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## STUDY OF DEVELOPMENT OF SCIENCE IN PRE VEDIC PERIOD: The Triumph of Science Begins

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### Abstract

In this paper researcher tries to explore scientific development in Pre Vedic period i.e stone age to bronze age in Indian subcontinent. At the early stone age man invented weapons consist of stone to survive. Then they discovered how to protect themselves from coldness of nature and they invented leather garments. By their daily life experience they found how to create fire. Then they invented more developed weapons which is consist of bronze which is more sharp then stone. Then researcher presented how a well planned civilization was established in that time i.e Indus valley civilization. Indus valley civilization was first step towards city life culture of modern age. Researcher explained how scientific development occurred in this period with daily life experience. How man used knowledge of observation to their daily life. Also elaborate the scientific approach of the human being such as development of transportation system , knowledge of geometry to construct buildings.

**Key words:** stone age, weapons, Indus valley civilization, scientific knowledge, geometry, bronze, scientific approach

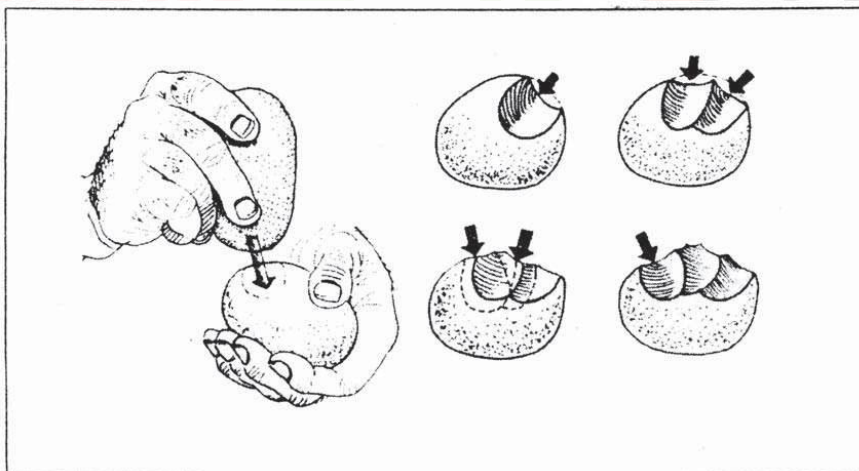
## Introduction:

Development of human civilization depend not only nature but also how man can utilizes the natural sources to comfort him or to fight against unwanted elements of environment. Progression of human civilization always depends on progression of science. Ancient Indian civilization was not exception of it. Feeling necessity of science in society man developed science and technology more and more. In living with nature they got experience and collect progressive knowledge which was nothing but science. Application of scientific knowledge changes human life how much should be kept in our knowledge. Evolution of science is not happens in a single step a continuous process and reached to its modernity. In discussing history of science researcher can understand the present situation and can find out way of control future situation. The emergence of science occurred in the Indian subcontinent in 2million B.C in the form of weapons and tools made of stones. The evolution of science and technology from stone made weapons, fire making, wheel invention ,copper made tools, to utilization of bronze happened in Pre Vedic period. Study of development of science from Pal Eolithic to chalcolithic period also inform of understanding of our course and context of hominine culture evolution. while our present status is distinguish from any other living animals by utilization of science, remarkably little is known about the evolutionary of this adoption .under what circumstances did it emerge and fluoresce and how might we use the inferences of prehistoric culture to understand the past of human as well as present and future. In this chapter researcher follows progression of science in pre Vedic period and its impact on human civilization.

## Stone age ; an approach of scientific analysis

In first situation man collect food from and then by huntig. They invented weapons to hunt or fight against ferosious animals. These weapons were made of stones and process of making this weapons has a scientific aspect .before making weapons, the form of the weapons is the imagination of the maker.the various steps in making weapons consisting of high and low sharp edges from a round stone were.[1]

Fig-1



- 1) First striking the edge of round stone with a hammer like another stone
- 2) &3) cutting of two choklas in this way
- 4) Repeating the same procedure on the opposite side of the stone.
- 5) After cutting off one more chokla the tool becomes composed of up down sharp edge

In time of making such weapons they found some materials are hard and some are soft. From this they gained basic knowledge of physics.

