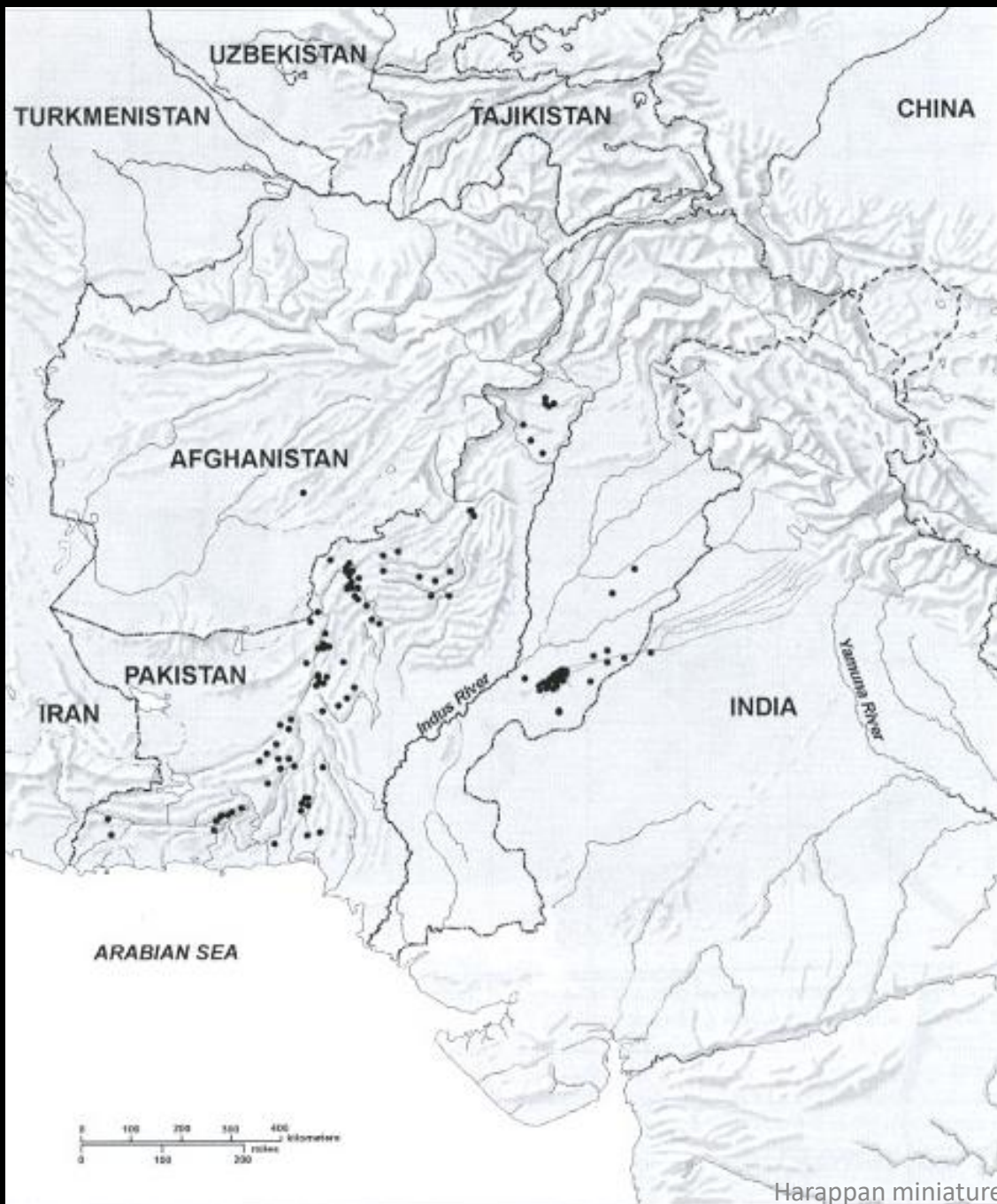
The writing

- ◇ A large fraction of the miniatures with writing have **three components**,
 1. a written script on the top,
 2. an animal
 3. Some kind of feeding cup(?) in front of it.
- ◇ We find many seals with only one of the first 2 items but item 3 does not appear in isolation.
- ◇ The writing contains somewhere between **20 to 650 signs depending on whom you ask!**
- ◇ Those who **claim the smallest number** claim that many signs are in conjunction with other signs.
- ◇ This **suggests** that the script is abugida – mixing vowels and consonants – something found almost exclusively in the South Asian scripts.
- ◇ A **primitive form of Abugida** is used for numbers where higher numbers are coded by a separate sign.
- ◇ But it is an **extremely useful tool to code languages**.

We do know a lot about Harappan writing

- ◇ The **writing is highly ordered** with flexibility similar to that of the linguistic scripts.
- ◇ They wrote from **right to left**, which may be due to the ease of reading what was written – if you were marking using your left hand and putting pressure with your right hand.
- ◇ It is always in small strings of an average of **5 signs**.
- ◇ We know that the **transition** from potters' marks to the complete script was rather swift.
- ◇ It **disappeared as swiftly** as it appeared.
- ◇ The writing was **highly standardised across the entire region** of Harappan Civilisation. This is true in the following aspects
 - ◇ The sign designs are very similar.
 - ◇ The medium of writing is very similar.
 - ◇ The sequencing of texts is very similar.
 - ◇ The signs that seem to have been used only locally are few and rare.

Evolution of writing from the work of Kenoyer



Stage 1 and 2

7000 to 3200 BC

Possehl (2002)



Stage 3

Early Harappan
(Ravi phase)
3200 to 2800 BC

Pot marks

HARAPPA

Period 1: Ravi Phase

Post-firing graffiti



Pre-firing potter's marks



Possehl (2002) & Kenoyer (2006)

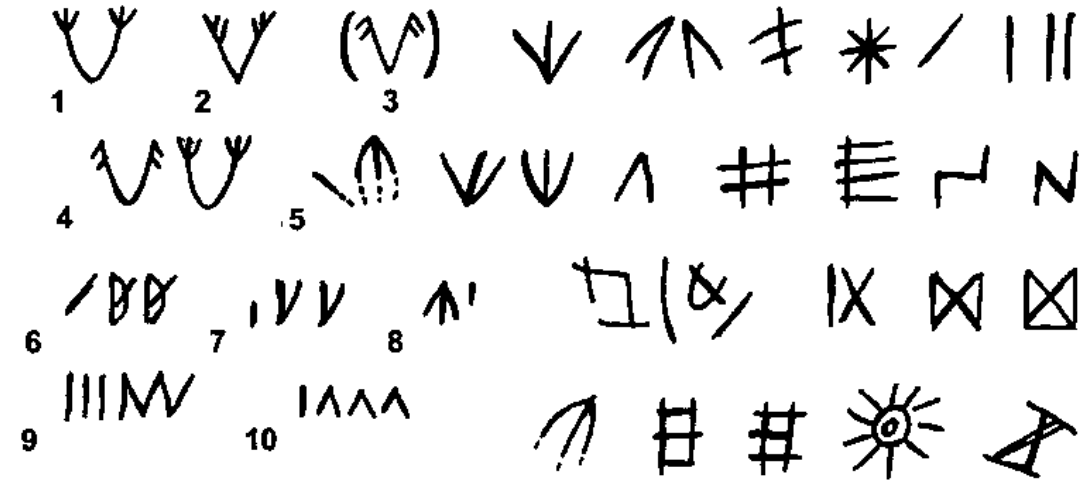


Stage 3

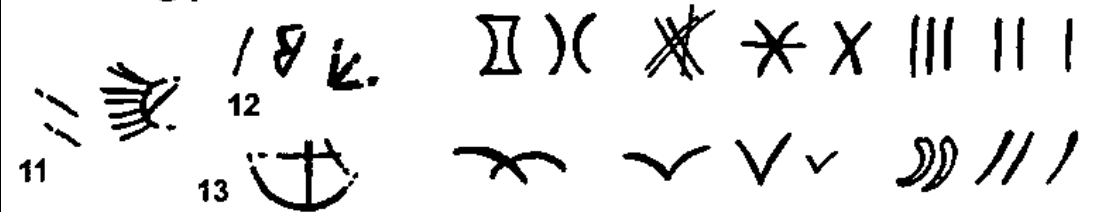
Early Harappan (Kot Diji phase) 2800 to 2500 BC

