The Contribution of Corpora and Concordances to the Field of Indus Script Research

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Contents

Indus Script

Concordances and their Role in Indus Script Analysis Current Research

Major Harappan Sites



Indus Valley Civilization – Stages of Development

Stage	Description	Period
One	Beginnings of village farming communities and pastoral camps	7000-4300 BCE
Two	Developed village farming communities and pastoral societies	4300-3200 BCE
Three	Early Harappan	3200-2600 BCE
Four	Early Harappan - Mature Harappan transition	2600-2500 BCE
Five	Mature Harappan	2500-1900 BCE
Six	Post-urban Harappan	1900-1000 BCE

Harappan Inscribed Objects



Incised Copper Tablet





Tablets

















Nature of the Indus Script

- Generally written from right to left
- Some examples of left-to-right and boustrophedon writing is also seen
- Most found on steatite seals (of about 2.5 x 2.5 cm), terracotta tablets, and seal impressions
- Also found on copper objects and pottery

Why is the Indus Script not Deciphered Yet?

- Absence of bi-lingual texts
- Relatively short texts (average text is about 4.5 signs long)
- Number of texts available is relatively few (~4000)
- Underlying language not known (with certainty)

Bilingual Texts that Helped other Scripts – Rosetta Stone



Egyptian Hieroglyphic, Demotic, and Ancient Greek inscriptions found at Rosetta/Rashid, Egypt, in 1798

Bilingual Texts that Helped other Scripts - Behistun Inscription



Akkadian, Elamite and Old Persian at Mount Behistun, Kermanshah, Iran

Indus Valley Civilization – Discovery

- "Great Game" George Masson's visit to Harappa in 1820s and publication of his accounts in 1842
- Alexander Burns visits Harappa
- Annexation of Punjab in 1848-49
- British rule of India and the formation of ASI
- John Marshall heading ASI (1902?-1928)
- RD Banerji and D.Sahni heading efforts in Mohenjodaro and Harappa, respectively
- Announcement in 1924

Discovery of the Indus Civilization

- John Marshall announced the discovery of the IVC in 1924. Field work by Rakhal Das Banerji in Mohenjodaro and Daya Ram Sahni in Harappa
- Assyriologists point to similarities with Sumerian and Elamite scripts



Sir John Marshall's announcement of the discovery: 1924



Marshall's Report

- John Marshall publishes
 Mohenjodaro and Indus
 Civilization (MIC) in 1931
- Publication contained "sign manual" by Gadd and Smith
- Also contained Langdon's hypothesis connecting the Indus Script to Brahmi



Mohenjodaro and the Indus Civilization

Gadd and Smith Sign Manual

- Published as part of Marshall's 1931 report
- First sign manual of the Indus Script
- Contained mix of unique signs and sign variants



Corpora and Concordances

- A corpus is a large or complete collection of data/ information on a subject; corpora its plural form
 - e.g. Entire corpus of Shakespeare's works
- In the context of Indus texts, a corpus typically contains texts from inscribed objects organized in a consistent way
- This becomes critical in case of objects with multiple sides, or multi-line objects



Concordances

 A concordance is an alphabetical index of the principal words of a book, such as the Holy Bible, with reference to the passage in which the word occurs

 Concordances are also created for texts in languages that are yet to be deciphered



Cruden's Concordance of the Holy Bible, first published 1737

Key Components of an Indus Corpus/ Concordance

- A clearly defined sign list
 - List of sign variants is a plus
- Rules for inclusion/exclusion of texts
- Rules for order of occurrence in a multi-side object
- Rules for presenting the texts
- Handling of other factors such as field symbols, duplicate texts, etc.

Hunter' Concordance

- Originally part of Hunter's doctoral dissertation at the University of Oxford in 1929. Published as a book in 1934
- Based on a sign list of 234 distinct signs, eliminating some of the sign variants from the Gadd and Smith sign list
- The corpus consisted of about 750 so inscribed objects from Mohenjodaro and Harappa grouped into 102 tables.
- Provided source reference (e.g. museum) for each object
- Provided line drawings of all inscribed objects
- Provided comparison between the Indus Signs and the signs of Sumerian and other scripts
- However, limited by the number of objects (750+) included

Hunter' Concordance – Table Structure

TABLE XIII

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A table from Hunter's book

Sign Grouping by Hunter (1932)

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Hunter' Concordance – Key Contributions