Near about 3000 b.c in the Longghonch of Gujarat some small weapons was found in India i.e microlith. Microlith were consist of stones adjusted with bone or woods. This instrument was used for cutting woods, to dick to sew. There was found clay pots in 6000 b.c

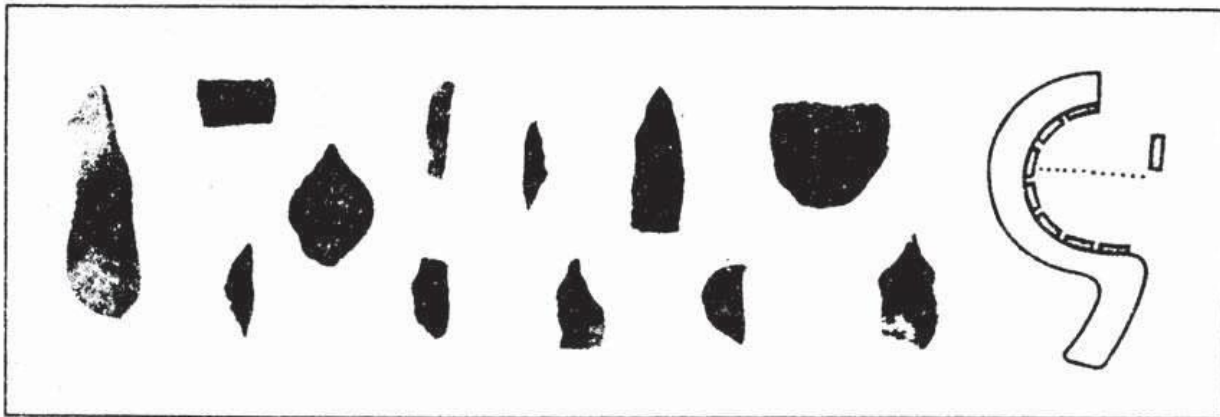


Fig 2

This kinds of weapons found more near small river, although this places have been destroyed. Ogate and onyx fine tools also found which had been sharpend by grinding or tooth cutting.

A comparison of these with the tools of Bushmen of Africa today suggest that they were part of longer machine. These tools were adjusted with wood or animal horn bones mined with vegetable oil or anything else to make spears ,arrows, knives, sickles and harpoons.[2] this stone tool were used for many purposes like cutting woods, hollowing, skinning animals, cutting meat, loosening muscle fibers under the skin[3]. Several narrow sharp and pointed stone probably served as needles or awls for sewing leather. Animals weapons were used for sewing. Some of the tools are shown in the figa(3)

- 1) A heavy knife
- 2) Bamboo splitting
- 3) Ancient hand kurul
- 4) A machine for digging up soil
- 5) Griding machine
- 6) Wood chiping macine
- 7) Batali
- 8) To bore fine needles by making parllel cracks in antlers deer
- 9) Knife blades
- 10) Used for cutting meat
- 11) Multi cornered stpne
- 12) For beating or throwing animals

Fg3



Fig-4

- 13) Hand knuckles of the later age
- 14) skinning of dead animals
- 15) boil
- 16) for skinning of animals
- 17) paring knife
- 18) to clean the hides of animal
- 19) ballam
- 20) for hunting animals by throwing

Long before pottery, baskets and leather produced weave used for traditional food storage and preservation purpose some pottery dating back to around 6000 b.c has been found various region of india. [6]

### **Clothing idea**

The idea of clothing developed long before learning to weave, perhaps from the practice of transporting food and tools. These clothes were tied at the hair, neck, waist, wrists and ankles. animal's skin, bones, feather etc, were added to the cloths. A notable discovery of this period was that the furry animal skin, kept human body warm. Also the use of animal skin for clothing brought special benefit to the people. As a result of this they were able to roam more areas and survive the winter.

### **Invention of fire and utensils**

It is not known exactly where and when the use of fire started. Initially people seemed to have feared fire. Slowly man learned to control fire. Then they saw that fire was a very useful for warding off the cold, for scaring away the wild animals. Suddenly they discovered cooking by charred meat. As a result hard meat could be eat easily and it was also tasty. As soon as people learn to use fire for cooking, they probably learned to use fire for making pottery and melt metal to make tools. There was a problem of heating or boiling water. In the early days water was heated by placing heated stone in the leather pouches. Stones cracked by heating followed by sudden cooling. This was found prehistoric sites. However it was discovered by accident in the late stone age even though these clay pots are cracked in fire, if those clay pots were set before fired, did not crack. Pottery was therefore a great invention in this age. as a result problem the problem of keeping liquids in containers for long time was solved. Preserved liquid changed its character was seen that occurred due to fermentation were observed. The concept of fermentation observed and they utilized to produce wine. In late stone age use of dyes tanning of leather suggest development of primary knowledge of chemical reaction.

## Scientific aspect of stone age

Ancient people practiced various from using tools and machinery such as cooking over fire, hunting animals, gathering fruits and seeds from trees for food. their culture grew out of combination these knowledge, religious practices and myths. with the creation and use of tools man was able to bring nature under his control.