HARAPPA, Period 2, Kot Diji Phase Script

Post-firing graffiti



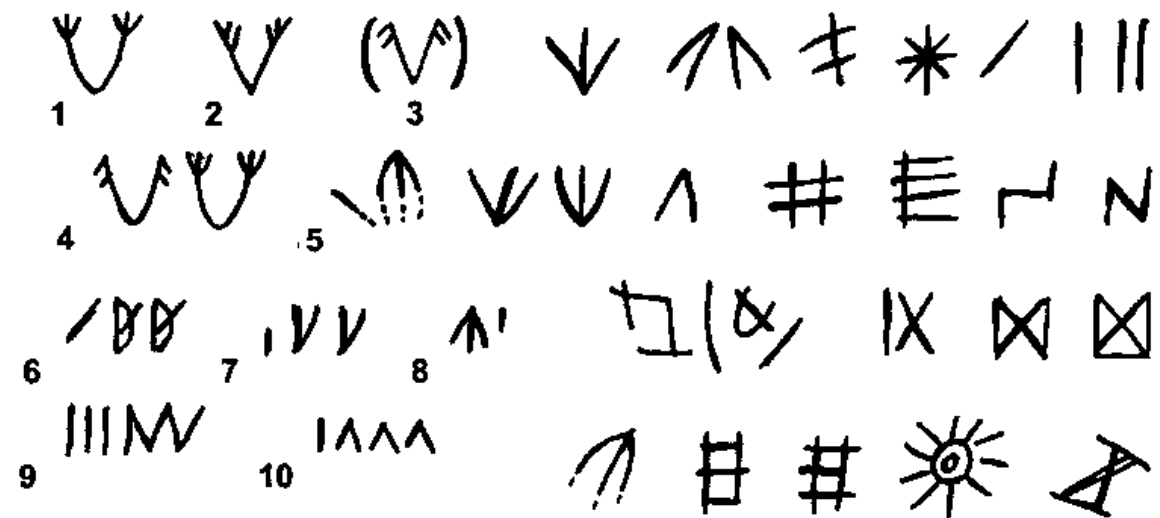
Pre-firing potter's marks



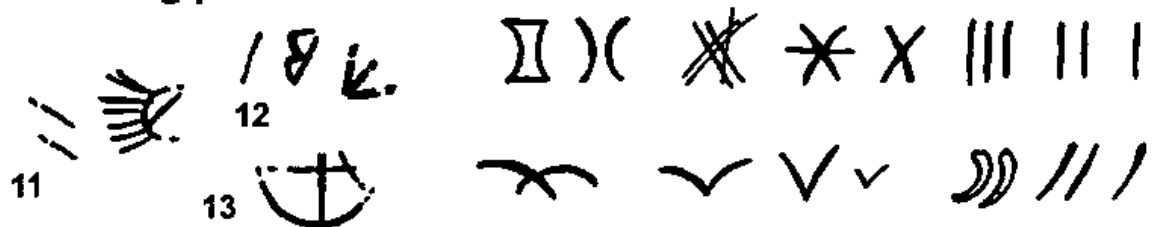
Kot Diji phase 2800 to 2500 BC

HARAPPA, Period 2, Kot Diji Phase Script

Post-firing graffiti

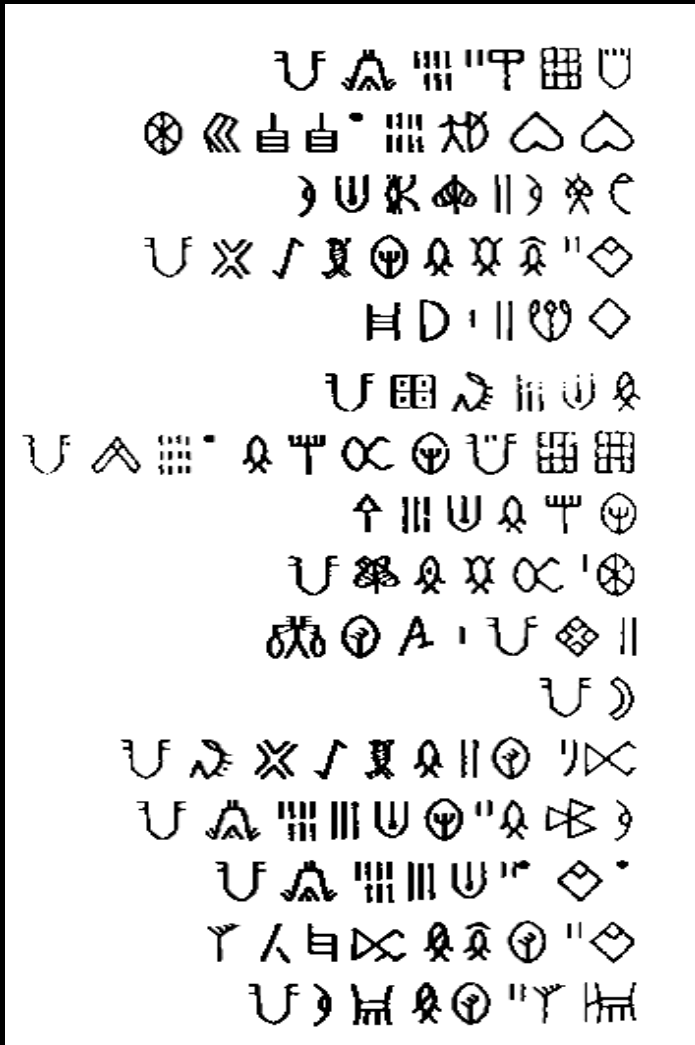


Pre-firing potter's marks



Kenoyer (2006)

Harappan Script 2600-1900BC



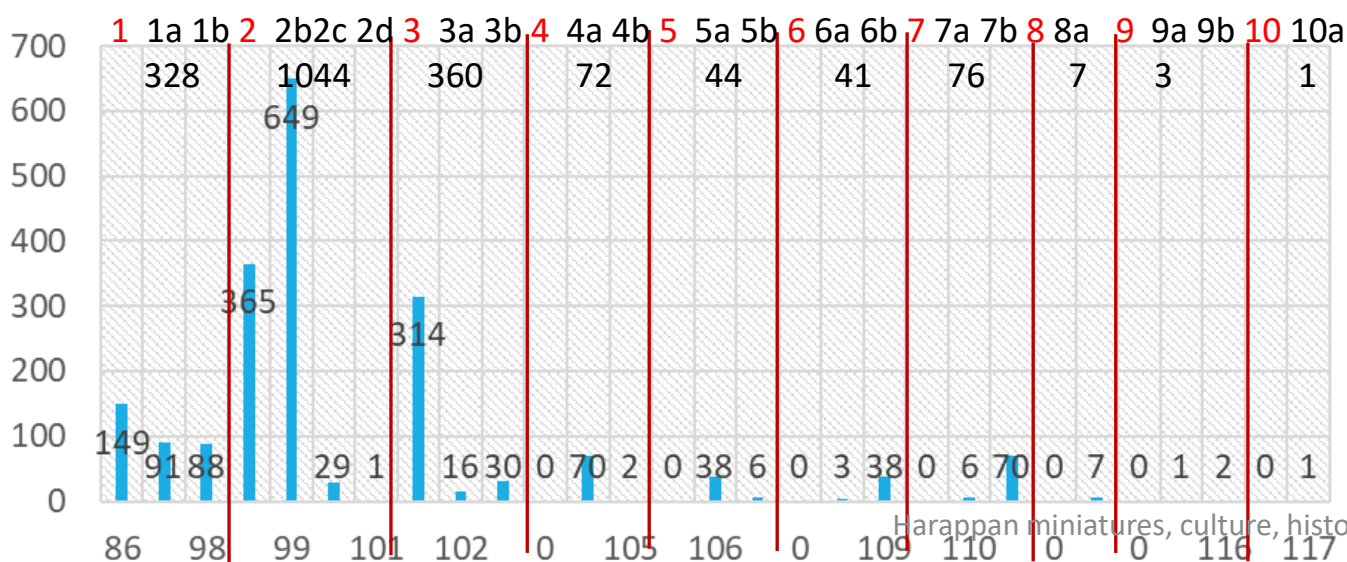
Mahadevan (1977)

The writing

86† 149	87† 385	88 1	89† 314	90† 2	91† 2	92 1	93 11	94† 11	95 64	96† 22
97 91	98† 88	99 649	100 29	101 1	102† 161	103† 30	104† 70	105 2	106† 38	107† 6
108 3	109† 38	110 6	111† 4	112† 70	113 17	114 7	115 1	116 2	117 1	118 1

Frequency of occurrence of signs with different strokes

Number of strokes



Harappan miniatures, culture, history and Harapan writing

"Number"	Sign no	Occurrence
1	86	149
1a	97	91
1b	98	88
2	87	365
2a	99	649
2b	100	29
2c	101	1
3	89	314
3a	102	16
3b	103	30
4	-	0
4a	104	70
4b	105	2
5	0	0
5a	106	38
5b	107	6
6	-	0
6a	108	3
6b	109	38
7	-	0
7a	110	6
7b	112	70
8	-	0
8a	114	7
9	-	0
9a	115	1
9b	116	2
10	-	0
10a	117	1

Mahadevan's Corpus



4002

4003

4004

4005

4006

4007

4008

4009

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U 11 火 11 11 11

U A III * 火 火 火 火 火 火 火 火 火 火

11 11 11 11 11 11

U 火 火 火 火 火 火 火 火 火 火

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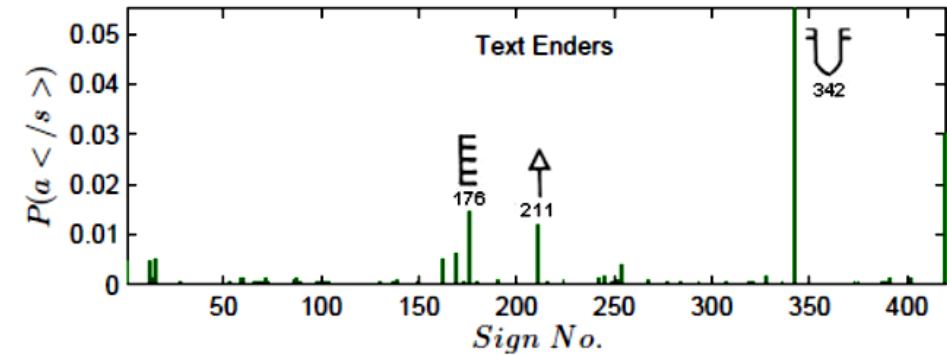
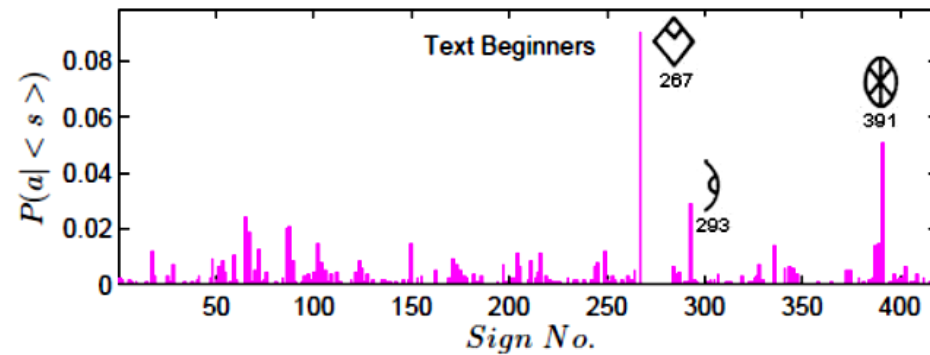
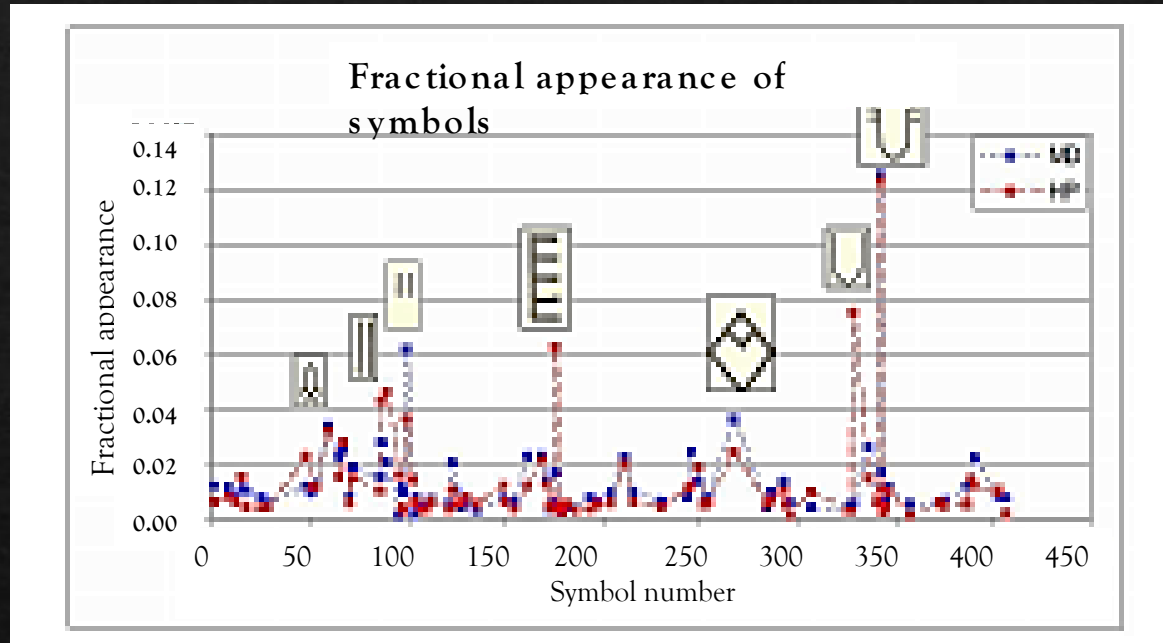
U A III III 11 11 11 11 11 11

