Tales that ancient letters tell

INSCRIPTIONS ON AN ARCHAIC CLAY OBJECT HAVE BROUGHT PERSIAN HISTORY TO LIFE FOR THE PEOPLE OF MUMBAI, WRITES **S ANANTHANARAYAN**

An example of refinement of a pictogram, which means "head", to a cuneiform symbol can be seen in this panel.

The *Cyrus Cylinder*, an artifact dating to the sixth century BCE and in the possession of the British Museum, is on display at the Chatrapati Shivaji Maharaj Vastu Sangrahalay, Mumbai. The exhibition is curated by Dr John Curtis, keeper of the Special West Asia Projects, British Museum, who explained the history and the importance of the artifact at a public lecture at the Mumbai museum premises last Saturday.

The Cylinder is about eight inches long and three inches in diameter and is covered with writing in the *Akkadian*, or *Assyro-Babylonian cuneiform* script, which describes the acts of Cyrus, the Persian King who captured Babylon from Nabonidus and brought the place into the Persian Empire. The writing on the Cylinder, which was placed in the foundation, as was customary, of a wall that Cyrus rebuilt in Babylon, records that King Cyrus did not sack and destroy the city after its capture, but let the citizens live in freedom, returned idols of other temples in the region and repatriated displaced people. The document has hence been described as the "earliest charter of Human Rights", but the view has been contested by some as typical of history recorded by a monarch consolidating his victory. Dr John Curtis, however, drew attention to the corroboration of the Cylinder in other records, particularly some of the books of the *Bible*, which speak of repatriation of the Jews.

Neil MacGregor, director of the British Museum, has in fact described the Cylinder as the "the first attempt we know about running a society, a state with different nationalities and faiths — a new kind of statecraft." Ancient inscriptions were written in clay using a stylus made of reed, which left a wedge-shaped impression — hence the word *cuneiform*, which means "wedge-shaped".

The earliest instances are of the Sumerian settlements in the Babylon region, dating to the fourth millennium BCE and these were pictograms, or writing with symbols, which pictorially resembled objects. Over the next millennium, the script was improved and abstracted, with the number of symbols used being reduced from about 1,000 to about 400, by the second millennium BCE. The authoritative study of the script by Rüster and Neu lists 375 cuneiform signs that replaced over 600 signs used earlier, and about half of these had syllabic or sound values, the remaining being ideograms or logograms, which are like the signs, "%", "&" or "@", as opposed to the letters of the alphabet in modern English. Scripts have progressed, in this way, to lead to forms of rudimentary alphabetic script and all the important primitive scripts, with the exception of the *Indus Valley* inscriptions, have been deciphered. The cuneiform of the Cyrus Cylinder is, thus, well understood and in some other tablet inscriptions, where passages from the Cylinder have been repeated, scholars have even been able to recognise a similarity of the handwriting!


The Indus Valley script also shows a pattern. For instance, the diamond shape, as shown in the picture, is often followed by the two parallel lines symbol and then there could be the fish shape and other signs. But never the man shape or the arrow shape, shown in the lower part of the picture. And then, there were signs that often appeared at the end of the text, like the jar shape shown in the picture.


Dr John Curtis, keeper of the Special West Asia Projects, British Museum, and Sabyasachi Mukherjee, director-general, Chatrapati Shivaji Maharaj Vastu Sangrahalay, Mumbai.

The pictures of an eye and a house could build a sentence as shown in the box to stand for "May I see you home?"

Deciphering

Deciphering of scripts is carried out by identifying symbols that appear the most frequently, finding patterns in the use of symbols and then through imaginative interpretation. When a symbol appears frequently at the start of writing, which may be royal edicts, for instance, the symbol could mean "the king". Once this symbol is identified, another symbol that often, or always, appears with the first symbol may mean "great". The same word appearing in another text that seems to describe a hunting trip may indicate a "great lion", which provides the word for lion, and so on. In a similar fashion, where there is information about the pronunciation of words, through derived languages that are in use, the phonetic import of symbols can be made out.

While reconstruction of the ancient language from the fragmented records available has been possible in many cases, this is not so with the Indus Valley script (3300-1300 BCE), mainly because the available material is sparse and also that we have little knowledge of how the words sounded. There are conjectures about the Indus Valley script — one that it is not really a script, another that it belongs to the Indo-European language family and yet another that it belongs to Dravidian languages, which were perhaps once current in north India.


An Indus Valley seal.


The Cyrus Cylinder.

While deciphering the script thus presents a great challenge, there are some features that can be made out. One, from inspection of samples of Indus Valley seals, is the direction of writing. The inscription on some seals seems to get crowded to the left, which would suggest that the inscriber found that he/she was running out of space towards the left. This would indicate right to left writing on the seal, which may be left to right when the seal was used to make an impression, but in any case, it shows the progression of the writing and also directionality, which is a characteristic of scripts.