- Hunter's concordance was the first to:
 - Analyze the signs individually, and identify variants
 - Study the structure and formation of Indus signs and analyze how compounding of signs occur
 - Formally tabulate the texts by reference sign so that the text can be aligned and presented.
 - Provide statistical analysis in establishing the direction of writing
 - Study the possible grammatical and textual meaning of signs and sign combinations
 - Develop rules of segmentation of texts
 - Perform contextual analysis Indus text; and
 - Perform comparative linguistic analysis between Indus script and Sumerian, Egyptian, Semitic and Sanskrit scripts

Computer-aided Analysis of the Indus Script

- 1960's saw the deployment of computers in the analysis of the Indus Script
- Soviets and the Finns spearheaded the Indus script analysis using computers
- Very little is known about the Soviet analysis (i.e. tools used, corpus details, etc.), but the Soviets concluded that the structure of the Indus script is closest to the Dravidian language
- The Finnish team announced 1969 the decipherment of the Indus script. This turned out to be rather premature

Mahadevan's Work on Concordance

- Broke into the Indus Script Analysis scene in 1970 with a paper drawing attention to the parallels between Dravidian languages and the Indus Script
- Created a photographic card catalogue to aid his research effort
- Created an early version of his computer-aided corpus/concordance in 1971
- Second version of the concordance created in TIFR in 1972/73
- Improved version of this concordance was published in 1977
- Not updated since 1977

Mahadevan Corpus and Concordance -Highlights

- Standardized sign list of 419 (only 417 were used in the corpus, concordance and analyses) unique signs and all possible sign variants
- Contained 2,906 inscribed objects from 26 sites
- Corpus and concordance presented separately
- Extensive textual and statistical analyses, with summary data presented in multiple tables

Mahadevan Sign & Sign Variants List

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Mahadevan Corpus and Concordance

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Mahadevan's Corpus

Mahadevan's Concordance

Mahadevan Corpus & Concordance – Key Contributions

- First published comprehensive corpus and concordance with analytical tables
- Thorough research work that went into its preparation
- Easy availability and accessibility of the corpus / concordance
- Centralized ownership/source for information, and institutionalization of data
- Has spawned several research papers. It still remains very much in use even after more than 45 years after its publication
- Extensive textual and contextual analyses.
- Recent initiative by Roja Muthiah Research Library to provide web-based access to IM77 data



Parpola's Corpora/Concordances

- With Seppo Koskenniemi and Simo Parpola created a "Pairs" concordance in 1973; not in use anymore
- With Kimmo Koskenniemi created a sign list (394 signs), corpus and concordance in 1979-82; not updated since

Parpola's Corpora/Concordances (contd.)

- Created 3-Volume CISI the most comprehensive photographic corpus of Indus inscribed objects to-date
 - Vol I with JP Joshi, 1985 (objects in India)
 - Vol 2 with SGM Shah in 1991 (objects in Pakistan)
 - Vol 3.1 with P Koskikallio and RH Meadow in 2010 (objects from HARP and other objects not included in vols. 1 and 2)
 - Vol 3.2 with several collaborators in 2019. Covers Shahr-i Sokhta;
 Mundigak; Mehrgarh, Nausharo, Sibri, Dauda-damb; Chanhudaro; Ahar,
 Balathal, Gilund; Kalibangan, etc.
 - Vol 3.3 with Petteri Koskikallio in 2022. Indo-Iranian Borderlands

Parpola's Corpora/Concordances (contd.) - CISI

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Corpus of Indus Seals and Inscriptions

1. Collections in India



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Corpus of Indus Seals and Inscriptions

3.2. Shahr-i Sokhta; Mundigak; Mehrgarh, Nausharo, Sibri, Dauda-damb; Chanhu-daro; Ahar, Balathal, Gihand; Kalibangan; Rojdi



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Parpola's Pairs Concordance

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Parpola's Pairs Concordance -Sign List

Parpola's Pairs Concordance Layout

Parpola's 1979-82 Concordance

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Parpola's Sign List

Parpola's 1979-82 Concordance

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Parpola's CISI Volumes



Parpola's CISI Vol 1

Parpola's CISI Vol 3.1

Parpola Corpora & Concordances – Key Contributions

- One of the early pioneers of the use of computers in the analysis of the Indus script
- The corpus/concordance of 1979-82 was comprehensive, but not widely published
- The photographic corpora (CISI volumes) have made significant contribution
- Parpola's own analysis of the Indus script
 - Textual analysis, especially the Grid Analysis and Pattern Analysis