U A III III 11 11 11 11 11 11

1 1 11 11 11 11 11 11 11 11

U 11 11 11 11 11 11 11 11 11 11

Variation by location



Development of the Corpus and Proposed Sign Lists





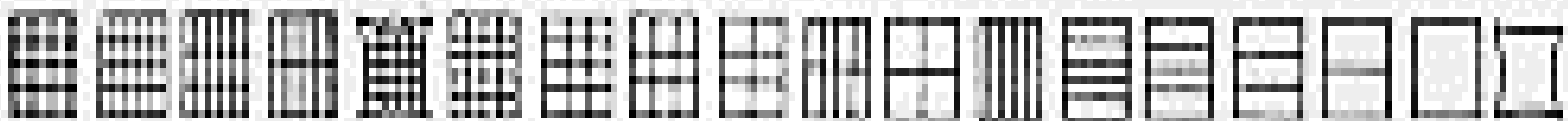
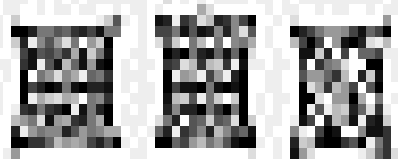
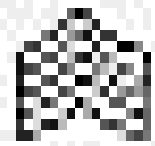
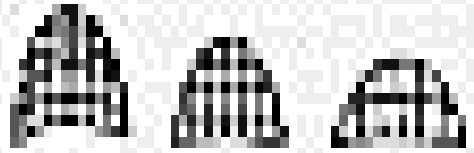



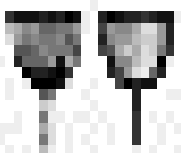






Institute of Geodesy and GeoInformation Science

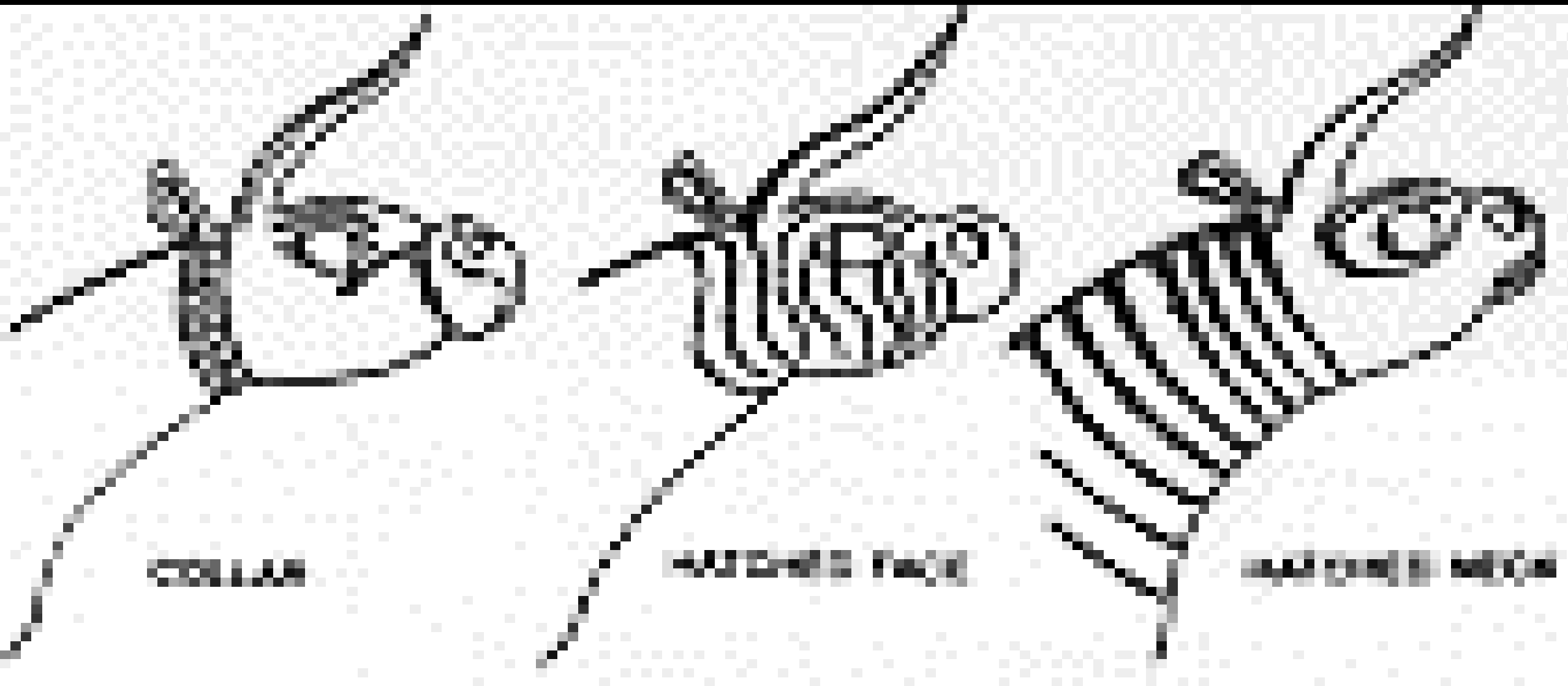


Publication or author	Year	Inscribed artefacts	Texts	Total number of signs	Sign list
Langdon	1931	750	-	-	288 signs
Hunter	1934	760	-	-	149 signs with 234 variants
Meriggi	1934	750	-	-	270
Mahadevan (IM77)	1977	2906	3573	13372	417+2 signs with 641 variants
Parpola (Pairs Concordance)	1973	3204	2942	14616	396 signs
Parpola	1982	3265	c. 3700	-	394 signs with 281 variants
Fairservis	1992	c. 4000	-	-	419 signs
Wells (ICIT)	1999	2153	2301	10004	610 signs with 828 variants
Wells (ICIT)	2011	3835	-	17423	676 signs
Wells (ICIT)	2015	3903	4794	17650	694 signs
Fuls (ICIT)	2020	4534	5506	19606 (17752 signs are legible)	704 signs

Writing and the animal motifs

Based on the work of M V Bhaskar, Chennai

I	a		b		c		d			
II	a									
	b		c		d		e			
III	a		b		c		d		e	
IV	a		b		c		d		Parpola	



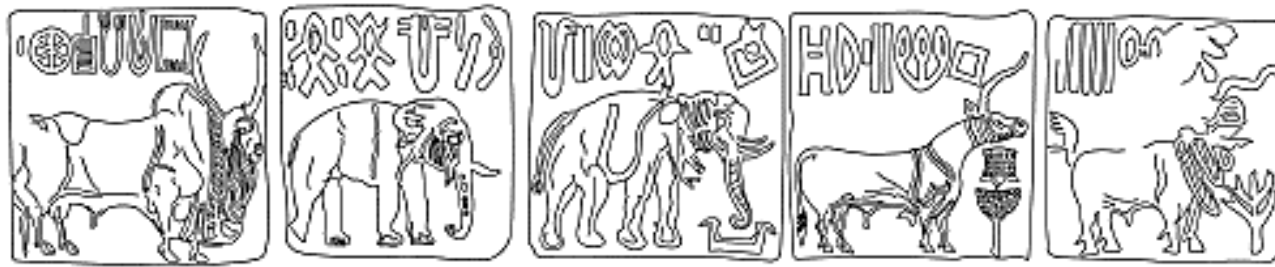
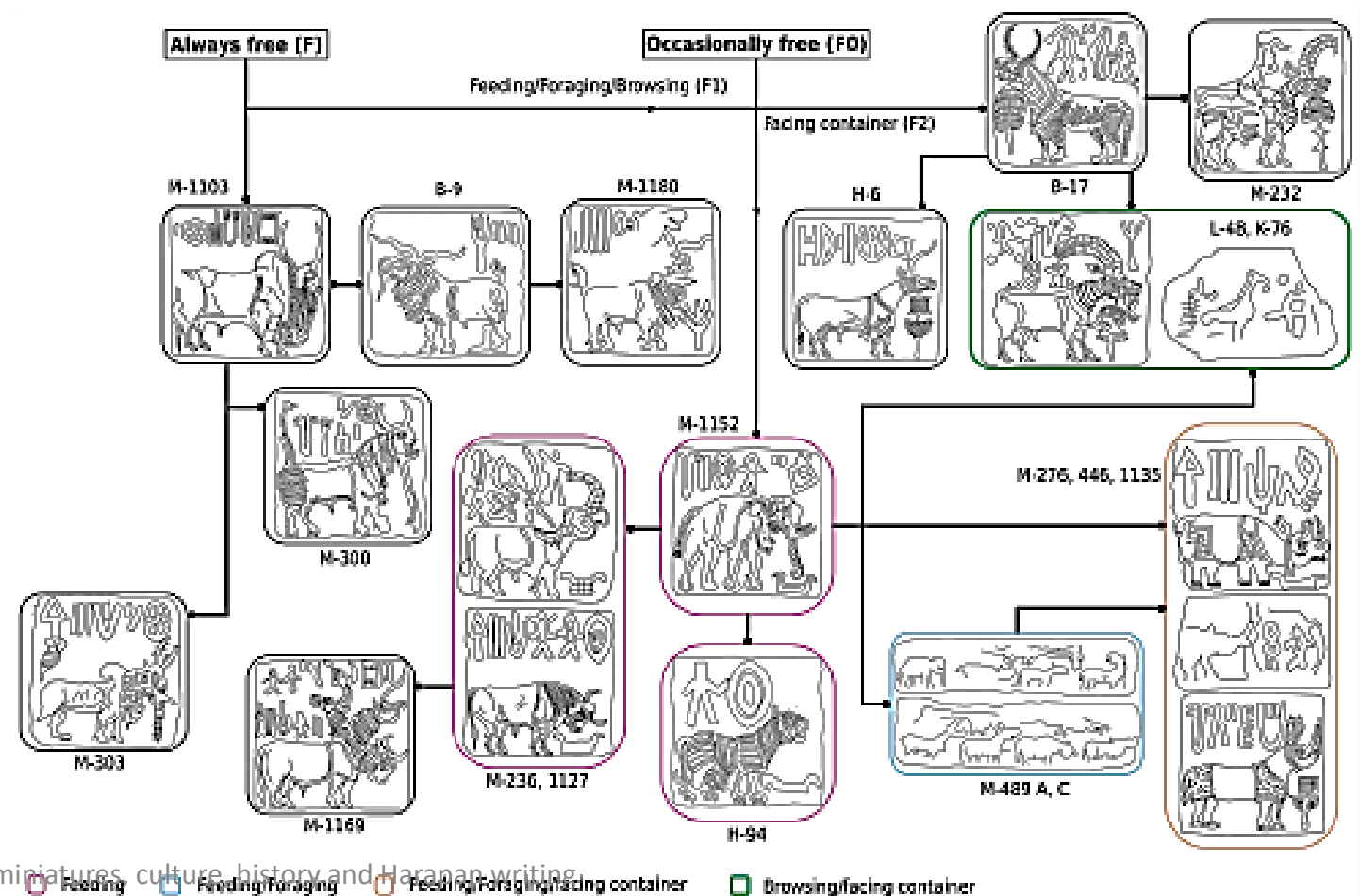