Another feature is whether there are patterns. For instance, in the English script, we know that the letter "q" is always followed by the letter "u". And the next letter must be one of the vowels. It turns out that the Indus Valley script also shows a pattern like this.

All this data can be fed to a computer, which can use statistical principles to evaluate the sign that is most likely to follow a string of other signs. The computer can then be tested by erasing a few signs from an existing string and asking the computer to say what signs there should have been. The tests showed that the computer was right about 75 per cent of the time. On the one hand, this indicates that there is a clear pattern in the symbols and they are a real script. And then, this can be used to fill in the signs that are missing in a damaged seal, thus generating more real data as bases for analysis.

On way of analysing the inscriptions is to assess the level of order or disorder in the series of signs. For instance, a random series of alphabets like this: *adhesuucwmopdrh* represents disorder. But a series like *ddddddddddddd* is highly ordered. A real sentence, like, "Thirty days hath September", is an instance of the second example. Nature tends to increase the level of disorder, which is the same thing as energy getting expended, or water seeking its own level. This means a meaningful series of symbols, like a real sentence, needs energy to create and represents order. Analysis of the signs in the Indus Valley script shows a level of order that compares with real language sentences, which shows that they are real scripts.

In fact, Dr Rajesh Rao, a researcher in the field says certain unusual patterns in this script have been found as far afield as in Mesopotamia. As the Indus Valley people were known to have wide trade contacts, the unusual patterns probably represent foreign words spelt by visiting traders!

Having found that the Indus Valley script is a real writing, the question is to find out what it means. A suggestion has arisen from the observation that many of the symbols are like humans, insects or animals. Now, many ancient scripts use the *Rebus* principle, or the idea that pictures could represent sounds, without reference to the meaning.

Using this idea, some of the Indus Valley seals have been interpreted to mean names of important constellations, in Dravidian languages, to support the theory of Dravidian origin.

But we really do not know. We only know, from the fascinating display of artifacts and their meaning, in the exhibition of the Cyrus Cylinder, on at Mumbai, that ancient scripts have much to tell us of how our ancestors thought and lived.

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FIGHT AGAINST CANCER

THE IMMUNE SYSTEM, WRITES **TAPAN KUMAR MAITRA**, CAN INHIBIT THE DEVELOPMENT OF METASTASES

Does the body have any defenCe mechanisms for protecting against the development of metastases? One possibility is the immune system, which has the ability to attack and destroy foreign cells. When cancer cells circulate in the bloodstream, where cells of the immune system travel in large numbers, they are especially vulnerable to attack. Of course, cancer cells are not literally of "foreign" origin, but they often exhibit molecular changes that might allow the immune system to recognise the cells as being abnormal.

Animal experiments suggest that in some cases, attack by the immune system does limit the process of metastasis. One such study by Michael Feldman and Lea Eisenbach involved two strains of mouse lung cancer cells: D122 cells that metastasise with high frequency and A9 cells that rarely metastasise. In general, the immune system's ability to recognise cells as foreign or abnormal depends on the presence of cell surface proteins called Major Histocompatibility Complex molecules. When Feldman and Eisenbach examined the MHC molecules carried by the two lines of tumor cells, they discovered a striking difference: A9 cells carry two types of MHC (called H-2K and H-2D), whereas the D122 cells express only one form, (H-2D).

The discovery that D122 and A9 cells carry different cell-surface MHC molecules raises an important question: is the differing metastatic behaviour of the two cells related to the immune system's ability to recognise and attack the two cell types? This issue was investigated by injecting A9 and D122 cells into separate groups of animals and monitoring the production of Cytotoxic T Lymphocytes, a class of immune cells specialised for attacking foreign and abnormal cells. The animals were found to produce numerous CTLs targeted against A9 cancer cells, but few CTLs targeted against D122 cells.

Why do CTLs attack A9 cells more readily than D122 cells? The most obvious possibility is that the immune system recognises the H-2K MHC molecules, which are carried by A9 cells but not by D122 cells. This hypothesis was tested by introducing purified DNA containing the H-2K gene into D122 cells, thereby causing the D122 cells to produce the H-2K form of MHC. As predicted, the altered D122 cells expressing H-2K exhibited a reduced capacity to metastasise when injected into mice, suggesting that the presence of H-2K made the cells more susceptible to immune attack.

However, the primary tumor at the injection site grew normally, implying that tumor cells attempting to metastasise through the circulatory system are more susceptible to immune attack than are tumor masses lying outside the bloodstream.

