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NOTE

This paper was presented at the Three-day international conference organised by the Government of Tamil Nadu to commemorate the end of the centenary year of the announcement of the discovery of the Indus Valley Civilization.

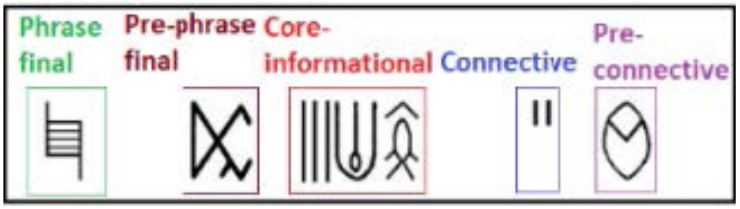
CONTENTS

Indus script's gemstone and precious shiny commodity related fish-signs, and Indus gemstone-word "maṇi": Ancestral Dravidian symbolism in Indus logograms and language(s)?

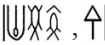
Ms. Bahata Ansumali Mukhopadhyay

Abstract

From archaeogenetic, linguistic, archaeological, and ethnographic evidences, several scholars have linked the people of ancient Indus valley civilization (IVC) with the ancestors of Dravidian speakers. This article argues that the semasiographically/logographically written Indus script (ISC) used certain fish-like logograms, whose iconicity emerged from certain Indus symbolisms, which are linkable with certain linguistic symbolisms found across today's Dravidian languages. As discussed in the author's previous articles, ISC was a mercantile script, and different segments of the formulaic ISC inscriptions were usually populated by signs belonging to specific semantic classes. The core-informational segment, which occur preceding the phrase-final and pre-phrase-final signs (in figure below), arguably encoded names of taxed commodities and licensed crafts.



This article claims that the fish-like ISC signs,

which mainly occur in the 'core-informational' segments, often accompanying the gold/precious-metal/goldsmithing related sign  (e.g.  ,) possibly encoded meanings associated with glittering gemstones. Other Indus commodities, such as faience, glazed steatite, or highly polished metallic artifact-types like copper mirrors, whose important features were their shiny bright appearances,

might have also been signified by specific fish-signs. Certain fish-signs might have contextually signified the crafts, taxes, licenses, standard metrological units, and barter equivalencies related to such shiny precious commodities. Interestingly, in various Indus settlements, mercantile seals/tablets containing fish-sign-inscriptions are found in significant concentration in the archaeological contexts of lapidary workshops and jeweler's shops, indicating that fish-signs possibly signified meanings related to gemstones, jewelry, and shiny metals. Revealingly, the polysemic Proto-Dravidian fish-word "mīn", which is used across Dravidian and other language groups in contemporary India, is etymologically connected to the Proto-Dravidian root-verb "*mīn", which signifies "to shine," "to glitter," "to polish", etc. Thus, in Dravidian languages, various "*min"-based words are used to signify shining/glittering/polished objects such as 'gems', 'bright coins', 'stars', 'fireflies', 'lightning', etc. In the whole Indian subcontinent, this fish-based homonymy and linguistic symbolism for glittering/polished objects are found only in the Dravidian language-group. This indicates that if Indus fish-signs signified glittering gemstones and polished metallic objects, then that symbolism possibly emerged from the ancestral Dravidian culture prevalent in IVC. Now, what was the Indus word for gemstone-beads? In Mesopotamia, the eye-patterned apotropaic gemstone-beads imported from IVC were called "fish-eye" stones ("NA4-IGI- ḪA", "NA4-IGI-KU6"), and "eye-stones" of Meluhha ("NA4-IGI-ME-LUḪ-ḪA"), indicating that the ancient Indus word for gemstone-beads possibly had an eye-related etymology. Intriguingly, "maṇi", the gemstone-bead word used across contemporary India, has been signifying meanings like "amulet" (see Atharvaveda), "bead", "apple of eye", and "gemstone" in Indian languages. Each of these meanings can be linked to the amuletic, eye-patterned gemstone beads of Meluhah. Moreover, the word "mani" has signified gemstone-beads in ancient documents of Near East, indicating its antiquity. Linguists argue that the Akkadian documents borrowed this "mani" word from ancient India. This article claims that "maṇi" was the Indus word for apotropaic gemstones, and it was originally an ancestral Dravidian word, later borrowed in other languages. It also analyses the inscribed drain-pipes of Kalibangan, and claims that they were repurposed as a gemstone-bead container, as signified by the gemstone related fish-sign  and  bead-string related sign engraved on it. This article also suggests that the Persian word Mīnākārī for enameling, was derived from an Indus-Dravidian "mīn"-based word, and was associated with the glazed blue faience of IVC.

1. Introduction

Analyzing various archaeogenetic (Narasimhan et al., 2019; Pagani et al., 2017), archaeological, linguistic (Ansumali-Mukhopadhyay, 2021, Parpola 1994; Parpola 2015), ethnographic (Parpola 1988; Krishnamurti; 2003, p.501), and toponymic (Balakrishnan, 2019) evidences, several scholars have argued that a significant population of the ancient Indus valley civilization (IVC) spoke ancestral-Dravidian languages. Many scholars have also tried to read Indus script (ISC), by applying the rebus principle, and treating Indus script signs as phonograms of certain ancient Dravidian languages (e.g., Heras, 1953; Parpola; 1994). Mahadevan (2014), who treated ISC's signs as logograms, often applied certain "Dravidian proofs" for connecting the iconicity of some ISC-signs with Dravidian linguistic words using homonymy, to "read" certain ISC inscriptions.

This study uses a novel approach for decoding the fish-like signs of the semasiographic Indus script, and for linking their symbolism to certain ancient symbolism found exclusively in linguistic symbolisms used in extant Dravidian languages. Fish-like signs (Fig.1a) are one of the most prominent groups of ISC signs, which occur in around 1250 inscription-lines among around 5500 inscription-lines recorded in ICIT (see Fig.1b-c). The usage of the crocodile-fish symbolism found in certain artefacts (e.g., seal M410, Fig.1b), and the fish-shaped incised-tablets containing fish-sign inscriptions (H-329, Fig.1b), confirm that the fish-like sematograms/logograms employed some kind of fish symbolism to convey their meanings. However, like most aspects of ISC, the semantics of these fish-signs have been highly debated by scholars. For example, the most frequent fish-like ISC-sign  is classified as a syllabic-sign by Wells (2015 p.7), an attributive-lexeme by Mahadevan (1986 p.21), and a metrological unit by Bonta (2010, pp.22-30,57-58).

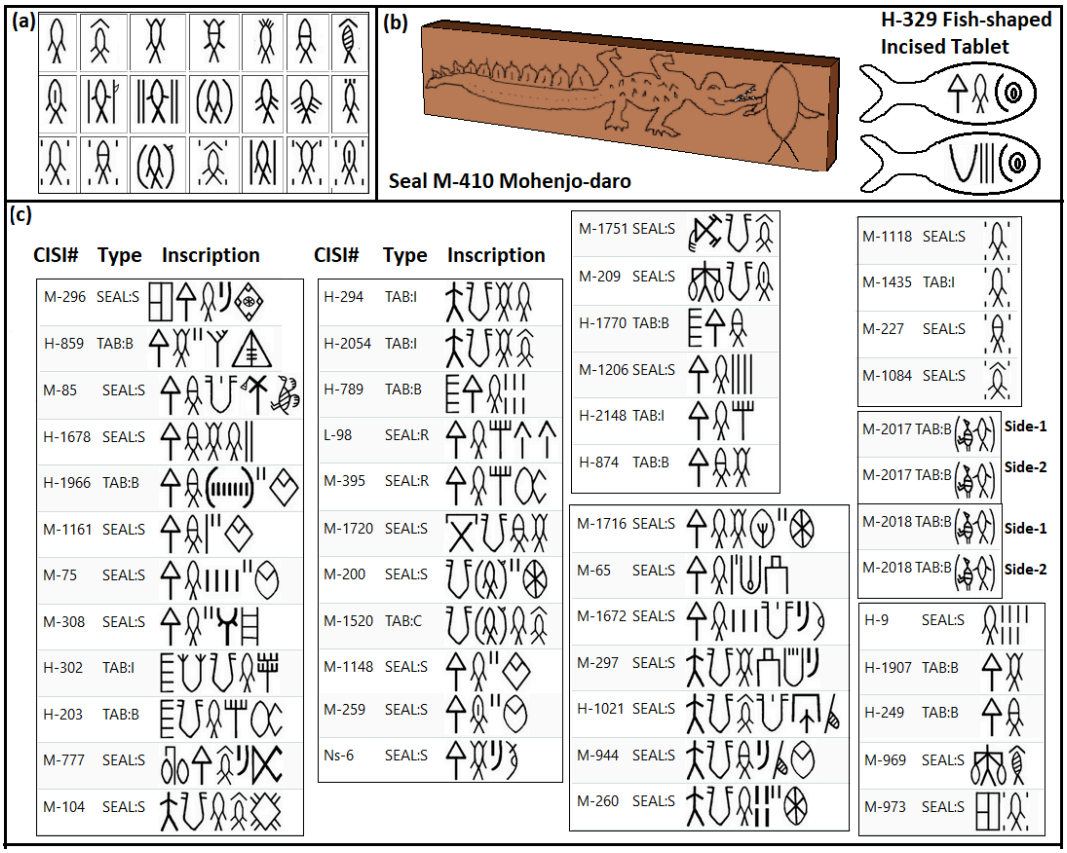


Figure-1 Fish-like logograms and their usages in Indus script inscriptions

Parpola (1994 pp.179-185,279-283) suggests that  might have encoded "mīn", a Dravidian homonym signifying "fish", "star", "to shine", etc., and might have formed certain theophoric-astral anthroponyms, along with its accompanying signs. According to Fairservis (1992, pp.11,48-58), the fish-like signs were semantically associated with a "knot or twist in a loom", not fish. Fairservis proposes that since certain Dravidian words are related to "twist"/"loop" (e.g., 'piri'), and are homonyms to words meaning "chief", the "fish-signs" were actually Dravidian chief-words ('pir', 'talpir', 'acci-pir', 'maru-pir', etc.). By considering Sanskrit as ISC's underlying language, and applying the principle of acrophony, Rao (1979 pp.183-186,262-264), has claimed to decipher almost all ISC-signs, and has assigned phonological values 'ś', 'man', etc., to various fish-signs. Contrarily, Mahadevan (2011) has reinterpreted the fish-signs as representations of certain "water nymphs" or "priestesses" worshipped in IVC.

Building on the author's previous articles (Ansumali-Mukhopadhyay, 2019; Ansumali-Mukhopadhyay, 2021; Ansumali-Mukhopadhyay, 2023; Ansumali-Mukhopadhyay, 2024a; Ansumali-Mukhopadhyay, 2024b) this article argues that:

i. The fish-like logograms of ISC signified meanings associated with gemstones, precious beads, precious shiny commodities such as polished metallic artifacts, lapidary crafts, gemstone-bead trading, the barter equivalencies for such commodities, and related taxes and licenses.

ii. The fish symbolism used for such logograms is linked to an ancestral Dravidian symbolism related to glittering and polished things, which is still extant in linguistic symbolism found across several Dravidian languages.

iii. It also analyses the inscribed drain-pipes of Kalibangan, and claims that they were repurposed as a gemstone-bead container, as signified by the gemstone related fish-sign  and bead-string related sign  engraved on it.

iv. This article also suggests that the Persian word Mīnākārī for enameling, was derived from an Indus-Dravidian "mīn"-based word, and was associated with the glazed blue faience of IVC.

If these hypotheses are correct, they not only decode the overall semantics of a significant set of Indus-inscriptions that contain fish-signs, but also provide another important link between the Indus civilization, and the ancient Dravidian languages and ideology.