Fig. 1 From left: One example each of a Animals that always stand free (zebu, M-1103), b Animals that occasionally stand free (elephant, H-89), c Animals that face a manger (elephant, M-1152),

d Animals that face a container (unicorn, H-6), and e Animals that face an Indus sign (human-faced markhor, M-1180). Illustrations by Karthikeyan Pitchaimallian, after CISI. Not to scale



End of writing

- The **script disappeared** more or less suddenly around 1700 BC.
- This was related to the **end of the Civilisation** itself.
- Why and **how they disappeared** is itself a mystery:
 - it was certainly **not violence**.
 - And it was **not one site at a time**.
 - **Natural changes** are an obvious suggestion – but the jury is out on this.
 - **Economic collapse** is another possibility.
- There are some claims of scattered examples of a later period but these are **not consistent with the grammar of the script**.
 - Some bronze in Maharashtra.
 - Some artefacts in Tamil Nadu.
- **Why the Civilisation disappeared so abruptly** – losing all its cultural traits in the smallest period that we can discern from archaeology

Writing in the context of the evolution of culture

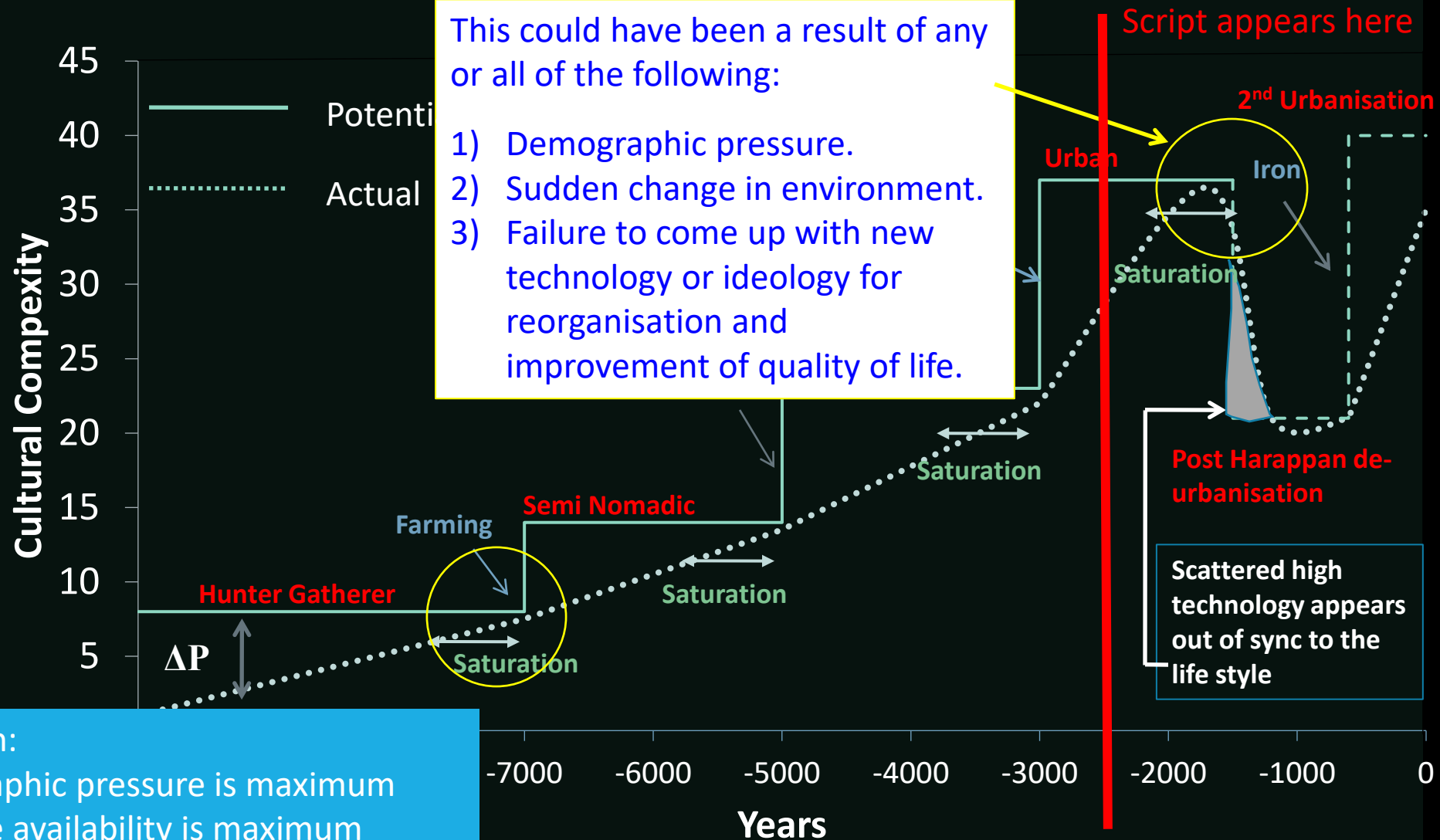
Dilemma of Indian pre-history

- IT IS THEREFORE CLEAR THAT WE HAVE A DILEMMA IN INDIAN PREHISTORY:
 - ALL HARAPPAN EVIDENCE IS ARCHAEOLOGICAL.
 - ALL VEDIC EVIDENCE IS LITERARY.
- They are difficult, if not impossible, to reconcile.

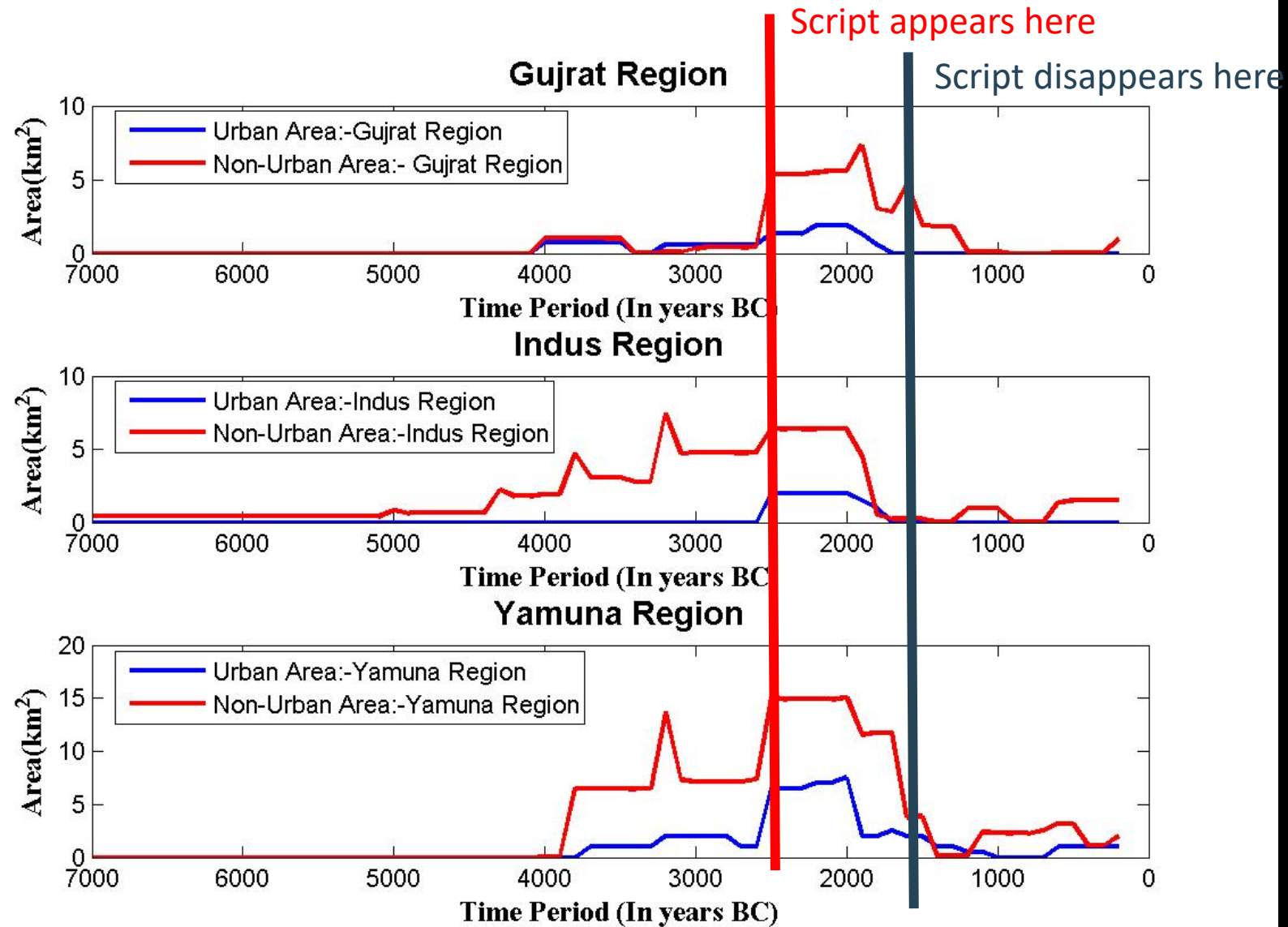
Where did the Harappans come from?

- **Harappan Civilisation is certainly local.** It has derived little from Mesopotamia or other cultures.
 - Its **architecture** is unique.
 - Its **technology** is unique
 - Several good and bad features of the Mesopotamian culture were not taken into the Harappan Culture.
- **Genetic and archaeological** data suggest that the Harappans had close contact with the **farmers of Iran** but then went on to urbanisation that outpaced anything else at that time.
- They were **not the people who wrote the Vedic literature:**
 - There is no **horse** in Harappa,
 - **no cities** in Rig Veda
 - RV people ate **barley** while Harappans ate **rice and wheat**.