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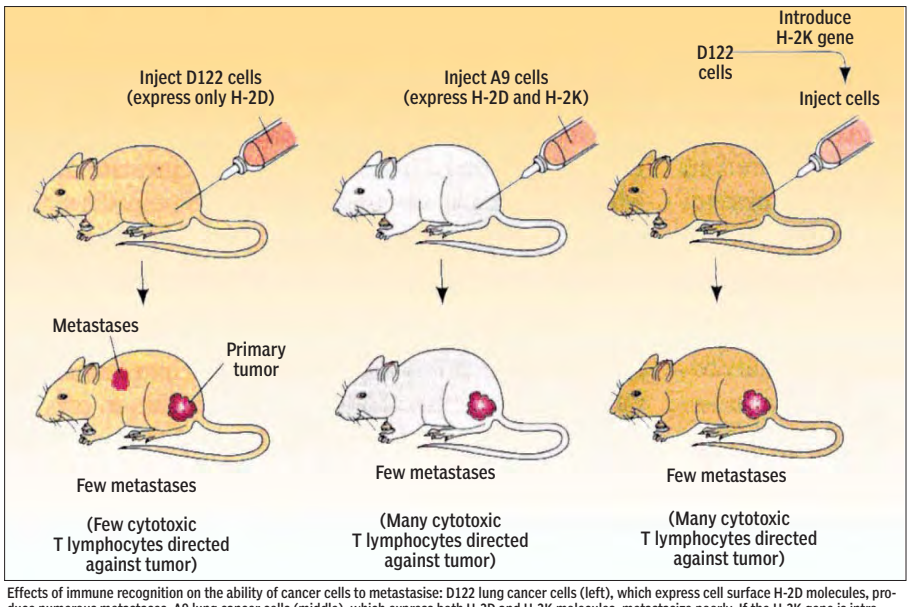

Effects of immune recognition on the ability of cancer cells to metastasise: D122 lung cancer cells (left), which express cell surface H-2D molecules, produce numerous metastases. A9 lung cancer cells (middle), which express both H-2D and H-2K molecules, metastasize poorly. If the H-2K gene is introduced into Dill cells (right), the cells lose their ability to metastasise. Since H-2K is a cell surface MHC molecule recognised by the immune system, such studies suggest that immune recognition influences the ability of cancer cells to metastasise.

PLUS POINTS

Highly inbred

A study has shown that Neanderthals took the idea of the close-knit family a little too far. DNA taken from the 50,000-year-old toe bone of a Neanderthal woman found in a Siberian cave in the Altai Mountains has shown that she was highly inbred.

Experts believe the inbreeding is the outcome of Neanderthal populations being very small. Scientific tests revealed that her parents were either half-siblings who shared the same mother, an uncle and niece, an aunt and nephew, or a grandparent and grandchild. Alternatively, they may have been double first cousins.

The DNA studies have now proved that Neanderthals and modern humans interbred, a question scientists have disagreed over for years. In fact, it is currently estimated that between 1.5-2.1 per cent of the genomes of modern non-African people can be traced to Neanderthals. Although they made tools and weapons, it is thought that Neanderthals did not survive as a human sub-species in the same way modern humans do because they lacked the inventiveness and social structures that has seen the latter flourish.


The 50,000 year-old toe of a woman found in Siberia holds the clues to inbreeding between sub-human species.

The findings, published in the journal *Nature*, also determined that Neanderthals and Denisovans were also closely related and identified at least 87 specific genes in modern humans that stand out as significantly different from any found in Neanderthals or Denisovans.

According to Dr Svante Paabo, who led the international team behind the project, the list of genes contains a "catalogue" of features setting modern humans apart from all other creatures, living or extinct.

Funny smelling planet

The giant planet GJ 436b in the Leo constellation is missing something — and that something is swamp gas. To the surprise of astronomers who have been studying the Neptune-sized planet using the National Aeronautics and Space Administration's Spitzer Space Telescope, GJ 436b has very little methane — an ingredient common to many planets in our own solar system.


This artist's concept shows the unusual, methane-free world partially eclipsed by its star. Models of planetary atmospheres indicate that any world with the common mix of hydrogen, carbon and oxygen, and a temperature of up to 1,000 Kelvin (1,340 degrees Fahrenheit) should have a large amount of methane and a small amount of carbon monoxide. But at about 800 Kelvin (or 980 degrees Fahrenheit), GJ 436b does not. The finding demonstrates the diversity of exoplanets and the need for further study.

Insect-derived vaccine

A new vaccine for influenza has hit the market, the first ever to contain genetically modified proteins derived from insect cells. According to reports, the US Food and Drug Administration recently approved the vaccine, known as Flublok, which contains recombinant DNA technology and an insect virus known as *baculovirus* that is purported to help facilitate the more rapid production of vaccines.

According to Flublok's package insert, the vaccine is trivalent, which means it contains genetically modified proteins from three different flu strains. The vaccine's manufacturer, Protein Sciences Corporation, explains that Flublok is produced by extracting cells from the fall armyworm, a type of caterpillar, and genetically altering them to produce large amounts of hemagglutinin, a flu virus protein that enables the flu virus itself to enter the body quickly.

So rather than have to produce vaccines the "traditional" way using egg cultures, vaccine manufacturers will now have the ability to rapidly produce large batches of flu virus protein using GMOs, which is sure to increase profits for the vaccine industry. But it is also sure to lead to all sorts of serious side effects, including the deadly nerve disease Guillain-Barre Syndrome, which is listed on the shot as a potential side effect.