2. Materials and methods

2.1 Methods:

This study builds on the author's recent articles, which claim that ISC is no more completely undeciphered. Ansumali-Mukhopadhyay (2019) has already proven how ISC was written using only sematograms (meaning-units) and/or logograms (word-units), and how signs belonging to different semantic classes usually occurred in different inscriptional segments (Fig.2). As argued in Ansumali-Mukhopadhyay, 2023; Ansumali-Mukhopadhyay, 2024a; and Ansumali-Mukhopadhyay, 2024b, the semantic scope of ISC-inscriptions comprised taxation, trade and craft licensing, commodity control and access control, and specific segments of the inscriptions encoded specific types of tax/license related information (Fig.2). Ansumali-Mukhopadhyay, 2024b specifically decodes the ISC signs for gold/precious-metals/goldsmithing  , discusses its occurrences on certain goldsmith's tools found at Mohenjo-daro, and argues that the core-informational segments of ISC inscriptions, where this gold () and precious-metals ( ) related signs/sign-sequences occur, encoded names of various taxed commodities and licensed trades and crafts (Fig.2). Building on these findings, this article decodes the fish-like Indus signs using the following types of evidence:

i. By analyzing the archaeological contexts of the inscriptions containing fish-signs in their core-informational segments, this study argues that such fish-sign inscriptions occur in significantly high frequency near jeweler's shops and lapidary workshops, indicating that fish-signs were related to the commodities made and sold in such places.

ii. By analyzing the ISC corpora, this study proves that the fish-like signs very often occur accompanying the gold and precious metal signs in the core-informational segments of ISC inscriptions. This indicates that the fish-signs signified certain precious commodities and crafts (e.g., gemstones, lapidary crafts, bead-trading, shiny metallic artifacts, etc.) related to gold and goldsmithing, as related crafts/commodities will logically co-occur in the core-informational segments of the tax/license related ISC inscriptions.

iii. The polysemic Proto-Dravidian fish-word "mīn", a popular fish-word used across several Dravidian and non-Dravidian languages of present India, also signifies 'shining', 'bright', and 'gemstone' in Dravidian languages. Since verbs derived from the Proto-Dravidian root-verb "*mīn" signify "to shine," "to glitter," "to polish", etc., shining natural things, such as stars, fireflies, glow-worms, lightning, etc., and polished glittering things such as gems and coins, are often signified with words derived from the "*min" root in several Dravidian languages. This linguistic symbolism, and fish-based homonymy for gemstones, metallic coins, and other glittering things, are not found in any other language-group of the Indian subcontinent. Since ancestral Dravidian languages and culture was prevalent in Indus settlements (Ansumali-Mukhopadhyay, 2021; Balakrishnan, 2019; Parpola 1994; Parpola 2015), the Indus scribes possibly applied the ancient Dravidian fish-based homonymy to encode gemstones, lapidary crafts, and other shiny polished precious commodities and their related trades/crafts by the fish-like logograms.

iv. Analyzing trade related documents of ancient Near East, this study discusses that the apotropaic beads made of precious stones, which were sold by ancient Indus traders to the traders of ancient Near East, were called "fish-eye beads", and argues that the ancient Indic word for beads and gemstones, i.e., "maṇi", travelled from Indus settlements to Mesopotamia, and remained fossilized in their documents. This paper further argues that the ancient word "maṇi" is a word of Dravidian origin, links its meaning to the apotropaic eye-patterned gemstone beads of Meluhha.

v. As discussed by Ansumali-Mukhopadhyay (2019; 2021), all decipherment efforts that treat ISC-signs as phonograms must be wrong, as ISC was written using sematograms and logograms. Thus, even when such attempts claim to have discovered Dravidian words "spelled" in Indus inscriptions, they are wrong due to their flawed methodologies. Indus inscriptions might have been influenced by contemporary linguistic symbolisms and

homonymy. Thus, the iconicity used in some of the logograms can be possibly traced to ancient Dravidian symbolism. But Indus signs were not phonograms used to spell words. Thus, while this article seeks to explore the symbolisms used in certain Indus signs, and seeks to link some of them to ancestral Dravidian symbolisms, it does not support the studies that try to discover Dravidian language words "spelled" in Indus inscriptions.

2.2 Materials:

The materials used here include three ISC corpora created by different scholars (Wells and Fuls, 2006; Mahadevan, 1977; Joshi and Parpola, 1987; Shah and Parpola, 1991; Parpola et al., 2010; Parpola et al., 2019). All inscribed artefacts are referred to using their CISI serial-numbers, unless mentioned otherwise. When CISI-numbers are absent, the excavation numbers of those artefacts, prefixed with ASI# (Archaeological Survey of India), are used.

Since most of the inscriptions were supposed to be read from right-to-left (Mahadevan, 1986), even if certain inscriptions were written from left-to-right, top-to-bottom, and radial directions, all the Indus-inscriptions are rendered in a right-to-left normalized direction, when not mentioned otherwise. Other than ISC-corpora, various archaeological excavation reports, ancient texts, and books on history and linguistics have been used in this study.

3. Archaeological evidences for decoding the fish-like ISC signs

Contextualizing ancient artefacts can be very tricky, as while doing it, the researcher needs to keep in mind the following: i) whether the actual deposition contexts were primary or secondary; ii) whether the artefacts were dislocated by natural processes such as complex cycles of surface decay caused by saline weathering, rain wash-out (Vidale, 2000), earthquake, flood, etc., or by human interventions, such as building, rebuilding, moving of soil from one place to another, robbery, etc.

Moreover, cities like Mohenjo-Daro were not like flat parking lots that grew up in perfectly horizontal layers. Thus, even the contemporary buildings of such ancient cities might have been laid at different levels, and artifacts found at different depths in different buildings might have been contemporary to each other. The opposite is also true.

To avoid errors caused by the above mentioned complexities, this study contextualizes Indus artifacts only when several artifacts related to the same trade/craft are found in high concentration in a very small area. In such cases, it would be statistically quite improbable that several mutually related, and almost undamaged artifacts (e.g., various materials for making ornaments) landed up in the same place from different strata. As discussed below, such contextualization of artifacts and inscriptions can immensely help to understand the semantic scopes of certain Indus inscriptions.

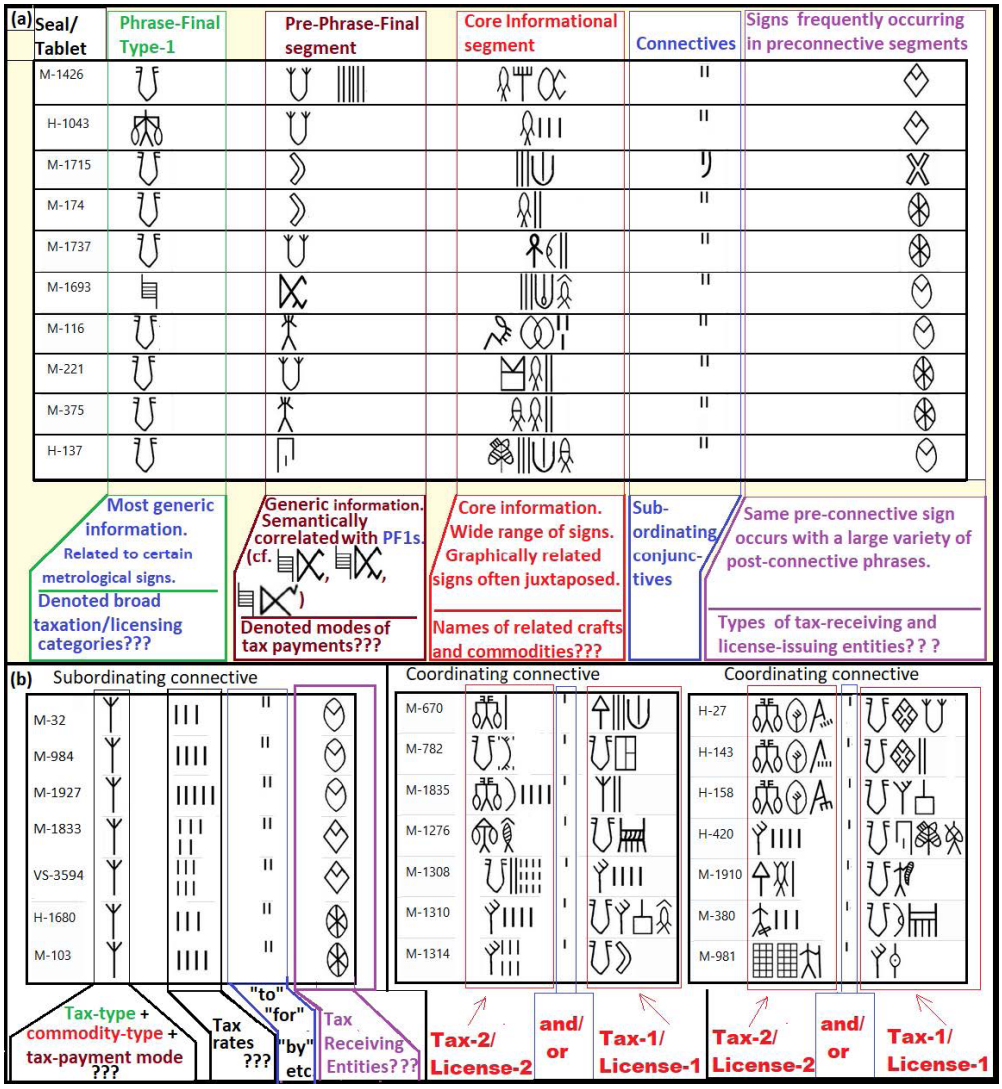


Figure-2 Inferred semantic scopes of different inscriptional segments explained by selected Indus script inscriptions

3.1 Fish-sign inscription found in a Jeweller's shop at Mohenjo-daro

Marshall (1931, Vol-1 pp.194-195) describes a small 8-by-7 feet room found in House-VIII of the HR Area of Mohenjo-daro, which "yielded the most important find of the season". The artefacts found in this room were: (i) silver and copper vases (ii) a copper axe and chisel (iii) various gold and silver ear-ornaments (iv) bangles, (v) diadems, (vi) fillets, (vii) pins, (viii) unfinished ornaments, (ix) "a large collection of beads of gold, silver, faience, semi-precious stones, mounted in some cases in gold caps at both ends", (x) pendants made of different materials, (xi) perforated spacers, (xii) hemispherical ornament terminals, etc.

This room was undoubtedly a part of a jeweller's shop as: (a) It is simply not possible that so many items linked to jewellery had been dislocated from different stratigraphic layers to get accidentally assembled inside this 8-by-7 feet small enclosure; (b) Since a chart scraper, several unfinished ornaments, and parts of ornaments (spacers, terminals, etc.) are also found in this room, it must have been a place of making and selling jewellery, not a personal treasury of a wealthy person. Interestingly, this jeweller's shop has yielded a single seal, CISI#M-294, containing the inscription , and an interesting iconography with two animals, a syncretic bovine-animal with a trunk, and an elephant (Fig.3a). Though this seal is clipped on right side (see CISI-1, p.71), analysing the position of its text and the accompanying iconography, the existence of the phrase-ending PF1-sign , the space remaining after , and the spacing pattern in similar inscribed seals/tablets (Fig.3 b-c), we can be sure that this inscription-line was the undamaged complete message of this seal, which is not affected by clipping (Fig.3a). Moreover, similar patterns of <Stroke-sign Fish-sign PF1-sign> are found in several other Indus seals and tablets (Fig.3 b-c), reinforcing the completeness of the inscription of seal CISI#M-294.