Evolution of Harappan Civilisation



Area of Urbanisation $\geq 0.50 \text{ km}^2$



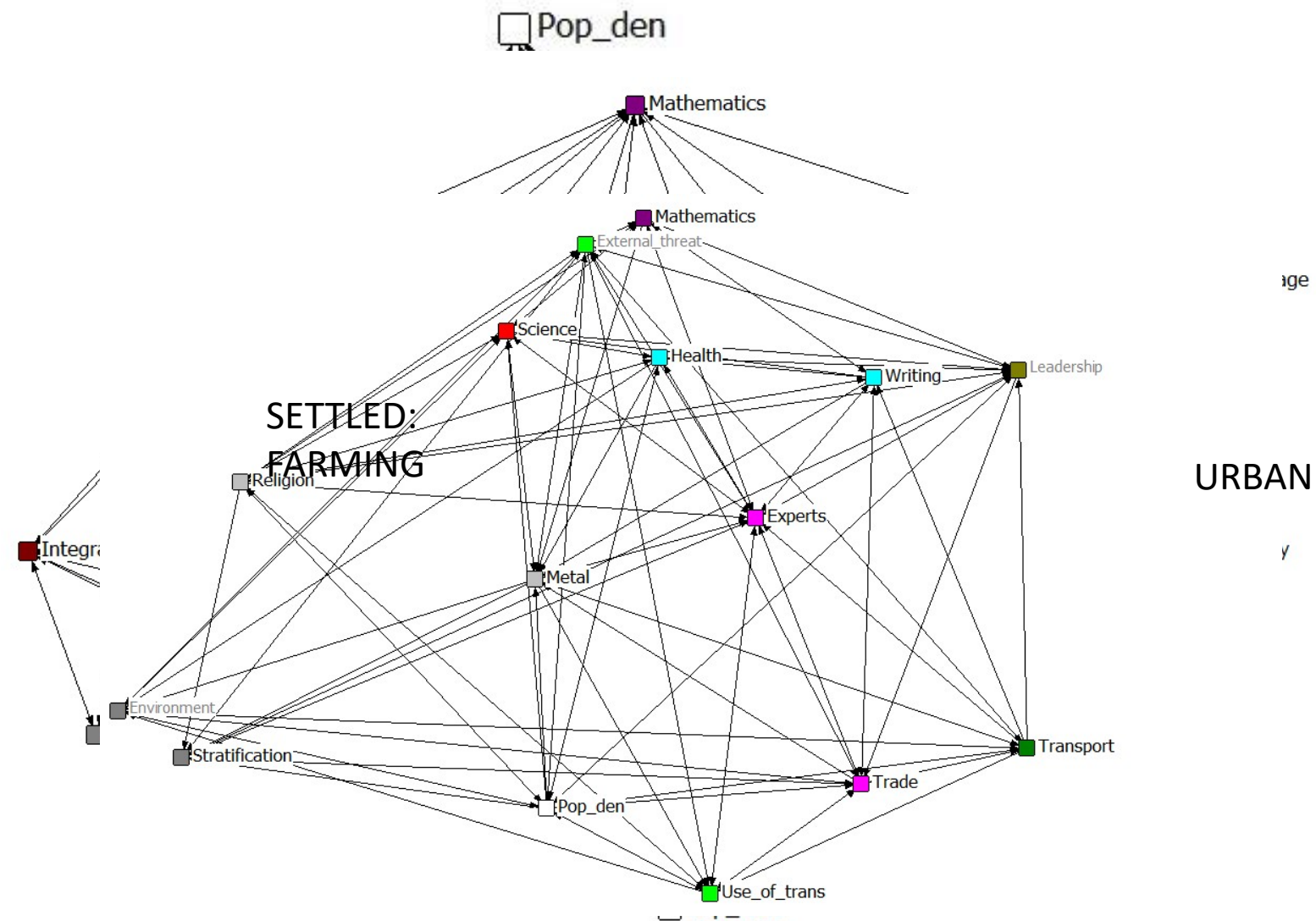
Graph courtesy Kavita Gangal

Harappan miniatures, culture, history and Harapan writing

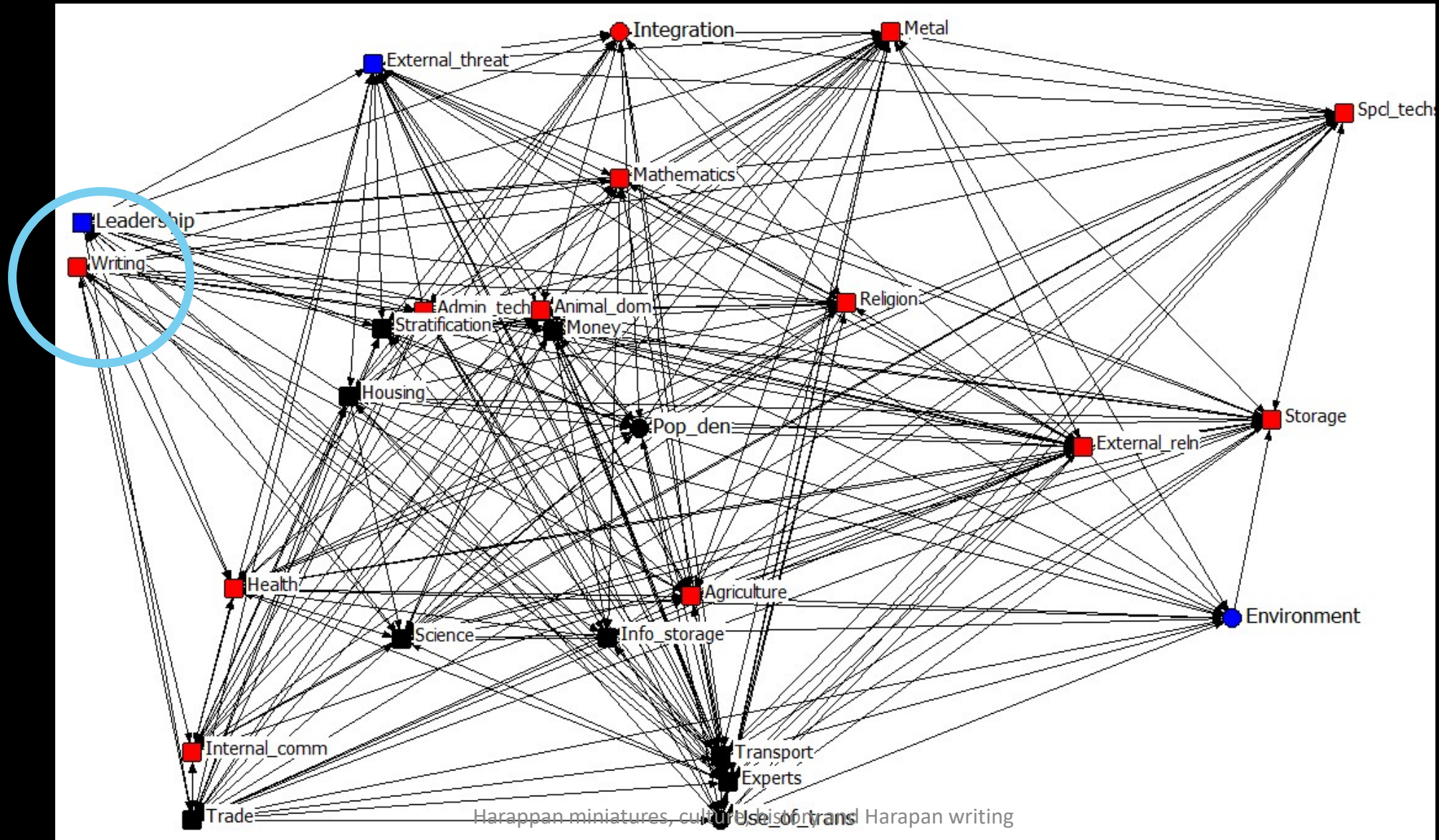
We define 26 specific cultural parameters and assign them values during 4 phases.

Sl. No.	Parameter	Nomad	Rural	Urban	Post Urban	Sl. No.	Parameter	Nomad	Rural	Urban	Post Urban
1	Environment	2	3	2	2	14	Admin_tech	0	2	3	1
2	Agriculture	1	2	3	1	15	Religion	0	1	3	2
3	Animal_dom	1	2	3	1	16	Exter_threat	1	3	2	3
4	Inter_comm	1	2	3	1	17	Trade	0	1	4	2
5	Writing	0	1	3	2	18	Transport	1	1	4	2
6	Info_storage	0	2	4	1	19	Use_of_trans	2	2	4	3
7	External_reln	0	2	3	1	20	Storage	1	2	3	1
8	Housing	1	2	4	1	21	Metal	1	2	3	4
9	Pop_den	2	3	4	2	22	Spcl_techs	1	2	3	1
10	Stratification	0	1	4	2	23	Mathematics	0	1	3	2
11	Integration	2	2	3	1	24	Science	1	2	4	2
12	Money	0	2	4	1	25	Health	1	2	3	2
13	Leadership	3	2	2	3	26	Experts	1	3	4	2

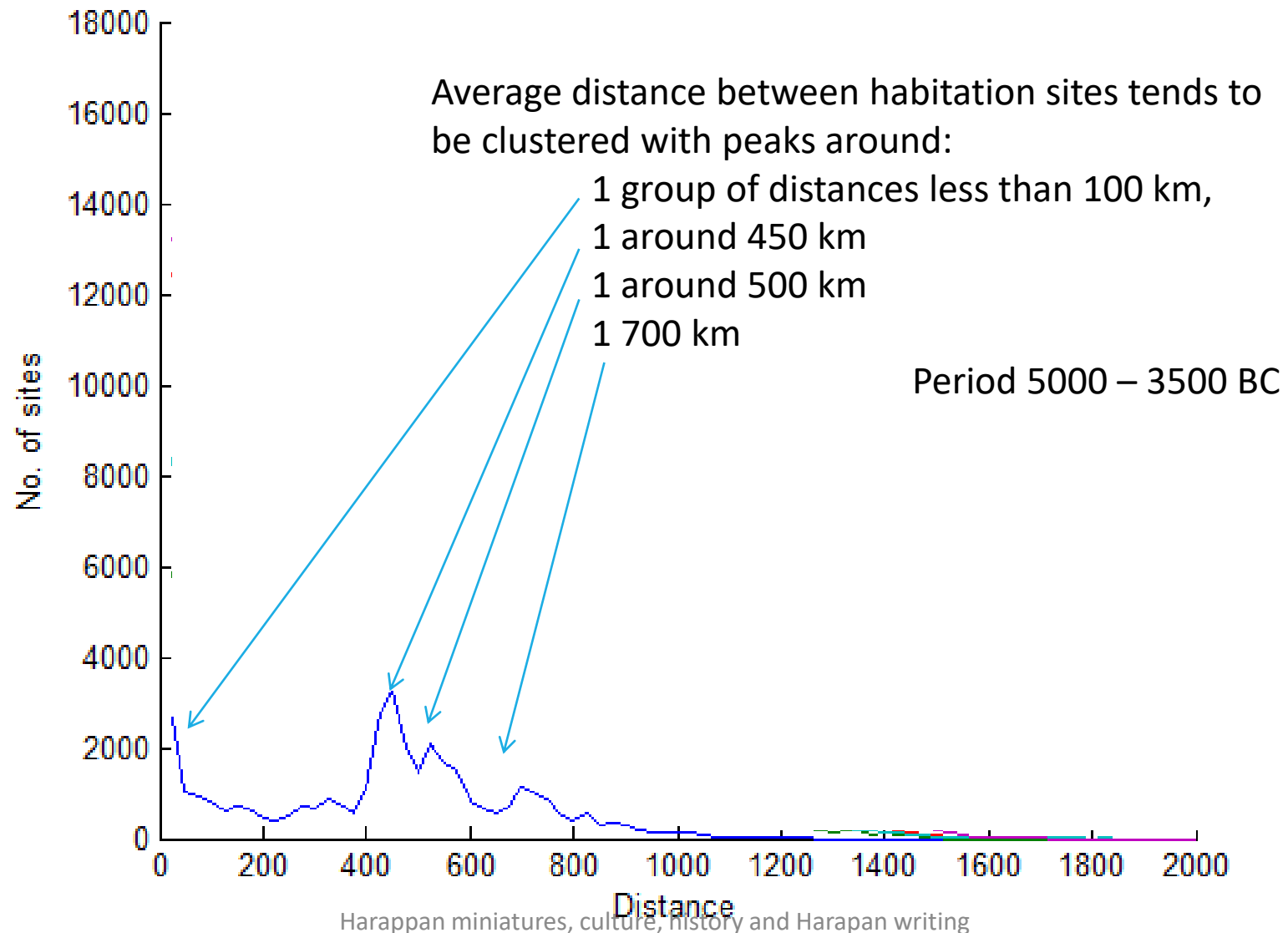
High frequency links and evolution of cultures