Wells Corpus

- Initial work in the form of his master's thesis on the Indus Script
- Created his corpus/concordance as part of PhD dissertation
- Included an expanded sign list and a more elaborate classification of objects (e.g. 10 different classifications for seals)
- Corpus includes Harappa Archaeological Research Project (HARP) data and other newly available data
- Currently available in web-enabled form
- Many dynamic analysis features
- Tabular display of data does not follow the "concordance" format

Wells Sign List

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 Significantly more signs (676) than Mahadevan or Parpola. Reduplicated signs, mirror images and sign variants treated as separate signs
Wells Corpus – Web-enabled

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- Many dynamic analysis features
- Data presentation not anchored on the key/reference sign

Wells Corpus – Key Contributions

- The most comprehensive Indus script corpus available currently
- Web-enabled and freely available access to scholars
- The first corpus to be created primarily from photographic images of the objects, rather than directly from the objects themselves
- Providing a different approach to handling signs and sign variants, even though has resulted in a large sign list
- Providing analysis of the Indus signs (particularly sign clusters)
- Providing structural, textual and contextual analysis of the Indus script
- Providing hands-on analysis tools
- On-going addition of new features to the on-line corpus
- Needs to be institutionalized

Conclusions

Comparison of the Four Corpora/Concordances

1 Number of Objects7502906Approx. 30003	3835	
2 Unit of Analysis - Entire object, Side Line Side S	Side	
each line, etc.		
3 Reference Number Exc. Number IM Number Parpola Number 0	Own internal number;	
	uses CISI Number where	
	available	
4 Direction of Writing (General) Right to Left Right to Left Right to Left F	Right to Left	
5 Sign List Yes, but not published Yes Yes Yes	Yes	
as a separate list		
Number of Signs 232 419* 394	676†	
Grouping of Signs Not in the original Yes Yes	yes	
work, but in his 1932		
paper.		
6 Sign Variance List		
List of variants Not in the original Yes Yes, but identified in	No	
work, but in a later, the sign list itself		
1932 paper.		
7 Sign Structure Analysis Yes No Yes	Yes	
8 Textual Analysis		
Frequency Analysis Rudimentary Yes Yes	Yes	
Positional Analysis Some No Yes	Yes	
9 Field Symbols		
Classification No Yes No	Yes	
Frequency Analysis No Yes No	Yes	

Comparison of the Four Corpora/Concordances (contd.)

	Criteria	Hunter (1934)	Mahadevan(1977)	Parpola(1979-82)	Wells(2006)	
10	Contextual Analysis	Yes	Yes	No	Yes	
	Site information	Yes	Yes	No	Yes	
	Locus	No	Yes, but partial	No	Yes, but partial	
	Stratigraphy	No	Yes, but partial	No	Yes, but partial	
11	Linguistic Analysis	Yes	Yes	Yes	Yes	
	Linking Indus to another known language	Yes	Yes	Yes	Yes	
	Interpretation of Indus Texts using a known language	No	Yes	Yes	Yes	
12	Nature of Language	Phonetic	Logo-Syllabic	Logo-Syllabic	Logo-Syllabic	
13	Review by other scholars	Some	Many	Some	Very Few	
14	Assumptions about the Harappan language	Yes. Considers it pre- Aryan, possibly Dravidian. Munda is also a possibility	Proto-Dravidian	Proto-Dravidian	Initially Proto-Dravidian, now leans towards Munda or Language X	
15	Function of inscribed objects	Discussed	Discussed	Discussed	Discussed	
16	Availability	Easily Available	Easily Available	Not easily Available	Easily Available	
17	Ease of Use	Not Easy to use, in paper form	Easy to use, but in paper form. Restricted availability of data in electronic form	Easy to use, but in paper form	Easy to use, electronic form	
18	Use of Corpus/Concordance by others	None	By Many	By a Few	By Many	

Contribution of Corpora and Concordances to the Indus Script Research

- Provided a comprehensive repository of Indus inscribed objects and a way of organizing them through standard sign and sign variant lists
- Performed statistical analyses of the data and made them available to scholars. This set the stage for further research
- Performed textual and contextual analyses of the Indus script
- Thus contributed significantly to the understanding of the Indus script
- Have also identified the potential areas for future studies that will lead to further understanding and potential decipherment of the Indus script. 42