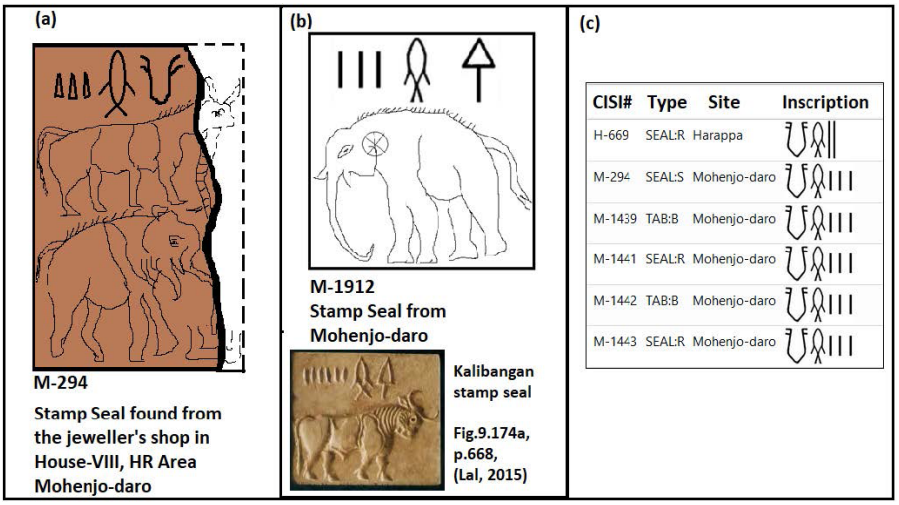


Figure-3 Representative Drawings of Seals M-294 (a), M-1912 (b), and some related inscriptions (c)

Now, Indus seals were mostly used as tax-stamps and commercial permits (Ansumali-Mukhopadhyay, 2023), and the signs occurring in the core-informational segments of Indus inscriptions were most possibly names of taxed commodities and licensed trades/crafts (Ansumali-Mukhopadhyay, 2024a). Thus, the core-informational segments of ISC inscriptions should be more context-sensitive. For example, the same tax-types (such as customs tax, or sales tax) will be applicable to multiple types of commodities and crafts, and the archaeological

contexts of the seals or tablets might not help to decode signs related to tax-types or tax-collecting entity types. But seals related to specific taxed commodities or licensed crafts, will logically contain names of those crafts/commodities, and such seals are expected to be found in higher frequencies near related craft-workshops or shops. Thus, when we get a single seal in an undoubtable archaeological context of a jeweller's shop, we should semantically link its inscription's core-informational context-sensitive part (i.e.  ,  , with commodities related to jeweller's craft and associated taxation and trade-license.

Now, in the sign-sequence  , the numeral possibly signifies the commodity-specific tax-rate or licensing-fee (Ansumali-Mukhopadhyay, 2023; Ansumali-Mukhopadhyay, 2024a). Hence the remaining fish-sign  of the context-sensitive core-informational part should be associated with the archaeological context of this seal, i.e., the context of a jeweller's shop. So,  possibly signified meanings related to gemstones, jewellery-making, etc. The PF1-sign of  possibly signified a common tax/license-type (Ansumali-Mukhopadhyay, 2023) that was also applicable in this context.

It is possible that the jeweller of this shop had to pay certain periodic fees to keep this seal issued to him by the authorities signified by the iconography of the seals, and that he had to stamp his packages with this seal to establish their licensed/tax-paid status. Otherwise, the seal might have been mainly used as the jewellery shop-keeper's license.

3.2 Fish-sign inscriptions concentrated in lapidary related context at Harappa

In Harappa, Vats (1940 pp. 58-60, 435) reports the finding of "a number of instructive antiquities, including a representative collection of jewellery" (Series No. 8650), which comprised

i. numerous objects of stone, faience, gold, and copper;

ii. two small cubical weights weighing 26.3 and 4.3 grams, which are suitable for measuring precious metals, gemstones, etc.;

iii. shells;

iv. a large collection of beads (of various shapes and sizes, made of gold, carnelian, steatite, faience, shells, etc.); and

v. several seals and incised tablets.

All these artefacts were discovered in squares H-12/21 and I-12/1 of Mound-F Stratum-IV where "a well and fourteen Workmen's Quarters of peculiar design" were also found. Here, the presence of a large collection of gemstone beads, small weights, and workmen's quarters

indicate that this place was an important lapidary workshop, and/or a place for hoarding and dispatching gemstone beads and other such precious commodities. Now, the tablets and seals found from the 8650-series contain 6 distinct inscriptions (counting tablets with same inscriptions only once), among which 4 inscriptions contain fish-signs (see Fig.4). Among the other seals/tablets found nearby, 3 more tablets contain fish-signs. Since Indus tablets were trade/craft licenses (Ansumali-Mukhopadhyay, 2023; Ansumali-Mukhopadhyay, 2024a), the existence of multiple tablets with identical inscriptions found here indicates that multiple tablets with permits for trades/crafts associated to the workshop were possibly being crafted here to be given/sold to related traders or artisans. The high concentration of fish-sign inscriptions with a lot of lapidary and jewellery related items indicates a strong correlation between fish-signs and lapidary and jewellery related trades/crafts.

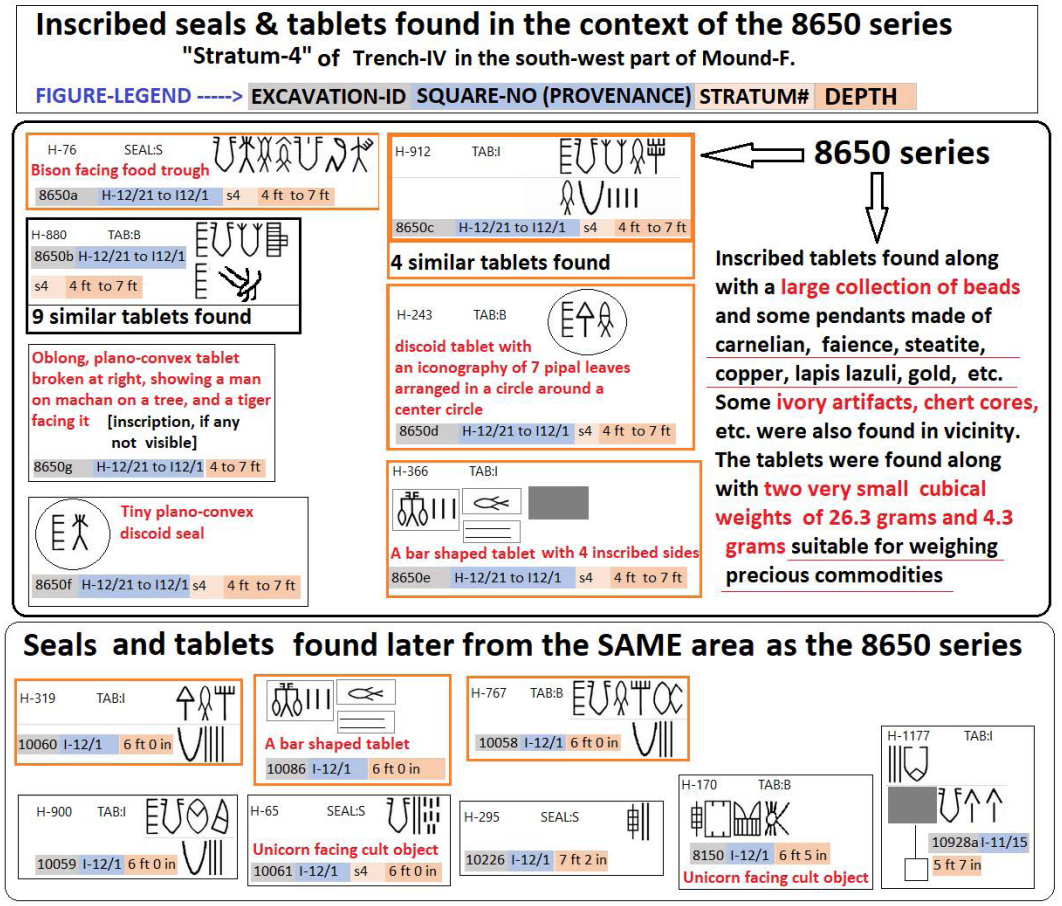


Figure-4 Contextualized diagrams of inscriptions of seals and tablets found from a lapidary workshop of Harappa. Objects with fish-sign inscriptions are marked with orange borders

3.3 Fish-sign inscriptions concentrated in lapidary related contexts at Chanhu-daro

During the Harappa-II occupation (middle of third millennium BC), the IVC settlement at Chanhu-daro was thriving with various commercial activities, among which "bead-making was an important source of revenue", as "large numbers of unfinished beads, together with the stone drills used for boring them", and "supplies of the raw materials for bead-making", such as lumps of amethyst, crystal, carnelian, and nodules of agate often treated with heat, are abundantly found here (Mackay, 1943 p.52). The Plate-IV in Mackay's (1943) excavation report contains a detailed contour map of Chanhudaro's Mound-II of Harappa-II occupation, where the excavated area is divided into 50-feet squares labelled with row and column numbers. Using this map, and the detailed provenance of the reported artefacts, I have made a contextualized diagram of the inscribed seals/tablets found in this area (see Fig.5). Now even though traces of lapidary activities along with other craft-activities have been found in multiple excavated Squares, Mackay has specifically identified a building of Square-9/D (comprising locations numbered 215, 286, and 287) as a "bead factory with furnace", where copper-tools, copper and bronze knives, shell and faience objects, a flake drill, some carnelian nodules, and various unfinished beads that were meant to be glazed, were found in the same level (+10.4 feet).

Moreover, 14 small-range weights suitable for weighing precious metals and gemstones, and small scale-pans of copper suitable for the same, were also discovered here. An additional small weight was found in a nearby furnace-room. Square-9/D is specifically identified as bead-maker's area, as it yielded not only unfinished beads, but various rare bead-making tools, and a system of flues possibly used for glazing beads (Mackay, 1943 pp.41-44,187). Now, we can see in Fig.5 that out of the nine inscribed seals found from Square-9/D, six seals have fish-signs in them. Moreover, among all the Squares of Mound-II, the Square-9D, which contained the bead-factory, has yielded the maximum number of inscriptions containing fish-signs, which should not be a mere coincidence.

According to Vidale (2000, p.121), the buildings of Chanhu-daro, "might have been warehouses of rich merchants, more than workshops and actual residences of craftspeople, while the working areas, as suggested by Mackay, might have been sheltered outside the buildings, under provisional roofings.

Some important activities such as storage, hoarding and perhaps accounting, and some critical manufacturing steps, for example the firing of good quality, valuable carnelian nodules could be carried on in the buildings (the kiln in room 215-286), under direct control of merchants and craft supervisors". Now, irrespective of whether Square9/D was a bead-factory (Mackay, 1943), or a place for hoarding, accounting, selective processing, and dispatching of gemstones

and beads (Vidale, 2000), it was certainly related to gemstone-beads. Thus, the unusually high presence of fish-inscriptions in the Square-9/D seals, strongly supports my hypotheses that Indus fish-signs were related gemstones and other similar shiny precious commodities.

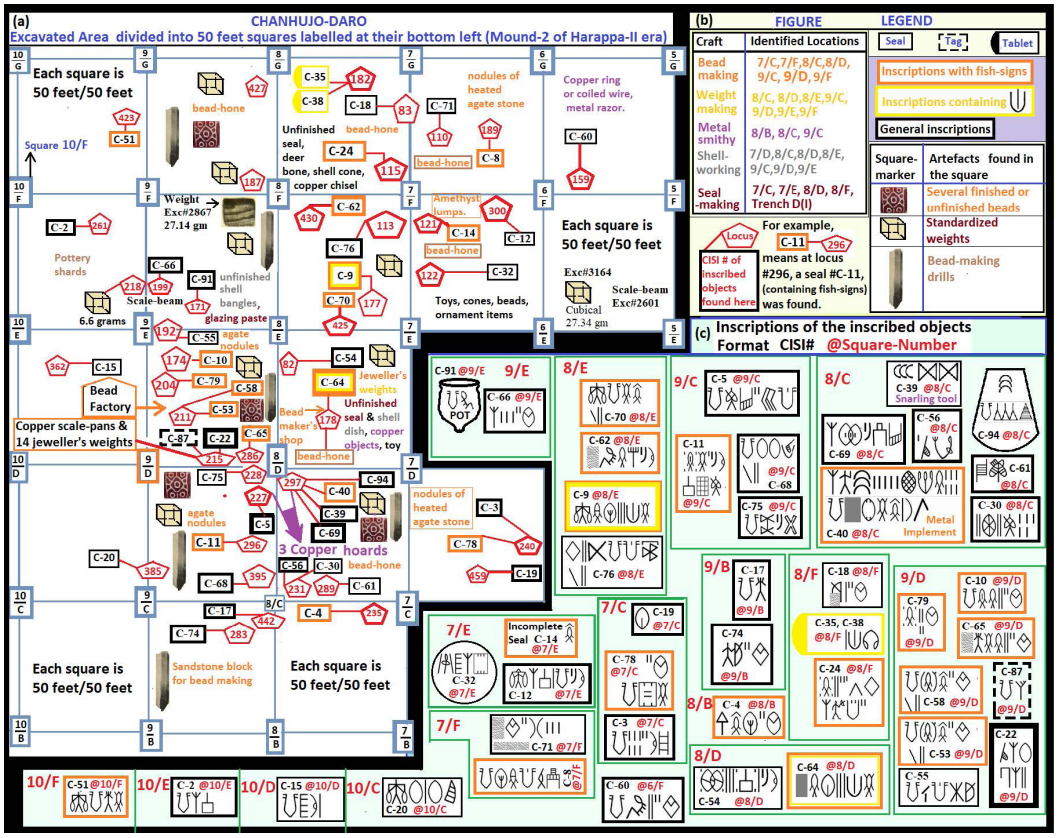
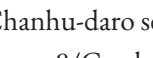
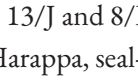


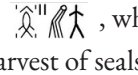
Figure-5 Some contextualized inscriptions found from Mound-II, Second Harappan Occupation at Chanhu-daro.