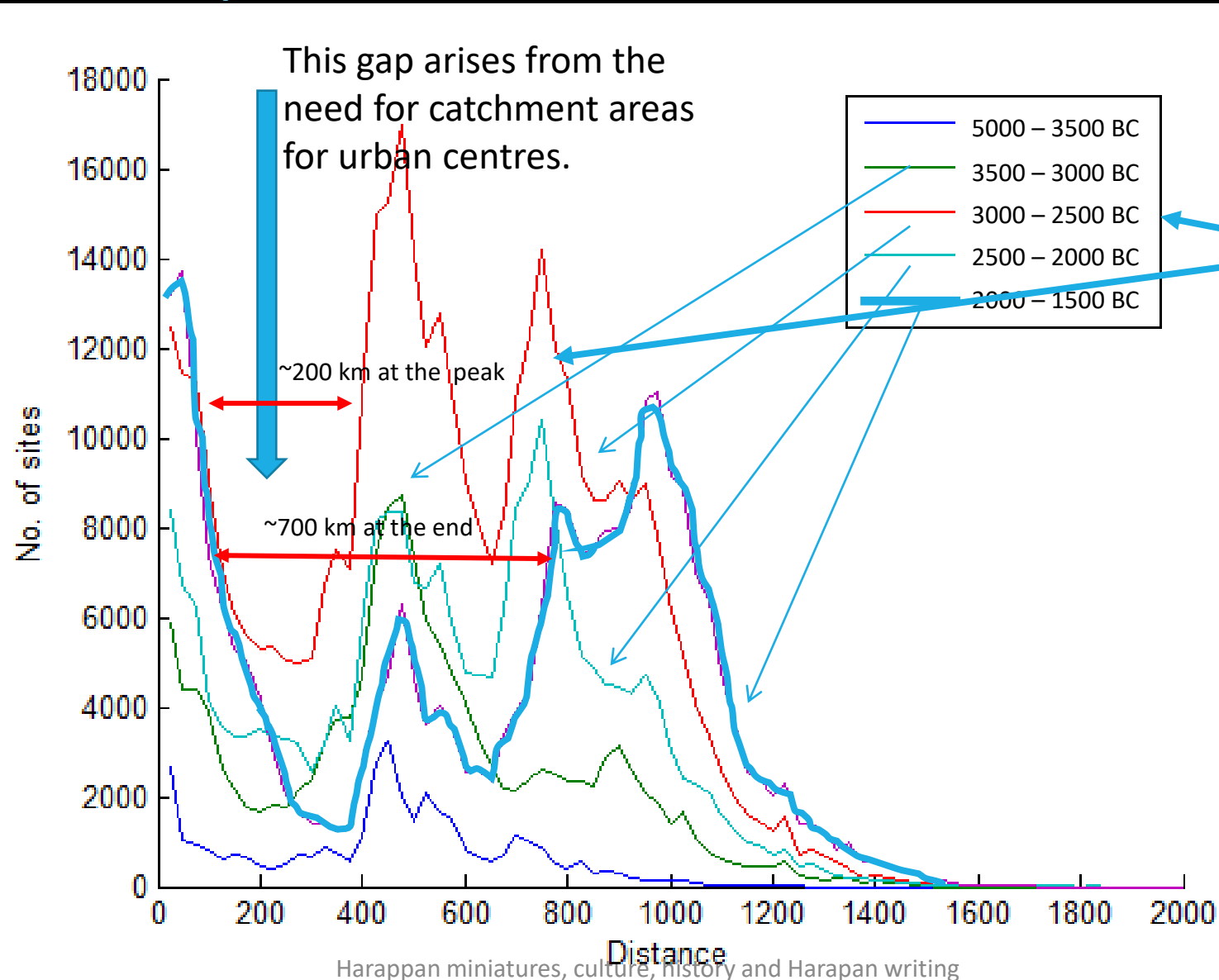
Urban phase all parameters

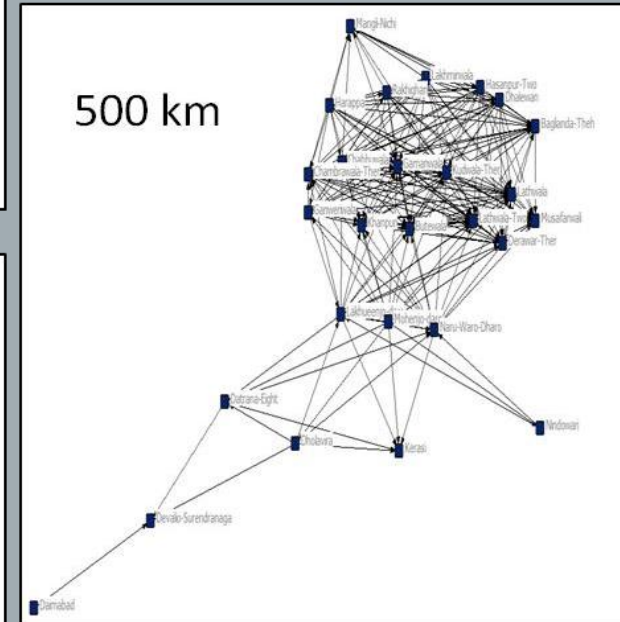
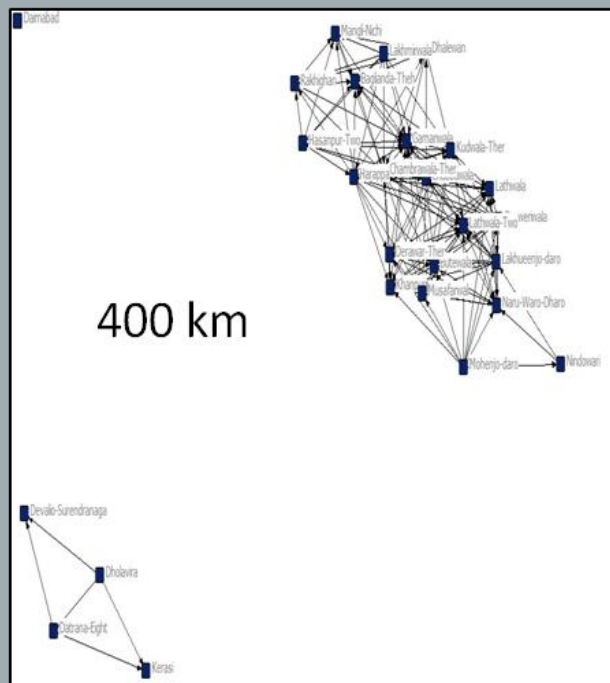
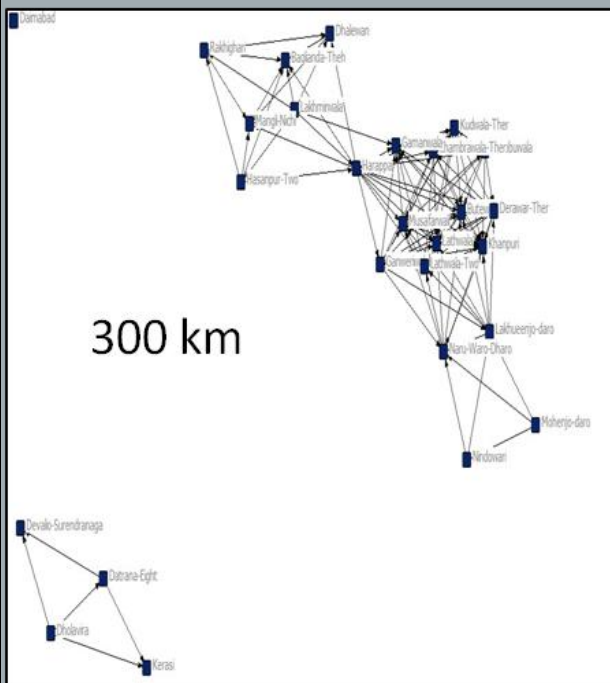
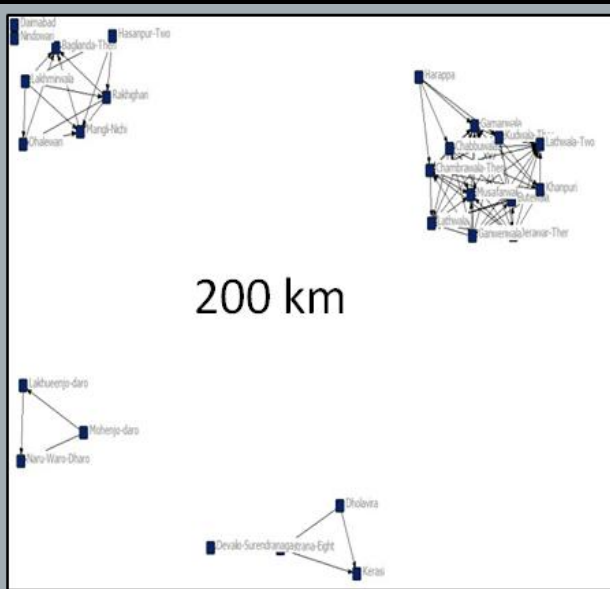
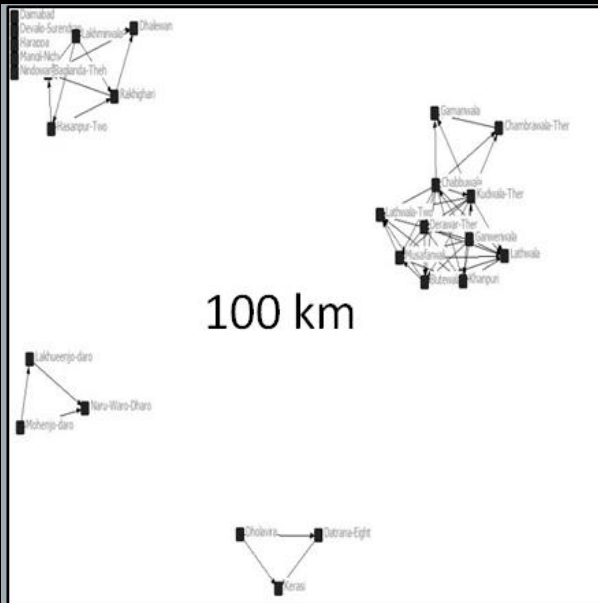


Spread of the Civilisation



Spread of the Civilisation





Middle East and Harappans

- the Middle East had been creating **intricately designed terracotta pieces** well before the Harappans
- However, there is **no evidence of writing there** – the only pieces with writing use Harappan Script.
- The writing there is on **large clay tablets**.
- They used **circular pieces** while Harappans almost exclusively preferred square or rectangular pieces.
- There are examples of **Seals** from West Asia with Harappan signs that have completely different grammar.
- Writing on seals is believed to have been transmitted from Harappa to West Asia (Laursen Arab. arch. epig. 2010: 21: 96–134 (2010))



What this tells

- It is clear that the Harappan Civilisation **developed in isolated groups** and isolated development of the residential clusters.
- But these were clearly in **close contact with each other**.
- Yet the writing and other cultural parameters are **highly standard** with only a small variation from region to region.
- This indicates a **high level of standardisation** that demands standardised administration.
- *This is not easy to achieve.* How they achieved this is a dilemma.