Possible Focus Areas of Future Research

- Contextual Analysis
 - Object type (e.g. seals, terracotta tokens, etc.)
 - Geographical variation
 - Stratigraphy
- Multi-disciplinary Research
- More textual analysis and interpretation of texts
- Development of additional analytical tools

Way Forward

- Issues Facing Indus Script Research
 - Lack of new talent to continue with research work
 - Availability of up-to-date corpus/concordance of Indus texts
 - Accessibility to original artifacts limited due to theft, deterioration and geographical factors
- 3-D rendering of objects will help compensate for lack of physical access
- Need to create a comprehensive, institutionalized, easy to access corpus of Indus Texts
- Cuneiform Digital Library Initiative (CDLI) is worthwhile emulating

Way Forward (contd.)





Selected Pages from Cuneiform Digital Library Initiative (CDLI) Website

Current Research

Current Areas of Research

- Ongoing excavation work at Gaggar-Hakra river bed.
- aDNA based research on the Indus people
- Computational Linguistics techniques for Indus script research

Thank You

Urbanization



Major Urban Centres Mohenjo-daro





Area ca. 225 ha or 2.25 sq.km

Major Urban Centres Harappa



Area ca. 100 ha or 1.0 sq.km

Major Urban Centres Dholavira



Area ca. 100 ha or 1.0 sq.km

Urban Planning: Modern – Neyveli, Tamil Nadu



Urban Planning: Citadel Mound – Mohenjodaro



Aerial View



Urban Planning



- Properly designed drainage system
- Separation of fresh water (e.g. well) from drainage water
- Lined, covered drainage Canals
- Bath/shower areas in many houses

Planned Cities – Mohenjodaro Plan











- Private and public wells
- Mostly circular, with some oval shaped
- Many lined with wedge shaped bricks



Drainage



Drainage - Lothal

Drainage - Harappa

- Harappans cities had covered drainage channels
- The drains were built in such a way that sewerage water was directed away from fresh water sources
- Many houses also had bathing areas and sump pits



Architecture

- Based primarily on fired bricks, which were standardized across IVC during the Mature Harappan phase
- Use of unburnt bricks also found in earlier and later phases. Mud bricks, along with certain locally available stone (e.g., Dholavira) use in some cases, or for specific uses (fortification)





Architecture



Architecture: Mohenjo daro's Great Bath



Architecture: Mohenjo daro's Great Bath



Dholavira – Schematic Plan



Architecture: Dholavira









Harappan Art – Kot Diji Phase



Terracotta Bangles





Gold sequins



Kiln



Terracotta Figurines



Water buffalo figurine



Zebu figurines



Ox/buffalo drawn cart













Harappans wore jewellery made from gold and semi-precious stones. Using pyrotechnical Expertise, Harappans were able to create semi-precious stones that they were able to export.





Many crafts "such as shell working, ceramics, and agate and glazed steatite bead making" were used in the making of necklaces, bangles, and other ornaments from all phases of Harappan sites and some of these crafts are still practiced in the subcontinent today.













The famous "dancing girl" bronze figurine of Mohenjo daro cast using "lost wax" process Woman striking a similar Pose on a potsherd engraving

A number of gold, terra-cotta and stone figurines of girls in dancing poses reveal the presence of some dance form.












Harappan Art – Late Harappan Phase



Even during the late Harappan period (e.g. Cemetery H culture) pottery with exquisite paintings were made. However, the Indus script is notably absent from the pottery of this period.

Economy and Commerce

Judging from the dispersal of Indus civilisation artifacts, the trade networks, economically, integrated a huge area, including portions of Afghanistan, the coastal regions of Persia, northern and western India, and Mesopotamia.

There was an extensive maritime trade network operating between the Harappan and Mesopotamian civilizations as early as the middle Harappan Phase



Economy and Commerce







Much commerce being handled by "middlemen merchants from Dilmun" (modern Bahrain and Failaka located in the Persian Gulf).

The land "Meluhha" found in Sumerian literature is widely believed to be the Harappan cities.

Decline and Fall



- A possible reason for the IVC's decline is connected with climate change that also affected the neighboring areas of the Middle East (e.g. 4.2 KYBP event).
- Another reason could disappearance of substantial portions of the Ghaggar Hakra river system, possibly due to a tectonic event / or decreased rainfall
- Implosion of the Harappan society due to social upheaval
- Arrival of a different linguistic group with access to superior technology