3.4 Fish-sign inscriptions from Indus sites with less detailed excavation reports

Excavation reports written without sufficient details often rob us off the opportunities of correlating Indus-inscriptions with their specific contexts. For example, In the draft report of the Rakhigarhi excavations (the final reports for seasons 1997-98 and 1999-2000 are not available yet), Nath (2014 p.116-118) mentions a fragmented mature Harappan era seal (ASI#6304) containing the fish-sign inscription  , which was found from Rakhigarhi's RGR-2 area which has also yielded a large number of beads. Among the 11421 beads found from the reported Rakhigarhi excavation, more than 8000 beads come from areas RGR-2 and RGR-4 (Nath, 2014 p.260). But Nath (2014) provided no detailed locational

information for the RGR-2 area's beads or seals, making their contextualization impossible. Similarly, in the "bead factory" found in RGR-1, where a room-floor measuring 2.3mx2.3m contained around 2000 beads in various stages of manufacturing, two sealings with elephant iconography were also found. But Nath (2014 p.117), gave no detailed description of those sealings, and their inscriptions (if any), even though he mentioned that the sealings should have been related to the precious stone trade.

Interestingly, inscriptions similar to this RGR-2 seal  are found from other Indus settlements with more contextual data, which can be correlated to lapidary related contexts. For example, in Chanhu-daro  , (Seal C-67) was found in Square-13/J of Mound-I, where lapidary-related small agate weights (e.g., 27.36 gm, ASI#3822; ASI#3882), rare round-sectioned chisels for making depression in beads (see Bisht, 2015 p.446), copper axe, shell inlays, antler of a hog deer (deer antlers are still used for making beads), etc., are found (Mackay, 1943). Similarly, another Chanhu-daro seal  (CISI#C-4, ASI#CH-2390) is found from square 8/B, very near to Square 8/C, where lapidary work and metal-smithy were in vogue and certain lapidary related weights were also discovered (Mackay, 1943). Interestingly, round-sectioned bead-drills are quite rare, and the only two such drills reported from Chanhu-daro are discovered from squares 13/J and 8/B, precisely the locations of the fish-sign inscriptions  and . In Harappa, seal-inscription (ASI#10835a) is found at 3 ft. depth in Mound-F's Stratum-II, Square P-9/5 (400 square-feet area), along with various faience and steatite beads (Vats, 1940 pp.9,124,130 & Plate XXVI).

The insufficiently detailed excavation reports from Banawali provide another example of lost opportunities of correlating seal inscriptions with archaeological contexts. For example, in the brief articles on Banawali, Bisht (1984, p.96; 1982, p.117) has mentioned a seal (CISI#B-17, ASI#BNL-9201) containing fish-sign inscription  , which was found from a "prominent" merchant's house, which also yielded "a rich harvest of seals, weights, beads, including those of gold, lapis and etched carnelian, besides the deluxe pottery of the age". However, this article provides no details about the other seals recovered from this house and its neighborhood. Thus, the other fish-sign inscriptions ( , , ,) found from Banawali remain mostly contextless.

Similarly, ICIT has recorded around 24 fish-sign-inscriptions from Kalibangan. But the Kalibangan excavation reports (Lal et al., 2015; Lal et al., 2020) contain almost no details regarding the exact find-spots of inscribed objects, beads, weights, and other artifacts, making any contextualization almost impossible.

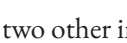
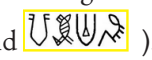
3.5 Fish-sign-inscriptions share archaeological context with jeweller's weights

As shown in Fig.5, in Chanhujo-daro, inscriptions containing fish-signs were strongly correlated with the findspots of tiny weights suitable for weighing precious metals and gemstones (e.g., at squares 9/C, 8/D, 8/E, and at 9/D along with 14 tiny jeweller's weights are found). Similarly, two small cubical weights weighing 26.3 and 4.3 grams were found along with a large collection of beads, a lot of jewellery related items, and many seals and incised tablets containing fish-sign inscriptions in Harappa (Fig.4).

However, unlike the seals/tablets found near workshops, the seals/tablets found together in residential buildings and 'khans' (ancient inns) have to be contextualized in a different way. For example, in Harappa, other than a few public houses, and some workmen's quarters, most of the buildings excavated by Vats (1940, p.14) are "dwelling-houses". Often, the seals/tablets found in such houses will have no specific craft/trade related contexts, as their dwellers might have controlled craft-workshops that were located far away from their residences or inns. For example, Vidale (2000) has observed that at Mohenjo-Daro, there is "positive evidence that at least some craft industries were performed outside the boundaries of the possible ceremonial-residential areas of the Citadel and the Lower Town".

However, when inscribed seals/tablets are found together with certain characteristic commodities in such a building, we might try to contextualize those inscriptions. For example, since traders dealing with gemstones, and tax-collectors controlling gemstone trading and lapidary crafts were supposed to carry small range weights suitable for measuring precious metals and gemstones while doing barter or tax-collection, they might have carried their seals/tablets containing fish-signs, gold-signs, etc., along with their small range weights, even at their dwelling places. Thus, fish-sign inscriptions might sometimes be found along with small-range weights in residential houses and khans. For example, at Harappa, in SquareP-10/15 of Harappa's Mound-F, tablet H-747 (ASI#11516) containing a fish-sign-inscription () is found with a cubical chert weight of 6.9 gram, at depth of 4 feet 8 inches below-surface (Vats, 1940 p.133-135). Similarly, in Square M11/15, at the depth of around 5' to 5'9" inches below surface, 5 complete seals containing fish-sign inscriptions ( ,  ,  ,  , ) and a fragmentary seal with a crucible-blowpipe based gold-sign (CISI#H-97), were found together, along with 9 cubical jeweller's weights (size ranging between 0.5" cube and 1 X 95" x 6" inches), 4 conch shells, a dozen terracotta beads, some pottery bangles and vases, shell beads, etc. (Vats,

1940 pp.85,416). These seals most likely belonged to a trader dealing with gemstones, jewellery and other precious commodities, whose licenses were possibly expressed through the fish-signs and the gold-sign.

In ancient civilizations, "temples" were often used as administrative centres for tax-collection (Stevens, 2006). Thus, the presence of certain small range weights and seals of in House-I of Mohenjo-daro's HR-A area indicates that this public building was not only a religious centre as interpreted by Jansen (1985), but also an administrative hub, which possibly used such weights for collecting taxes and tributes in modes of precious commodities such as precious metals, gemstones, etc. Interestingly, among the seven "unicorn" seals found at House-I (Jansen, 1985), four of the seals contain the gold-sign and/or fish-signs ( ASI#HR-164,  ASI#HR-629,  ASI#HR-167, and  ASI#HR-99), whereas two other inscriptions ( ASI#HR-1575,  ASI#HR-2582) contain signs  and  , which frequently co-occur with fish-signs and/or gold-signs in more than 100 inscriptions recorded in ICIT (e.g.  and ).

Thus, it might not be a coincidence that a public administrative building of IVC, which yielded standardized-weights for measuring precious metals or gemstones, also yielded stamp-seals with gold-sign, fish-signs, and other signs that are highly correlated with these signs.

4. Script-internal and iconographic evidence of fish-signs signifying meanings related to gemstones, beads, similar precious commodities, and lapidary crafts

4.1 Fish-signs' co-occurrences with precious-metal related signs

Depending on which ISC-signs frequently co-occur with which other ISC-signs in different inscriptional segments, we can analyse the semantic relationship between them. For example, signs co-occurring in the core-informational segments of same inscriptions are arguably names of crafts/trades/commodities subjected to the same taxes or licenses (see modern examples of this theory in Fig.6a). Similarly, if the craft/commodity based ISC-signs occur in different sides of the same incised or bas-relief tablets, then those signs arguably signified related crafts or commodities, for which licenses or permits were assigned to the same tablet owner. We have already seen how inscriptions containing fish-signs are often found near the archaeological contexts of lapidaries, and in the context of gold/gemstone measuring small-range Indus weights. Interestingly, in the inscriptional space, the fish-signs very frequently co-occur with the gold/precious-metal based signs (, ) in various types of correlated inscriptional contexts. For example, fish-signs and precious-metal signs often co-occur in the core-informational segments of seal/tablet inscriptions (Fig.6b).

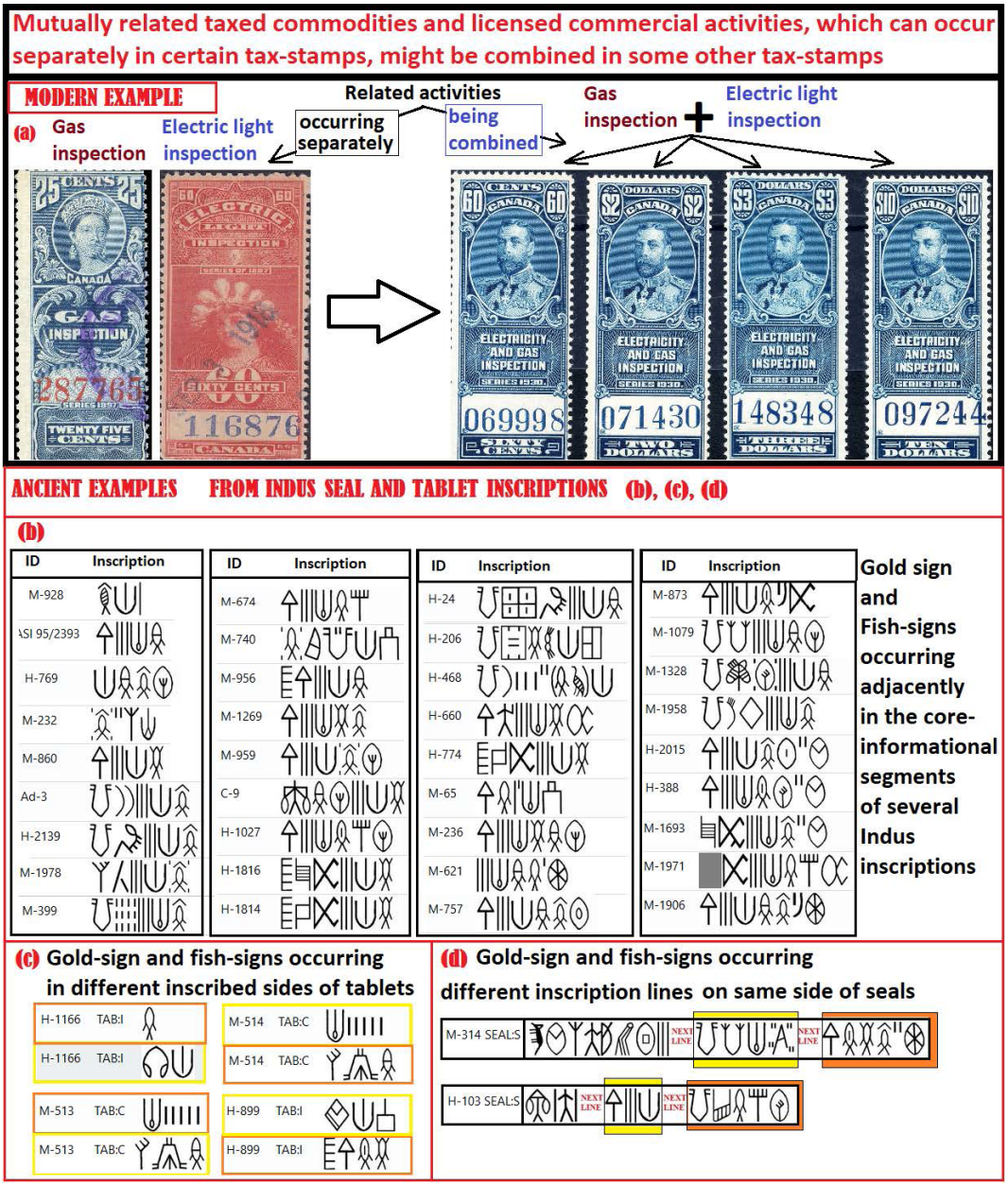


Figure-6 Modern (a) and ancient (b) examples of related craft/commodity names being consolidated in tax-stamps. Fish-signs and Gold-sign of Indus script co-occurring in different inscriptional contexts