Problems with decipherment

The difficulties

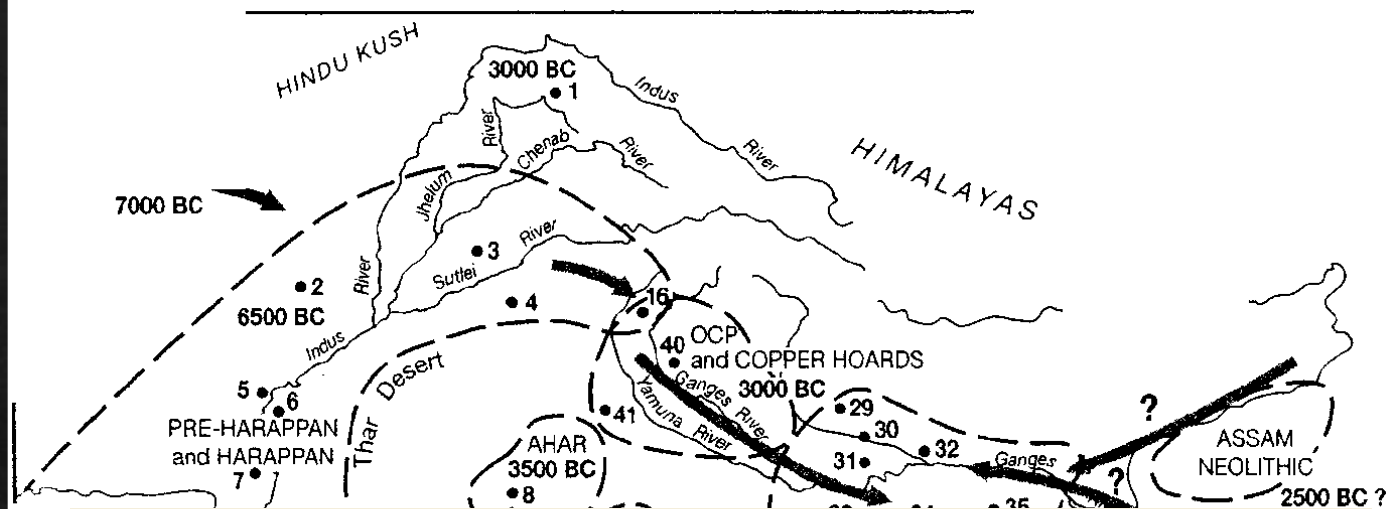
- The **problems** with decipherment are manifold
 1. Writing is **cryptic** – there are no longer text and surprisingly few cases of the same writing.
 2. We **don't even know** if it is **linguistic** and the underlying language if any, is unknown.
 3. But syntax has the same **flexibility** as language.
 4. The writing is *highly standardised*.
 5. **No bilingual text** has been found.
 6. We have **no literary data** (even from later memory) of the culture, its rulers etc.
 7. There is **no clear evidence of continuity** between the Harappan and later cultures.
 8. More than **100 attempts to assign 'instinctive'** meaning to some signs as a starting point have all ended up with an internal contradiction.

Harappan script is mathematically shown to be highly structured and similar to be at least a formal language, if not a natural language!

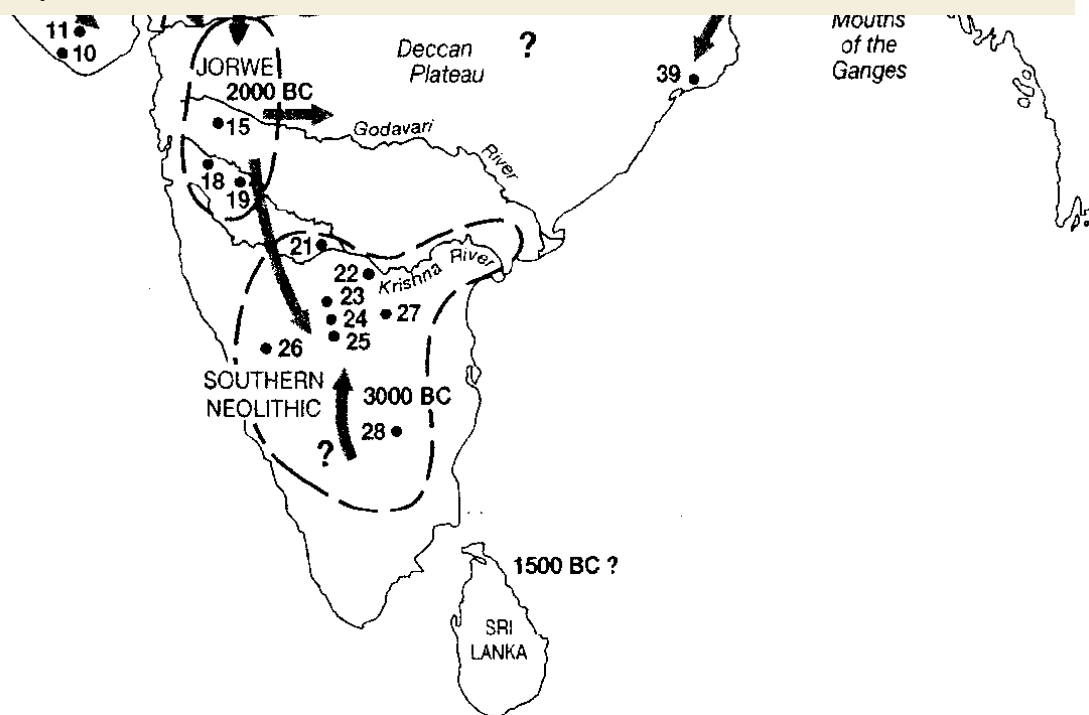
We know how to write in Harappan script, even if we do not know how to read it!

Disappearance of writing

- ◆ **Appearance and disappearance** of the Harappan writing are both of great importance.
- ◆ **Appearance** indicates the rise of civilisation – large-scale organisation and specialisation.
- ◆ **Disappearance** can have multiple reasons:
 - ◆ The writing was restricted to **trained elites** and the system of training broke down.
 - ◆ The need for writing was **no longer needed** as Civilisation disintegrated.
 - ◆ It was replaced by a **simpler form of writing**.
- ◆ However, the disappearance of the Harappan script is apparently **sudden** but the decay of the cultures is gradual and not violent.
- ◆ Understanding **the reasons for the disappearance** is also important but currently, we only have some guesses.



While there is evidence of early movements, serious movement
Happens only after iron is discovered around 1500 BC



1. Burzahom
2. Mehrgarh
3. Harappa
4. Kalibangan
5. Mohenjo Daro
6. Kot Diji
7. Amri
8. Balathal /Ahar
9. Dholavira
10. Rojdi
11. Rangpur
12. Surkotada
13. Prabhas Patan
14. Lothal
15. Oaimabad
16. Alamgirpur
17. Kayatha
18. Inamgaon
19. Songaon
20. Navdatoli
21. Budihal/Watgal

22. Utnur
23. Maski
24. Sanganakallu
25. Brahmagiri
26. Hallur
27. Ramapuram
28. Paiyampalli
29. Narhan
30. Imlidih Khurd
31. Khairadih
22. Chirand
23. Koldihwa J Chopani
24. Mando J Mahagara
25. Taradih
26. Senuwar
27. Kunjhun
28. Pandu Rajar Dhibi
29. Kuchai
30. Golbai-Sasan
31. Atranjikhhera
32. Jodhpura J
33. Ganeshwar

34. Taradih
35. Senuwar
36. Kunjhun
37. Pandu Rajar Dhibi
38. Kuchai
39. Golbai-Sasan
40. Atranjikhhera
41. Jodhpura J Ganeshwar

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ORIGINAL PAPER
Agricultural Origins and Frontiers in South Asia: A Working Synthesis
Dorian Q. Fuller

The story so far

- ◊ The writing was a highly coordinated activity suggesting **centralised teaching centres**.
- ◊ **Flexibility** in writing is similar to that of linguistic writing.
- ◊ Long distance **trade** would be one obvious purpose – this would explain the need for near linguistic writing that is understood by all – “Sending rice to Mohenjo Daro” – kind of sentences.
- ◊ This would explain the **need for near linguistic** flexibility.
- ◊ It is **unlikely** that the writing includes literary works.
- ◊ The relation between the motifs and the written material is unclear.
- ◊ The script was used for expressing **heterogeneous information** but using highly standardised grammar across both space and time.
- ◊ **The Harappan script had multiple uses and was used to convey fairly sophisticated ideas or information cryptically across vast regions through specialised writers.**

Larger issues

Understanding writing

- ◈ Writing involves **cognitive and physical processes** to translate information (or thoughts) into symbols for reference over space and time.
- ◈ It is **highly sensitive to the information** it wishes to convey. Why would Indian languages need a word for Snow?
- ◈ A system of **writing relies on many** of the same structures as the knowledge it represents, with the added dependency of a system of symbols.
- ◈ A written language may take on **characteristics distinctive** from the spoken language.
- ◈ Writing is a series of **physically inscribed symbols**. The interpreter or activator of a text is critical to this coding.
- ◈ **Writing systems do not themselves constitute languages**; but a convention that is meant to inform other humans separated by time and/or space. A commonly agreed convention is central to this.
- ◈ **WE NEED TO GET A BETTER HOLD ON THE WAY HARAPPANS WERE THINKING RATHER THAN BEHAVING. AND THIS IS EASIER SAID THAN DONE.**

Path to decipherment?

- ◆ Archaeologists have given us data to work on but not enough to decipher it easily.
- ◆ We now have some idea of its syntax.
- ◆ We need to understand the context of *sign modifications*.
- ◆ We need to understand the context of the signs with respect to other entities on written material.
- ◆ We, therefore, need Computational linguists to help us with this.
- ◆ However, it will have to be put in the context of other cultural aspects of the Harappan Civilisation.