4.2 Fish-sign inscriptions' co-occurrences with bead-string or beaded-stick symbol

Since ISC signs carefully retained their pictographic character for centuries, their meanings must have been directly or indirectly (metonymy, homonymy) associated with their graphical referents. While in many cases it is difficult to recognize those referents with our modern eyes, in certain cases the objects depicted by the signs' graphemes seem to be quite recognizable. For example, in case of signs and , the graphical referents of those signs seem to be strings of beads, hanks, or beads strung on sticks (Fig.7D). Stringing beads has been a standard way to keep beads organized, which is used even today (Fig.7D). Especially sign shows three bead-like oval/spherical objects with a vertical stroke going through them, closely resembling bead-strings (Fig.7D). Since gemstones like carnelian were translucent, if they are stringed around a thread or a stick, the stick or thread would be visible, explaining why the sign depicts the vertical line through the oval structures.

Among the inscriptions found so far, these signs are less frequent, as they occur in only 13 seals recorded in ICIT (Fig.7A). Among them only 9 inscriptions have more than 2 signs. In seals with only 2-signs, these signs occur with the tax/license category related generic Phrase-final signs (e.g. , ,). So, in only 9 inscriptions, these bead-string like signs get the opportunity to occur with other signs specific to crafts or commodities. Among these 9 inscriptions, in 4 inscriptions either the gold-sign or the fish-signs occur (M-46, M-636, M-1765, Krs-1). Thus, the bead-string like signs seem to have semantic affinity with signs signifying precious-metals, gemstones, etc. Since beads are strongly semantically related to gemstones and precious metals, this inscriptional pattern and the graphemic features of signs and suggest that these signs could indeed be representations of beads, lapidary crafts, and bead trading. When more seals/tablets with such signs engraved on them will be excavated, we will be able to reanalyse this tentative decoding of signs and .

4.3 Fish-sign inscriptions' co-occurrence with rare seal iconography of beaded necklace

It is true that the iconographies of Indus seals/tablets are generally not directly correlated with their inscriptions. As discussed in Ansumali-Mukhopadhyay (2023), seal iconographies were mostly emblems of the issuing-organizations of those seals. Since the same merchant or trade guilds, or the same settlement-based authorities could be involved in performing and controlling crafts/trades for different commodity types, the same iconography could be used for different types of mercantile inscriptions. However, inscribed Indus seals mostly use zoomorphic and anthropomorphic iconographies, accompanied by mangers, cult-symbols, etc. Sometimes the iconographies display certain religious or ritualistic narratives. But the seals

rarely depict artifact-centric iconographies. Interestingly, seal L-51 of Lothal, has a rare artifact-centric iconography accompanied by a fish-sign-based inscription (Fig.7C).

In CISI volume-1 (p.249), Parpola et al. have described the iconography of L-51 as an "unidentified object". In the Lothal excavation report, S. R. Rao (vol.2 1985 pp. 310, 317) has described the "unique" iconography of L-51 as an object resembling a "seed drill". However, as shown in Fig.7C, this iconography is unmistakably a depiction of a beautiful choker-style multi-layered bead necklace, features of which can be compared to a necklace found from Mohenjo-daro, and various similar necklaces used in modern times. Perhaps it takes a woman's eye to recognize the design of an ancient beautiful necklace? Jokes apart, this is an extraordinary scenario, where a necklace is chosen as the emblem of an ancient organization. Now which kind of guild will choose a necklace as its emblem? Most possibly a guild of jewellers, and/or gemstone traders, and/or lapidary-based artisans would want to identify itself with an image of a beautiful necklace, to advertise about their products and craftsmanship. Thus, since this seal's inscription contains two fish-like signs in the commodity/craft-related core-informational segment (), our hypothesis, that fish-signs were related to gemstones, lapidaries, and shiny precious commodities, get a significant amount of corroboration.

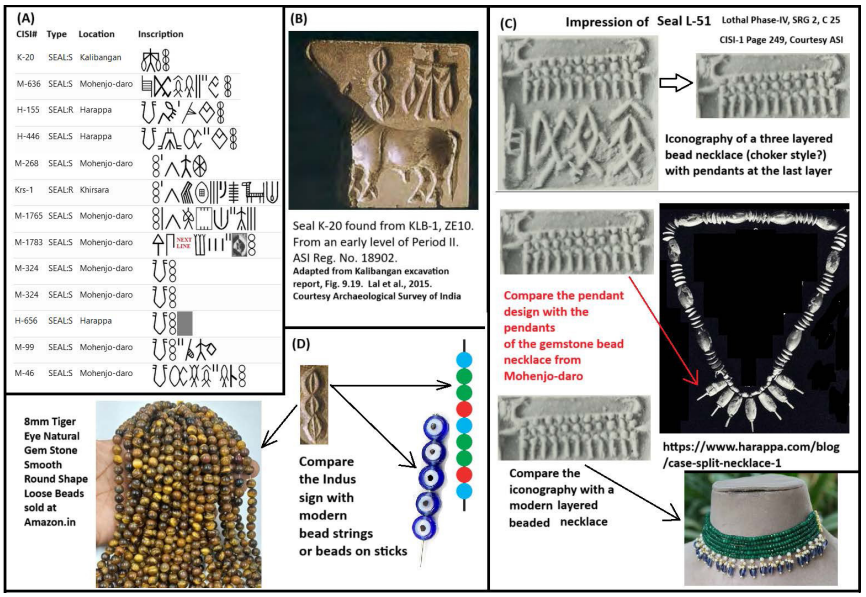


Figure-7 Bead-string-like signs in the Indus script inscriptions (A, B, C) and fish-sign inscriptions in a seal with a rare artifact-centric iconography of a beaded necklace

Interestingly, whenever the pre-phrase-final sign  and phrase-final-sign combination occurs in a seal, in more than 80% cases either the precious-metal sign or the fish-signs occur in the core-informational segment, showing that  was possibly specifically applicable

to lapidary, jewellery, and related crafts. Importantly, in the inscription  of a Mojenjo-daro seal (M-636) the bead-sign  occurs along with fish-signs and the  sequence in the terminal position.

5. Ethnolinguistic and historical evidence that link fish-symbolism with gemstones, shiny precious commodities, apotropaic beads, and lapidary crafts

The linguistic and cultural basis of gemstone's fish-related iconicity can be understood by exploring the ancient linguistic and historical records of both India and Near-East. To unravel the fish-symbolism related to the gemstones and beads in Indus culture, this study engages with two kinds of possibilities:

A. Homonymic usage of the Proto-Dravidian word "mīn" that meant both 'fish' and 'gemstone', could have led to the use of fish-based Indus logograms to signify gemstone related meanings (explained in Section-5.1).

B. IVC's eye-patterned gemstone beads were coveted in the ancient Near East, and were notably recorded as "eye-beads" and "fish-eye beads" in Mesopotamian lexicons and trade documents. Thus, the apotropaic aspects of fish and fish-eye, as believed in several ancient cultures, could have led to the fish-eye based names of the apotropaic gemstone beads of IVC which contained either natural or manmade eye-patterns (elaborated in Section-5.2). Since "maṇi", the Indus word for gemstones, is discovered fossilized in documents in Near East, this study explores the possible link between the fish-eye beads, and the related meanings of the "maṇi" word, i.e., "amulet", "bead" "apple of eye", and "gemstone" (Section-5.3). This study also argues about the possible Dravidian root of the word "maṇi" (Section-5.4).

These above-mentioned possible reasons behind the fish-based symbolisms used for gemstones and lapidary craft related meanings in Indus script, need not be mutually exclusive. They might have been mutually complimentary.

5.1 The Dravidian homonymy-based aspect of fish related symbolism for gemstones

A significant portion of IVC's population most possibly had spoken some ancestral-Dravidian languages (Ansumali-Mukhopadhyay, 2021; Parpola, 1994). Therefore, some of the popular trade/craft/commodity related Indus words could have had Ancestral-Dravidian roots. According to Ansumali-Mukhopadhyay (2021), a Proto-Dravidian elephant-word 'pīlu' was used by IVC traders to signify ivory. This word had travelled from IVC to ancient Near East through ivory trade, and remained preserved as the elephant-words 'pīri', 'pīru', etc. and the

ivory-word ‘pīrus’, in Akkadian and Old-Persian languages. Similarly, this study conjectures that another Proto-Dravidian fish-word “*mīn”, and its homonymic usages could have inspired IVC’s scribes to choose fish-like logograms for signifying gemstones and similar shiny-precious commodities.

Interestingly, in several Dravidian languages (e.g., Tamil, Telugu, Malayalam, Kannada, Kodagu, Tulu, Kota, Toda), the Proto-Dravidian root-verb “*mīn”, and other verbs derived from it (e.g., ‘miṉṉu’, ‘miṉuṅku’, ‘minnuka’, ‘minugu’, “miṉukku”, ‘minukkuka’), mean “to emit lightning”, “to shine”, “to glitter”, “to polish, brighten, varnish, make glitter”, etc. (Starostin, 2006-2013; Burrow and Emeneau, 1984). This is why, things that shine and glitter, such as stars, fireflies, glow-worms, lightning, etc., are also signified with words derived from the “*min” root. Also, ‘mīṉ’, ‘mīn’, ‘mīnkō’, etc. mean ‘star’ across Dravidian languages. Similarly, ‘miṉṉal’ (Tamil, Malayalam), ‘minnu’ (Malayalam), ‘miñcu’ (Kannada), etc., mean lightning (Tamil Lexicon).

Thus, as glittering and shiny polished objects, gems, jewels, and metallic coins are also signified by “miṉ”-based words. For example, “minni” (Malayalam) and “minna” (Telugu) means “a gem” and ‘a jewel’ (Burrow and Emeneau, 1984; Brown 1798-1884 p.992). In Sinhalese, an Indo-Aryan language with significant Dravidian influence, “mina” meant ‘fish’, “zodiac Pisces”, and “a sort of gem” (Clough, 1892). Similarly, the Tamil word ‘miṉṉal’, and the Telugu words ‘minuku’ or ‘minku’, also signify meanings like ‘a bright coin’, ‘a small gold coin’, etc., evidently because of the polished glittering look of metal coins. Thus, certain coins of ancient India were named ‘putu-miṉṉal’, ‘tiruvāṅ- kōṭṭu-miṉṉal’, etc. (Tamil Lexicon).

Now, how a semasiographic script will express gems and jewels? We know that the most important aspect of gems and jewels is that they glitter. But that intangible abstract quality is difficult to express through a logogram/sematogram. Thus, it is quite possible that the people of IVC used the “*min”-based words, which signified both “fish” and “gems” by homonymy, for encoding such meanings through fish-like sematograms/logograms.

Certain other Indus commodities, such as faience, glazed steatite, or highly polished metallic artifacts (e.g. copper mirrors), important features of which were their shiny bright appearances, might have also been signified by specific fish-signs. The existence of Dravidian ‘miṉ’-based coin-words in historical India indicate the applicability of glittering-related words for signifying certain artifacts that characteristically shine or glitter. The existence of fish-sign in the inscribed metallic implement C-38 of Chanhu-daro ( ) might have been due to such reasons.

The word “*min” is still one of the most popular words used for fish across several Indo-Aryan and Dravidian languages across India. Interestingly, if one translates the English

sentence “The gem is glittering like fish and firefly” into Tamil, through Google-Translation (https://www.google.com/search?q=English+to+Tamil), it reads: “Māṇikkam mīṉ maṟṟum miṉmiṉip pūcci pōl miṉṉukiṟatu”. Here “mīṉ” means fish, “miṉmiṉip pūcci” means firefly, and “miṉṉukiṟatu” means “is glittering”. This sentence shows how “miṉ” is one of the most widely used Tamil root-words to signify any object that glitters or shines, even today. Thus, being a semasiographic/logographic script used by a population with considerable number of ancestral Dravidian language speakers, ISC possibly chose “miṉ” (fish) based symbols to signify gemstones and other similar precious shiny commodities through homonymy.

5.2 The apotropaic aspect of gemstone’s fish-eye and eye symbolism

Gemstone beads imported from IVC were highly prized commodities in Persian Gulf and West Asia. Thus, beads were among the most specialized craft items and trade commodities of IVC, having a crucial place in IVC’s economy. Relevant in this context is Vidale’s (2004 p.271) remark: “Just to give an impression of the possible cost of an Indus necklace or belt made of long barrel-cylinder carnelian beads, on the basis of experimental replications we calculated that the production of one of these ornaments roughly amounts to 480 days of work by a highly skilled artisan ... No wonder that such precious beads were actively sought for and monopolized by the Sumerian elites”. Analysing IVC’s industry-scale bead-production systems, Kenoyer (2013) too comments: “The use of shell beads with concentric circular patterns that could be interpreted as eyes begins around 7000 BC at sites such as Mehrgarh. Later, during the Regionalization Era or Early Harappan Period, new forms of eye designs were created using natural stones and also carved steatite beads and button seals. The use of eye motifs became more widespread during the urban period and continued to become more elaborate during the late Harappan and Early Historic periods.”

Several texts of ancient Mesopotamia, including the Mesopotamian lexicon “ḪAR-ra=ḫubullu”, have documented “fish-eyes” (“IGI-KU6” and “IGI-ḪA”), “Eye-stones” of Meluhha (“NA4-IGI-ME-LUḪ-ḪA”), and “fish-eye-stones” (“NA4-IGI-ḪA”, “NA4-IGI-KU6”) among the treasured import items of Mesopotamia (Donkin, 1998; Howard-Carter, 1986 pp,305-310). Donkin (1998, p.50) refers to a scholarly consensus that the “fish-eye”, “fish-eye-stones” and “eye-stones” in old Mesopotamian texts refer to the etched carnelian beads and pebbles of banded agates, which were “cut to resemble closely a black/brown pupil and white cornea” (see Fig.8b-d), and were imported from northwest India.

As documented by archaeologist Howard-Carter (1986:305-306), certain pedagogical texts taken from tablets of Sultantepe give clear explanation of the etymology of “fish-eye-beads”. The texts instruct that the “name of a stone which looks like a fish-eye is fish-eye stone” (see Fig.8a-b), “name of the stone which looks like a snake’s eye is snake-eye stone”, etc. Carter also

clarifies that though eye-stones got their first textual references in the Akkadian version of the "Descent of Ishtar", their first archaeological appearance was in the Indus trade-port in Lothal. The eye-patterns on such gemstones, when not natural, were manmade, and were achieved by a special process called "etching", which involved painting eye-like patterns on the beads using alkaline solutions. Analysing the "dramatic increase in methods to create eye designs during the Integration Era" of IVC, Kenoyer (2013) states that, this phenomenon "cannot be explained simply as a growth in technical expertise", and hypothesizes that IVC's "eye stones", or "fish-eye beads" possibly had an ethno-historical significance of "protective amulets" (Fig.8b).

Even in modern days, eye beads or eye-shaped amulets, used as talismans against the so-called "evil-eye", are prevalent in Turkey, India, and many other places (see https://www.nytimes.com/2017/02/22/nyregion/zigana-gift-shop-evil-eye.html; https://www.bbc.com/culture/article/20180216-the-strange-power-of-the-evil-eye). Such beads are presently famous as "Dṛṣṭi" ('Dṛṣṭi' means eye-sight or glance in Sanskrit) and "Nazar" ("Nazar" means eye-sight in Arabic) amulets (Fig.8a). Interestingly, the Tibetan dZi/gZi beads, which are mostly etched agate beads, are particularly prized depending on the number and type of eye-patterns etched on them (Ebbinghouse and Winsten, 1988; Reinhardt et al. 2020). Similar etched beads are also found in various places of Southeast Asia, and scholars (Glover and Bellina, 2001 pp.192,210; Beck, 1933 p.39) believe that since etching these beads had a specialized method which few people can emulate even today, these beads that were often found in burials, were technically and culturally continuations of the apotropaic eye-patterned etched beads produced in India, whose origin was in IVC.

The significance of fish as an apotropaic amulet against evil-eye possibly stems from the fact that since in many cultures "evil-eye" is supposed to cause "drying, desiccation, withering, and dehydration", "fish are thought to be immune from evil-eye as they are always wet" (Pitts-Taylor, 2008 p.111). Even today, fish-designs are part of various protective amulets (see Fig.8a-c).

Another relevant symbolism prevalent among the Semitic people of ancient Persia is the comparison of fish-eye to the God's watchful eye, as both never shut, and hence symbolize divine protection (Frankel and Teutsch, 1992). Even in Christianity, the term "ichthys" (symbol ⋋), which means "fish", is considered a very powerful apotropaic (Elliott, 2017), and it occurs in various amulets. Moreover, an intriguing Indic traditional symbolism that directly associates 'fish' with 'eye' is recorded in the Buddhist Aṣtamangala signs, where symbol of two golden fish or "gser nya", represent Buddha's eyes, "with which he gazes at the world with compassion" (Reis & Hibbeln, 2006; Namgyal, 2016 p.37). Also, the name of the Indian goddess Mīnākṣi, the tutelary deity of Madurai, means "one with fish-like eyes". Beautiful women with long and slender eyes shaped like the body of a fish are frequently praised in ancient Indian literature.

Figure-8 Eye, Fish-Eye, and Fish symbolism in ancient and modern evil eye amulets. a) Modern Nazar and Hamsa amulets; b,d) A few examples of IVC's beads, some with eye patterns. c) Modern era agate amulets

The above mentioned facts satisfactorily explain why fish are very often portrayed in evil-eye talismans in independent cultures. Thus, the concentric eye patterns found in natural gemstones such as agate or onyx, closely resemble the eyes of fish (see Fig.8). Interestingly, in ancient Mesopotamian medicine, the "fish-eye stone", "papparmīnu-stone", lapis lazuli, and carnelian were mentioned as part of a set of thirteen stones that were used as talismans against waning hair (Scurlock, 2014). The "pappardilû" and "papparmīnu" stones were also prescribed to be used as stone charms against ghost-induced pain (Scurlock, 2014). Now, "pappardilû" and "papparmīnu" were banded agate stones with one and two white bands respectively (Parpola S, 2007), and as mentioned before, etched carnelian beads and banded agates imported from IVC were known as "fish-eye stones" and "eye-stones" (Donkin, 1998) in ancient Mesopotamia. Moreover, an inscribed Kassite eye-stone amulet bead found from the early iron grave from Daba of Oman is inscribed with Goddess Gula's name (Frenez et al., 2021), who was a Mesopotamian healing deity and patroness of doctors. Thus, it is evident

that such fish-eye-patterned gemstones (see Fig.8b-c), which were mostly imported from IVC (Howard-Carter, 1986 pp.305-306), were indeed used as talismans against evil forces at Near East, and the names of such stones arguably had ethnolinguistic connection with the apotropaic "fish-eye" symbolism. So, along with the linguistic aspects discussed in Section-5.1, there could also be an apotropaic-related cultural basis of using fish-logograms to denote "fish-eye-beads" or "eye-beads" of IVC.

Interestingly, in the Tamil Lexicon (University of Madras, 1936), the carnelian stone is recorded as "akki-k-kal", which literally means "eye-stone", as "akki" or "akṣi" means "eye", and "kal" means stone. Now, the age and etymology of this composite word is difficult to ascertain. The word "akṣi", which was also mentioned in Vedic texts, has a possibly Indo-European etymology (Bandyapadhyay, 1932-46). Moreover, the reference of "akki-k-kal" is sourced from a nineteenth century document (Manual of the Administration of the Madras Presidency, 1893). However, irrespective of this word's etymology, it is remarkable that carnelian has been referred to as "eye-stone" in the Indic context. Moreover, in Tamil Lexicon (University of Madras, 1936), the "tiger's eye" (sardonyx) and "cat's eye" stones (chrysoberyl) are recorded as "puli-k-kaṇ-kal" and "pūṉai-k-kaṇ-kal" ("puli" and "pūṉai" signify "tiger" and "cat" respectively, "kaṇ" means "eye", and "kal" means stones). These usages indicate the eye-related gemstone symbolisms prevalent in Indian contexts.

5.3 "Maṇi" - the Indus "fish-eye" word for apotropaic gemstone beads, fossilized in Mesopotamian documents

In my quest to find out the Indus word for gemstone-beads, I searched whether any ancient word of Indian languages encompasses the meanings "eye", "amulet", "gemstone", and "bead". Revealingly, there is such a word, which arguably was also used in IVC. The Indian word "maṇi", which is used in several Indo-Aryan and Dravidian languages, is attested to signify (i) "pupil of eye" or "apple of the eye"; (ii) "amulet"; (iii) "gemstone" and " supernatural gem"; (iv) "bead" (Turner, 1999; Tamil lexicon, 1924-36; Clough, 1892), strongly demonstrating the ethno-historical connection between these meanings. Now, our "pupil of eye" resembles the round "fish-eye". Considering that IVC's gemstone beads had natural or manmade circular "fish-eye" like apotropaic patterns (Kenoyer, 2013), and they were also used as amulets (see Section-5.2), "maṇi" seems to be an appropriate word for them.

Very strong evidence that "maṇi" was the Indus word for the amuletic eye-patterned gemstone-beads of IVC, comes from the fourteenth century BC letters of "El-Amarna Correspondence" (Rainey, 2014), which repeatedly refers to the Akkadian "maninnu" necklaces, which the Mitanni king Tushratta sent as gifts to his son-in-law, the Egyptian king "Nimmureya". These "maninnu" necklaces mentioned in Tushratta's letter were undoubtedly "maṇi-hāra" or "bead-

necklaces", as each of them was described as containing lapis lazuli beads and other precious stones ("ḫulalu", "ḫiliba" etc.) mounted in gold. Interestingly, as documented by Scurlock (2014, p. 293), "Lexical texts and the Agum Kakrime inscription mention pappardilu and papparminu stone as varieties of ḫulalu-stone".

So, the ḫulalu stone must have been some type of agate, as pappardilu and papparminu stones were specific types of banded agate stones (Parpola S, 2007). Hence, the Maninnu necklaces were closely associated with stones of Indus origin. i.e., lapis lazuli, and banded agate stones. As Parpola (2015) confirms, in the Akkadian word "maninnu", the "-nnu" part was an Akkadian suffix, added to the word "maṇí" or "mani", which is undoubtedly of Indian origin, and is also used in Ṛgveda (1,122,14) — maṇi-grīvá-, "wearing a maṇi-necklace on one's neck". Yajurveda has also mentioned 'maṇi-kāra' as jewellers (Macdonell & Keith, 1912 p.120). Evidently, since IVC was the exporter of such apotropaic gemstone beads coveted in Mesopotamia, the maṇi-word travelled from IVC to ancient Near East, and remained fossilized in certain texts in its Indus form ("maninnu"< maṇi). In other cases, "maṇi" was possibly used as calques or "loan translations" in Mesopotamian languages, translated as "fish-eyes" ("IGI-KU6" and "IGI-ḪA"), "Eye-stones" of Meluhha ("NA4-IGI-ME-LUḪ-ḪA"), and "fish-eye-stones" ("NA4-IGI-ḪA", "NA4-IGI-KU6"). This 'maṇi' word is still used across India to mean gemstones.