Harappan Script and Harappan people

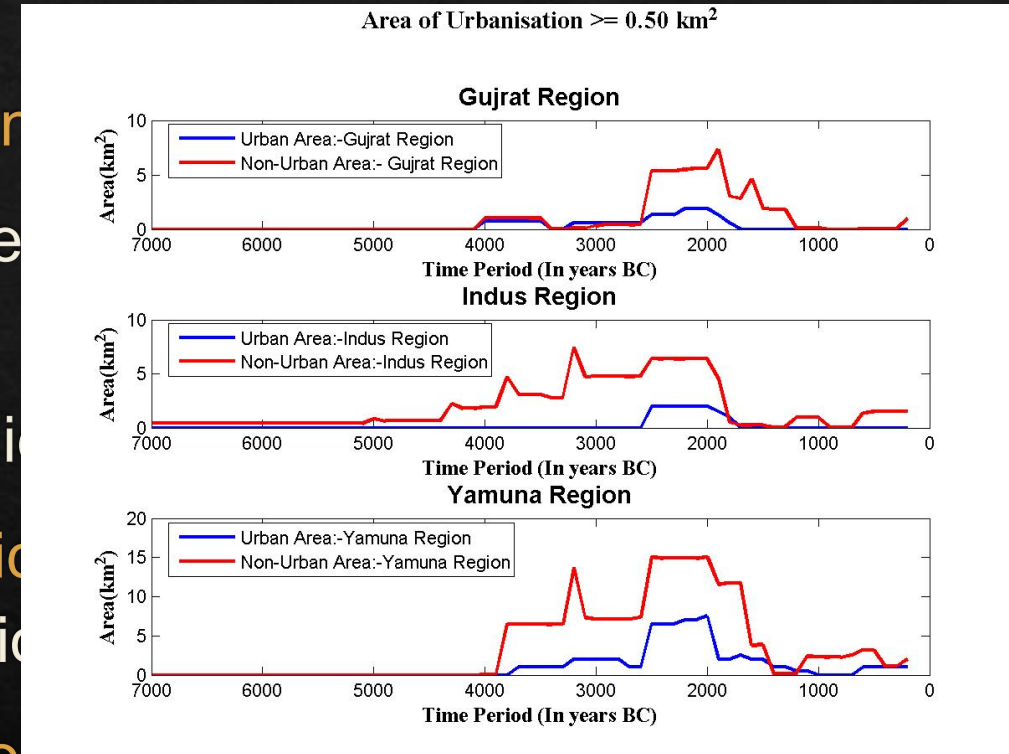
- ◆ The final answer to the Harappan writing may well depend on how we can understand the decline of the Harappan civilisation, and how and where its knowledge was distributed.
- ◆ There is some indication (from crude Harappan Bronzes in Maharashtra) and a possible axe with Harappan markings found in South India but the evidence is, at best, weak.
- ◆ There is also evidence of eastward migration to the Gangetic planes – but it did not carry any of the cultural traits.
- ◆ Genetic data which can help us determine the pattern of migration pre and post-urbanisation - is yet to come in.
- ◆ Within these limitations we can look at the possible scenarios of the decline of Harappan Civilisation.

The most likely scenario

- ◇ The possible reasons for the decline that are possible include:
 - ◇ Drought
 - ◇ Disease
 - ◇ Economic collapse due to failure of trade with West Asia
 - ◇ Collapse of the social structure due to leadership failure
 - ◇ Disintegration due to internal strife.
- ◇ So there seems to have been more dispersal of the population rather than a forced evacuation.
- ◇ My personal feeling is that we need to do some unusual perspectives to understand the complexity of Harappan Script.
- ◇ We need to map out the origin and movement of seals based on their composition.
- ◇ We need to focus on the structure of the writing including sign designs and their relation to the images on the objects.

Reasons for the decline

- ◆ Harappan Civilisation was not destroyed by violence
- ◆ No evidence of a standing army, so the people seem to have been City States.
- ◆ There is no destruction of the cities through conflict
- ◆ There seems to have been a steep but systematic decline in urban centres rather than any panic or sudden evacuation
- ◆ We know that while villages are vulnerable to short-term changes but are adaptive to long-term changes, the cities can be quite resilient to short-term changes but face disaster against long-term changes.



Possible scenarios - 1

- ◇ Becoming a part of the **Vedic culture**. This has several difficulties.
 - ◇ **27 ribbed horse** is central to the Vedic literature while it is absent in the Harappan Civilisation
 - ◇ The Harappan Civilisation was **highly urbanised** and the economy was dependent on this equilibrium – there is no mention of such activity in the Vedic literature. Even Mahabharata represents a culture in transition from tribal dynamics to urbanisation.
 - ◇ There is **no clear indication of worship** in the Harappan Civilisation while Vedic religion revolves around worship through Havans.
 - ◇ **Harappans ate** a wide range of plants and animal products, including fish. Their diet was mainly based on wheat, barley, millet, cattle, sheep, and goats.
 - ◇ **Vedic diet** is far more limited.
 - ◇ The landscape described in the Vedic literature is more like that found in **Central Asia** rather than India.
 - ◇ Rain was central to Harappan Civilisation, Vedic literature finds very little place for **Rain God**.
 - ◇ By timeline, the Vedic cultures seem to have come to India just **after the decline** of the Harappan Civilisation and the former shows no clear evidence of the earlier culture.

Possible Scenarios - 2

- ◆ The other common suggestion is that the Harappans migrated to the South and the Dravidian cultures represent the residue of the Harappan Civilisation. This scenario also has problems:
 - ◆ The time difference between the decline of the Harappan Civilisation and the rise of the culture in the South is more than a thousand years.
 - ◆ Distance between the Dravidian region and the Harappan region is large. There is a large landmass of the Narmada plains where the Harappans could have settled. But it shows no evidence of residues of Harappan Culture.
 - ◆ There are only a few if any examples of replication of the Harappan technological excellence in the Dravidian Culture.

Some other clues

- ◆ One of the most interesting but not fully explored aspects of the Harappan Civilisation is its **connection to the older Mesopotamian and Sumerian Cultures** in the Euphrates and Tigris regions.
 - ◆ Many Harappans seem to have come from there through Bolan Pass.
 - ◆ This culture was much older and must have influenced the Harappans
 - ◆ We know that Harappans had close contact with them.
 - ◆ Stylistic seals were in existence there before Harappans started using them, but they tended to be circular or rolling seals.
 - ◆ Writing was originally invented there some 800 years before it was used in Harappa
 - ◆ There are about 30 seals found in West Asia that had writing in Harappan script but with a fundamentally different grammar.

So what is it?

◇ The interpretations have varied from:

1. **Dravidian** – I Mahadevan, A Parpola, B Wells and several others
2. **Labels** – tags, item or people identifiers, promissory notes or religious tokens
3. **Numeric** – B V Subbarayappa
4. **Random** – Farmer
5. **Sanskrit** – S Kalyanaraman

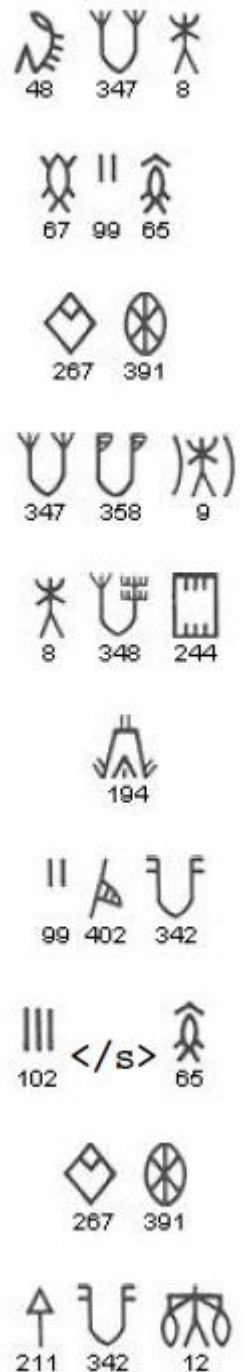
◇ **NONE OF THESE ARE CONSISTENT WITH THE SYNTACTIC ANALYSIS.**

Some paths to moving forward

- ◆ By now it is clear that
 - ◆ The writing is grammatically precise and versatile.
 - ◆ The signs seem to be a mix of individual and compounded signs.
 - ◆ It has the flexibility of linguistic writing
 - ◆ We know the grammar – we know the syntax but not the meaning.
- ◆ No current model comes even close to an answer to what they wrote.
- ◆ One way forward may be to look at synonyms.
- ◆ With computational linguistics, we have a clear idea of which signs are grammatical synonyms – signs that can replace other signs and still be grammatically acceptable.

The Synonyms path

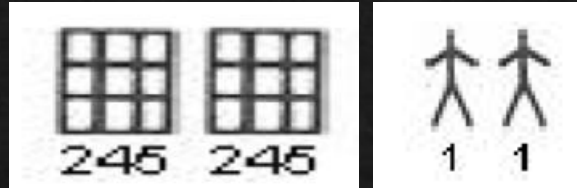
- ◇ **Synonyms** can be:
 - ◇ **Linguistic synonyms** (words with similar meanings).
 - ◇ **Grammatical synonyms** – words that mean completely different things – but are grammatically identical.
 - ◇ **Synonyms that look different** because they may refer to tense – past present future.
- ◇ For example:
 - ◇ I have food (to eat) or I have chocolate (to eat) – the difference is that the entity is different but in the context of eating.
 - ◇ I have clothes (to wear) I have no clothes (to wear!) – grammatical synonyms
 - ◇ I have food (to eat) and I had food – the difference in tense.
- ◇ Within this lies a pattern that can reveal some of the patterns in writing and GIVE MORE CONSTRAINTS ON FUTURE DECIPHERMENTS.
- ◇ It should also be noted that the writing was almost certainly not for a single purpose only.
- ◇ HOWEVER NO TWO SYNONYMS ARE IDENTICAL – it would be a waste of resources



Repeating and complex signs and signs with add ons

◆ Repeating signs

- ◆ In many cases we have seen that the same sign repeats locations within a text.



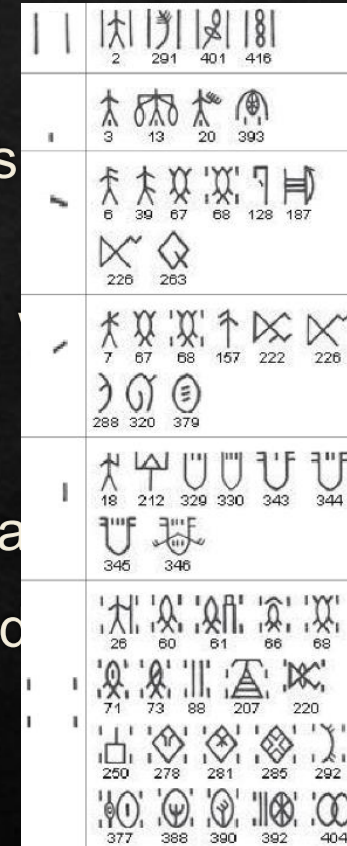
- ◆ Which are the signs that show these characteristics and

◆ Complex signs

- ◆ While some signs are roots, many signs seem to be an a or more other signs.
- ◆ This is not short-handing and the composites appear in o nments.
- ◆ These need to be isolated and studies

◆ Sign add-ons

- ◆ There are several elements that are clearly not signs but value additions to the signs.
- ◆ They also appear on a few signs and these need to be identified.



Welcome to a problem.

Thank you for listening.



The End!