Also, in the context of analysing Asia's maritime bead trade, Francis (2002) shows how Sanskrit "Māṇikya", Tamil "Maṇikam", Hindi "Maṇi" and "Māṇek", Malay and Indonesian "manik" and "manik-manik" (plural), are all words meaning "bead", "beads", and "precious-stone". This study confidently claims that the ancient international "eye-bead" trading, which was initiated, and for a long time dominated by the Indus traders, made this Indus gemstone word so popular across South and Southeast Asia.

5.4 Possible Dravidian root of the Indus word "Maṇi"

Even though Parpola (2015, p.86) stated that the Akkadian word 'maninnu' "is one of the few Mitanni Indo-Aryan words that have been etymologically identified", I argue that this word "maṇi", although found in the earliest Vedic texts, was possibly of Dravidian origin. In Atharvaveda, "the second oldest text in Sanskrit" (Jamison and Brereton, 2014 p.4), we find numerous usages of the word "maṇi", which cover all kind of amulets made from different plant-based, animal-based, and mineral-based materials, used as protective charms, counter-witchcraft products, and magical instruments of attack (Bloomfield, 1899). Thus, the most ancient meaning of the word "maṇi" surely revolved around apotropaic meanings, not confined to signifying only gemstones. This goes well with my aforementioned conjecture, that the circular "fish-eye" patterns, the apotropaic symbols used in IVC, were associated with the "maṇi" word, which also meant "pupil of the eye".

This is why, IVC's etched carnelian beads and pebbles of banded agates were "cut to resemble closely a black/brown pupil and white cornea", and were called "fish-eye", "fish-eye-stones" and "Eye-stones" of Meluhha ("NA4-IGI-ME-LUḪ-ḪA") in old Mesopotamian texts (Donkin, 1998 p.50). So, the Mesopotamian phrase "eye-stone" ("NA4-IGI") might have been a calque of the Indus word "maṇi" signifying "pupil of the eye".

Thus, in ancient IVC, anything which had a round bead-like shape, could possibly be called "maṇi". But, in the Indo-Aryan languages of later India, the word "maṇi" has been mainly used in its reduced meaning of "gemstones", and "gemstone-beads".

However, across Dravidian languages, we find much wider usages of this "maṇi" word (Tamil-Lexicon). For example, other than meaning gemstones, "maṇi" also signifies small bead-like seeds in Dravidian languages, and is frequently used as a suffix to various plant-words to signify their seeds —e.g., kuṉṟi-maṇi, tāmarai-maṇi, kārā-maṇi, etc. (Brown, 1903; Tamil-Lexicon). Interestingly, the meanings of "maṇi" recorded in the Tamil lexicon include everyday objects and observations like "small round thing, as bead", "round sinkers attached to a net", "knot in a fishing net", "knuckle or joint of lobster, scorpion, etc.", "wattle on the throat of a sheep", etc. Moreover, 'maṇi'-based phrases for mundane observations, such as "maṇi-k-kaṭṭi" meaning the "bead-like formation on the surface of congealed substances, as ghee, lard", are also recorded in Tamil lexicon. These instances show that the word "maṇi" has a much deeper root and wider scope in the Dravidian culture. This wider usage of this "maṇi" word is not found in Indo-Aryan languages.

Many linguists claim that many words found in the earliest Vedic texts came from different substrata languages of non-Indo-Aryan origin (e.g., Witzel, 2019; Kuiper, 1955). Most importantly, according to certain linguists, the retroflex sounds used in earliest Vedic texts are indicative of ancient Dravidian influence (Mohan, 2021). As ingeniously argued by Deshpande (1979 p.298), "In the case of Sanskrit, the origin of retroflexion lies not so much in the Aryans' borrowing this trait from Dravidians in early times as in Dravidians' adapting Aryan speech to their native phonology".

Thus, the bilingual "ethnic non-Aryan segment of this Aryanized community" of the Indus valley region, who participated in the composition of the earliest Vedic hymns, possibly contributed to the genesis of Vedic retroflexion (Mohan, 2021; Deshpande, 1979 p.298). In a passage of Aitareya-Araṇyaka, certain Vedic sages instruct that when one is in doubt about whether a word should be pronounced with a dental "n" or a retroflex "ṇ", according to the teachings of sage Māṇḍūkeya, one should pronounce it with retroflex "ṇ" (Deshpande, 1979). As Deshpande contends, such passages conclusively prove that in the Vedic era, the doctrine of retroflex sounds such as "ṇ" or "ṣ", were not accepted by all the composers and reciters of the

Vedic hymns. So, the Vedic words that have the retroflex "ṇ", have more probability of being borrowed from the Non-Indo-Aryan languages. So, the use of the retroflex sound "ṇ" in the Vedic word "maṇi", reinforces its Non-Indo-Aryan, ancient Dravidian origin.

As observed by Vedic scholars, while being linguistically the closest text to Ṛgveda, Atharvaveda stands outside of the ritual system of the other three Vedas (Ṛgveda, Yajurveda, and Sāmaveda) and consists primarily of hymns and spells of a more "popular" nature, often magical or healing (Jamison and Brereton, 2014 p.4). The hymns of Atharvaveda also indicate that its composers had in-depth understanding of several medicinal plants, and medicinal qualities of various animals, which is expected only from indigenous people, living for thousands of years in the subcontinent. Thus, it is possible that some of the composers of Atharvaveda, who belonged to certain indigenous bilingual tribes, used certain non-Indo-Aryan indigenous words in the scope of their original wider connotations. This possibly explains the reason that the Indus word "maṇi" was used so many times to signify amulets or charms, not gemstones, in Atharvaveda. It is quite possible that 'maṇi', the Indus word for apotropaic beads, was initially coined by the ancestral Dravidian speakers of IVC. Thus, the word retained its wider semantic scope only in today's Dravidian languages.

6. Possible Meaning Variations of different Fish-signs

Various ISC fish-signs are constituted by making small modifications on the basic fish grapheme  of ISC (Fig.1a)., which is also the most frequent fish-sign , occurring in more than 450 inscribed objects recorded in ICIT. Other frequent fish-signs are: (c. 350 ICIT occurrences)  , (c. 250 ICIT occurrences), (c. 190 ICIT occurrences), and (c. 90 ICIT occurrences). Often, multiple fish-signs occur adjacently in the same inscription (e.g.  , of Seal H-1678).

Now, though archaeological, historical, and linguistic evidence indicates that these fish-signs had meanings related to gemstones, beads, and possibly other shiny precious materials and related trades and crafts, how their individual meanings differed from each other is not clear yet. One possibility is that since the Indus people made various types of precious shiny materials and artifacts, such as gemstones, glazed steatites, faience, highly polished metallic artifacts, etc., they needed different types of mutually related signs to signify such object categories. Even among bead-making materials, wide variations existed. For example, Indus people used extremely expensive gemstones (e.g., lapis lazuli, carnelian, banded agate), comparatively less expensive gemstones (e.g., turquoise, jasper, quartz, green felspar, onyx, haematite, limestone, serpentine, breccia), precious metals (gold, silver, copper, bronze), and less costly materials (e.g., shell, steatite, faience, clay, vitreous paste, etc.). Since the prices, and

tax-rates or licensing rates of such materials could have differed a lot, different signs for different categories might have been used. Alternatively, some of the fish-signs could also have signified licensing of different types of lapidary and craft-making activities such as gem cutting, glazing, etching, metal polishing, etc.

Interestingly, the most frequent fish-sign is very often preceded by numerical stroke signs. For example, in around 131 inscriptions recorded in ICIT some stroke numeral has preceded : (68 inscriptions) , (6 inscriptions), (20 inscriptions), (15 inscriptions), (2 inscriptions), (2 inscriptions), (1 inscription), (4 inscriptions), (1 inscription), (12 inscriptions), (1 inscription). But fish-signs other than , are very rarely preceded by Stroke-numerical signs, and there are only around 15 such inscriptions recorded in ICIT— e.g. (H-25), (M-1266), (H-440), (M-951), (M-1910), (M-1982).

Sign might have contextually signified the most general category of the commodity types signified by the fish-signs (e.g. 'gemstones'), and the metrological/revenue standard related to that general commodity-type. Thus, the numerals preceding possibly contextually denoted the licensing-fees, tax-rates, or barter based equivalencies related to such commodities and associated trades/crafts. The other fish-signs possibly signified more specific meanings related to gemstones, lapidary activities, and other shiny-precious materials signified by them.

7. Fish-sign with bead-sign on a "gemstone-bead" container?

The absence of any "Rosetta Stone" like multilingual multi-script Indus document has been often stated as one of the main reasons that ISC is not yet decoded. However, ancient inscribed implements that are not multilingual/multi-script documents, may also help in the decipherment of inscriptions. This is because the inscriptions engraved on those implements are often related to their functionalities, which can help us to narrow down and infer the semantic scopes of such inscriptions, and facilitate their decoding.

For example, a 1700 BC ivory comb excavated from Tel Lachish, which was used for removal of lice from the hair of head and beard, and has yielded the remains of head lice, contains a functionally related seven-word inscription in early Canaanite script of pictographic style. Its inscription read "ytš ḥṭ ḏ lqml śʿ[r w]zqt", meaning "May this tusk [ivory comb] root out the lice of the hai[r and the] beard" (Vainstub et al., 2022). The purpose (lice removal) and material of this ivory comb, and the linguistic and metonymic tradition of the related civilization (e.g., the tradition that ivory combs were referred to as "tusk" or "ḥṭ") have enabled the researchers to decode the script. Similarly, as discussed in Ansumali-Mukhopadhyay, 2024b, the occurrence

of sign  on a goldsmith's tool has reinforced its decoding as the crucible-blowpipe symbols used to signify gold/precious-metal/goldsmithing related meanings. As discussed below, another unusual inscribed object of IVC, that has a fish-sign and a bead-string-like sign engraved on it, can help us to identify the object's functionality, reinforcing our gemstone-bead related hypotheses

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7.1 The inscribed "drain-pipes" of Kalibangan

Regarding the artifact shown in Fig.9A, the Kalibangan excavation report's volume-1 (Lal et al. 2015 pp.556) writes the following:

"Two pieces of wheel-made, well-fired terracotta pipes, which may have been used for water drainage, bear inscribed signs. One of them (Fig. 9.91, No.2) bears the fish symbol (M-List No. 59). while the other (Fig. 9. 91, No. 1) has three interconnected vertical ovals, one below the other, the middle one having a vertical stroke inside (cf. M-List Nos. 415 and 417). The Reg. Nos. respectively are No. 21582 and No. 21583 These were found from a late level in, Sq ZA8 of KLB-1."

The report (p.74) also mentions that those 'drain pipes' were "not in situ". The volume-2 of the Kalibangan excavation report (Lal et al., 2020) states the following:

"KLB-1, has yielded two examples of terracotta pipes from a residential area in trench No. ZA8, Qd. 3. Both were discovered in the big house of an important person, which belonged to Phase V. Both are wheel-made, out of which one is intact and [the] other slightly damaged. One pipe is joined with another by a rim which could be entered into another pipe to hold it [Fig.20.4(b)]. The pipe is 26 cm long up to the rim. The rim has having a width of 4 cm and a dia. 11.8 cm. The dia. of the other end is 14.5 cm. The pipes were an important object and are marked by an incised chain and the fish symbol. After joining these pipes, the total length of the pipes is 56 cm. From a late level of Period II. (KLB-1, Reg. No. 21582 and 21583)."

7.2 Drain-pipes repurposed to make quiver-like protective containers to keep gemstone bead strings?

The way modern human beings repurpose various kinds of tools, prehistoric people also did the same. For example, see the article Cooper, 2024, titled "Prehistoric Repurposing of Mississippian Dover Tools". Another article (Raczek et al., 2018) titled "Artifact Reuse and Mixed Archaeological Contexts at Chatrikhera, Rajasthan", explores how various ancient Indus artifacts are being repurposed by modern villagers of India, to understand how similar repurposing and recycling of artifacts might have happened in prehistory. In my opinion, these two drain pipes were also repurposed as a quiver-like container of bead strings, or beads stuck

Figure-9 Inscribed ancient "drain-pipes" found (not in situ) from an excavated house of Kalibangan (A, B), and examples of similar drain-pipes used in Mohenjo-daro (C, D)

around sticks (see AI generated schematic images of Fig. 10). The fish-sign 𓆟 here signified gemstone, and the bead-string sign 𓏽 signified beads, indicating that it was a "gemstone bead" container. The reasons behind these hypotheses are as follows:

i. The drain-pipes were inscribed. Why would someone scribble Indus script signs on drain-pipes, which will not be visible when installed inside walls or floors? In case such artifacts are at all inscribed, those inscriptions are expected to be stamped inscriptions that were applicable to many such artifacts for providing useful information about their manufacturers, their materials, their quality, etc. But these signs were incised by someone after the drain pipes were made.

The inscribed signs are also not random. One drain-pipe is inscribed with sign 𓏽 . Here only the middle oval shows the vertical line 𓏽 ,but that seems to be the lack of aesthetic motivations or the haste of the scribe, who engraved the sign for its meaning, not its decorative look. Now, the sign 𓏽 is already found in a Kalibangan seal (see Fig.7B). So, it is expected to have a standard commercially important meaning, which according to our hypothesis is related to beads and lapidary crafts. The other drain-pipe contains a fish-sign, which according to our hypothesis, signifies gemstones. As discussed in Section-4.2, and shown in Fig.7A, in multiple seal inscriptions, gemstone related fish-signs have co-occurred with bead-string like signs 𓏽 or 𓏽 . So, their co-occurrence on these pipes should also not be accidental.

ii. The drain-pipes were not found in situ. This means that unlike the drain-pipe of Mohenjo-daro shown in Fig.9D, these two drain-pipes were not found as built into a wall. Then what were they used for?

Certain plausible scenarios might explain this puzzle:

- The owner of these drain-pipes did not want to install them inside a wall for drainage purposes. They were repurposed as a quiver-like container. The inscribed signs indicated the contents of the container. It is possible that a merchant packed strings of valuable and fragile gemstone beads inside these drain-pipes, carefully tied their joints with strings and covered their ends with perishable materials such as clay, wooden lids, or leather, and scribbled the signs on the container, so that without opening it, its content could be known. The same container might have been retained by the recipient owner to store similar things. Drain-pipes with telescopic joints might have been quite handy for an artisan for storing bead-sticks of varying lengths, as by simply adding or removing a pipe, the container's length could be easily changed. Please check the AI generated images in Fig.10, that explains such designs.

- Another interesting possibility was that the drain-pipes were built into a wall, but were actually used as a hidden storage of valuables, such as precious metals or gemstone beads. The ISC signs were used so that the owner could easily check which pipe contained the valuables when he needed to access them in urgency. Various hordes of precious commodities have been retrieved from Indus sites, which were securely buried under the floor. This might have been another such innovative hidden storage facility. If this seems too far-fetched, one might explore how fake walls, fake plumbing pipes, false ceilings, fake bookshelves, or mattresses are used to hide valuable things in modern homes. For example, a recent article at https://newsukraine.rbc.ua/news/5-unexpected-ideas-for-hidden-storage-in-1722640177.html suggests the following: "A curtain rod, a mop handle, or any empty pipe that opens and closes easily can serve as a great hiding place for money. Just roll the bills into a cylinder, like American criminals do in the movies. It's also important to attach some string to the money for easier retrieval from inside the pipe." In ancient Kalibangan, bead strings could have been similarly secured in a secret marked chamber in a wealthy merchant's house. Truth is often stranger than fiction.

However, I believe that Scenario-A, where drain-pipes were used by merchants as protective containers for storing and transporting precious and fragile items, is a much more likely scenario. To check what a generative Artificially Intelligent system will think about the scenario, I asked ChatGPT, "In what ways could the people of Indus civilization repurpose

their drain pipes? Please explain with examples." ChatGPT gave the following answer, which twice mentioned the possibility of ancient drain-pipes being used as containers of beads, jewellery, and related tools:

"The Indus Valley Civilization was known for its ingenuity, and terracotta drain pipes could have been repurposed into containers for various uses. These cylindrical, durable structures would suit many practical applications.

For storage, pipes could hold grains, spices, or liquids like water and oils, keeping them protected and dry. Smaller pipes could serve as organized storage for beads, threads, or tools used in crafting and jewelry-making.

Repurposed pipes might also serve in cooking and food preparation, as terracotta withstands heat. They could store fermented products like curd or act as roasting vessels. Pipes could function as quivers for arrows or storage for farming tools, combining practicality and portability.

In rituals, pipes might hold sacred offerings, ashes, or burial items. For gardening, they could be used as planters or water channels in small irrigation systems. Broken pipes might even transport valuable trade goods like beads and spices.

Decorative uses were likely too, with pipes arranged as columns or adorned artistically. Their adaptability extended to communication, serving as primitive horns."

In a reverse process, I uploaded an image of the joined inscribed Kalibangan drain-pipes at https://gemini.google.com , and asked Google's generative AI Gemini to analyze it. Gemini could recognize it as a "prehistoric vessel", made of terracotta, and stated its possible use as a storage container. So, at least from the viewpoints of unbiased AI systems, my conjecture regarding the functionality of these drain-pipes is logical and plausible. So, my decoding of the "drain-pipe" inscriptions, that support this article's hypotheses regarding the fish-signs and bead-string signs, also seem quite plausible and logical.

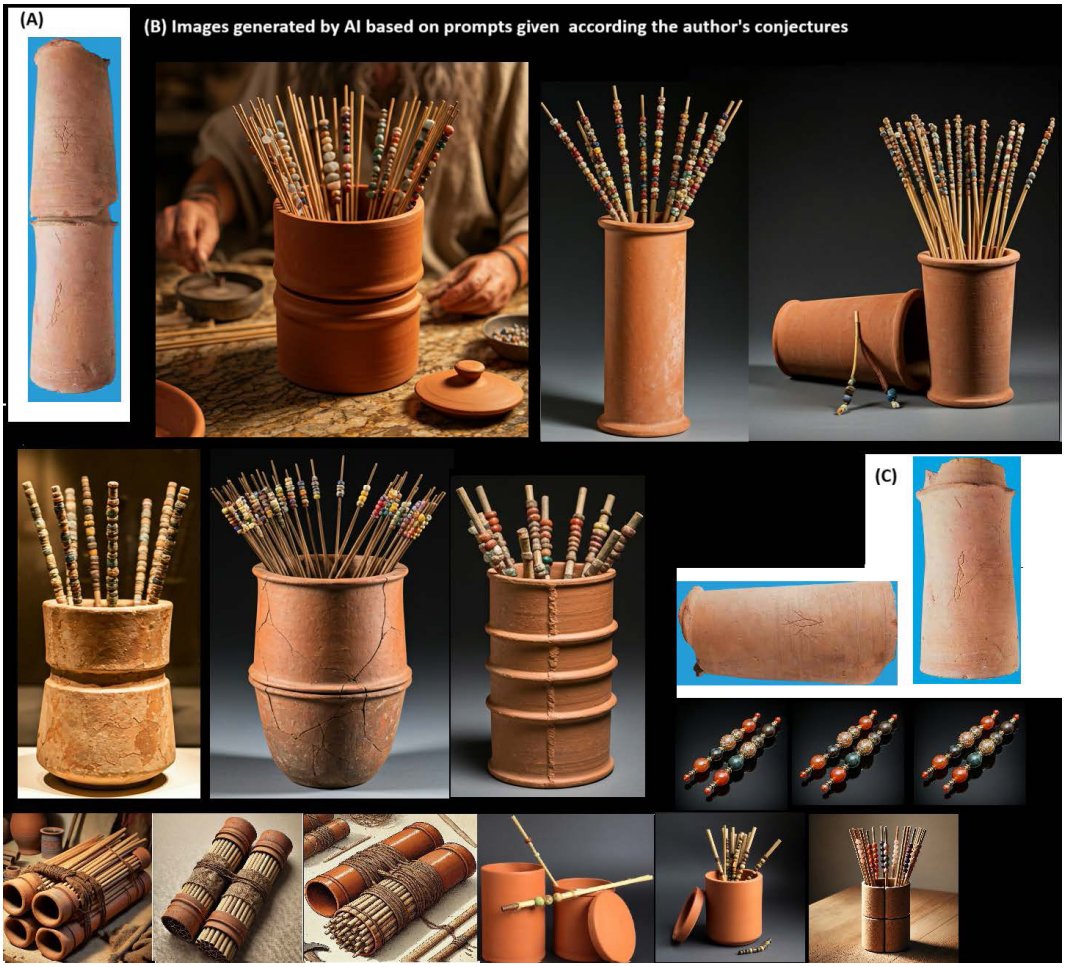

Figure-10 AI-generated schematic visualizations of repurposed drain-pipes used as containers of gemstone bead strings stuck on sticks (B), and their comparison with the inscribed drain-pipes of Kalibangan (A, C). All the AI-generated images are kept in black background and the images of actual Indus artifacts are given white backgrounds to avoid confusion.

8. Conclusion

This article attempts to decode certain ISC-signs based on the archaeological contexts of their inscriptions, the script-internal relationship of these signs with certain other decoded signs of Indus script, and by comparing the ancient symbolism used for the commodities found in the archaeological contexts of these signs, with these signs' iconicity. This is possibly a novel approach for decoding Indus script, not present in any existing research on ISC.
The hypothesis that the Proto-Dravidian root-verb "*mīn", which signifies "to shine," "to glitter," and "to emit lightning", has been used to derive the Dravidian nouns for "fish", and "gemstones", should explain the affinity of Indus script's fish-sign inscriptions to lapidary contexts. In this context I also want to mention that the Persian word 'minakari' ('میناکاری'), which means "enamel" or "azure," referencing the bright, glass-like finish that resembles the clear blue of the sky, may also be linked to this "mīn"-based Indus word of ancestral Dravidian origin. Like Persian, even in Telugu, "minnu" means sky or heaven (Gwynn, 1991 p.422).

The way the Proto-Dravidian elephant-word 'pīlu' used by the Indus ivory-traders travelled from IVC to ancient Near East through ivory trade, and remained fossilized in their vocabulary (Ansumali-Mukhopadhyay, 2021), the "mīn"-based Indus-Dravidian word for gemstones, shiny glittering things, and polishing, might have also remained preserved in the ancient languages of Persian Gulf as a loan-word.

It is quite possible that the glazed "compact glassy faience" of IVC (https://www.harappa.com/content/reconstruction-faience-tablet-manufacturing), which was often made in blue colour to imitate "deep azure blue lapis lazuli", and "blue-green turquoise" (https://www.harappa.com/indus2/174.html), was the original inspiration of the Persian word "Minakari". Interestingly, in Egyptian Hieroglyphs, the other meanings of the hieroglyph used for faience () are "sparkle, shine, coruscate, lightning, lightning-stone, and blue-glazed faience." That hieroglyph also uses the hieroglyph of 'sky' or 'heaven' as one of its components (Budge, 1920 p.cxxiv).

Interestingly, Dravidian "mīn" based words also mean sparkling, lightning, gemstone, bright coins, and sky. This validates my conjecture that the same symbolisms have been used in different civilizations for these meanings, though their graphemic and linguistic forms have been different based on the civilizational cultures and linguistic traditions. So, the Indus-Dravidian mīn-based words seem to be very strong candidates as the root-word of the Persian word Mīnākārī. Later, when the craft of enamelling metals and ceramic tiles (initially mainly in blue colour) further flourished in Iran, this word might have been reused to coin the "mīnakari" term for enamelling. Thus, it might later have come back to India, disguised as a Persian word. Future researchers should explore the validity of this intriguing conjecture using archaeological, historical, and linguistic evidence.

Also, "maṇi", the Indus word for apotropaic "fish-eye" beads, which has been fossilized in ancient Near Eastern documents both in its original form ("the 'maninnu' necklace"), and its calque-form "fish-eye stone", corroborates the use of fish-symbolism for gemstone beads in ancient IVC. The possible Dravidian origin of "maṇi", and the typical Dravidian homonymy used for the "*mīn"-based fish-words and gemstone-words, indicates that the fish-symbolisms used in Indus script signs possibly have an ancestral Dravidian origin. My conjecture regarding the functionality of a quiver-like container made by repurposed drain-pipes also helps us to understand why a fish-sign and a bead-string-like sign was inscribed on it.

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