- 1) In time of making stone weapons man earned knowledge of rigid body[4]
- 2) They collected the knowledge of mechanics by the utilization bow and arrow
- 3) Use of animals skin as cloths gave them knowledge of bad conductor and good conductor of heat
- 4) Preserved liquid changes its character gave them lesson of fermentation which they later used to produce wine.
- 5) Tanning of leather by using dye suggested them to develop first knowledge of chemical science.
- 6) In the case of use of the lever they knew if pressed one side other would react how. They connected with nature by these instruments

### 7) Utilization of observation knowledge;(scientific approach)

Seeing a phenomenon occurring regularly in nature, people took advantage of it even if they did not understand its meaning. It was enough for them to know in what circumstances when and what to expect to take chances . for example they observed soil fertility changes seasonally.[7] Tree's growth and wild life movement also affected by seasonal changes. Fruits and seeds are available at particular time of the years and not other times . flocks of birds herds of buffaloes and deer changes with the change of seasons. Necessary for survival stone age people observed these. From this type of orderly observation of environment and nature scientific angle of observation started and that utilizes later on(8).

### 8)Utilization of knowledge of experience

They could easily say when a stone thrown upward it will come down i.e mechanics of daily life[5] could be easily predictable by them. But in time of cooking or wine preparation it could not predict easily as it depended upon many factors such as exact amount of water, temperature, time etc. so there is lot of uncertainty in case of chemical reaction. This uncertainty was overcome by work of experience. Knowledge in this matter passed down through generation to generation by word of mouth.

### 9) Knowledge of classification

Similarities between different or events give rise to classification. First the classification was between animate beings, things (organic and inorganic), emotion or action. As one member of the particular class behaves other in that class behave. The selection knowledge and experience played a particularly important role in primitive biology and chemistry.(10)

### Conclusion

So far we have seen that the early human society had invented various technologies for worldly pleasure it can be seen from archaeological evidence that at the end of the stone age ancient people used huts ,stitched clothes. They also invented the craft, boat, harpoons. Many of these are still use today among various tribes of India. In general researcher attempted to investigate the origin of science in primitive human society.

The mechanics and physics started its journey in this period by using various tools. Starting of chemical science by utilization of fire. Knowledge animals and planet was nothing but knowledge about biology.

### Bronze age

This age is called bronze age after the new metal that was used instead of stone. Infact a direction of production was introduced during this period that was agriculture . researcher will look how science was born as a result of socio economic changes and urbanization. Urbanization brought changes in social structure and this later hindered the advancement of science in bronze age civilization.(9)

### Science and technology advances in the bronze age

A major advance in technology associated with urbanization was the discovery and use of metals ,particularly copper and its alloy bronze. Also trade between different societies expanded and improved transportation system was introduced. Various activities in urban life brought about a qualitative change in the society .this was the beginning of conscious scientific practice . this was possible because at the early stage of progress the artisan and the intellectual priesthood to work together to solve the problems. Qualitative science was found in the bronze age by recording the number of quantity of materials, creating specific unit of measure, counting, creating accounts and calenders. Researcher will discuss all these aspect in scientific approach.(11)

### Utilization metals

Man was attracted by the luster of gold and copper , two metals found free in nature .initially(12) they were used as ornaments. Metal fragments have been in necklaces and other ornaments in stone age. As copper is a very soft metal lumps of mined copper can beaten into various shapes but they are not very useful for making tools or instruments . with the introduction of fire kilns for making terracotta pots, it became possible extract copper by oxidizing the mineral copper were in kiln. later alloy of copper and tin were discovered .being stronger and harder than copper it could be forged into weapons and tools. A mixture of molten copper and tin was poured into moulds. As the mixture cools, it took the form of mold. It was found that the tools made in this way were superior and easier to make the tools than stone tools.

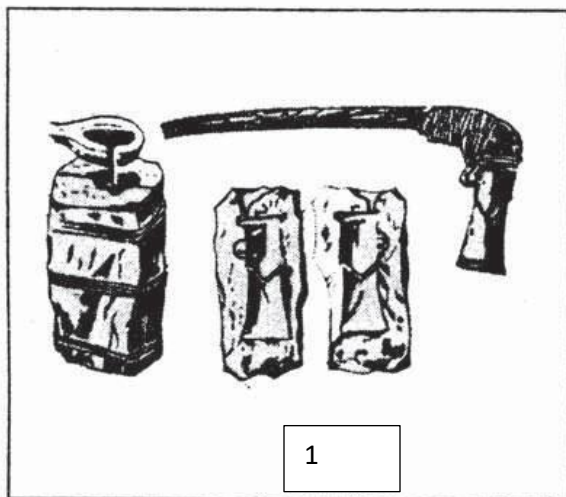


Fig 5

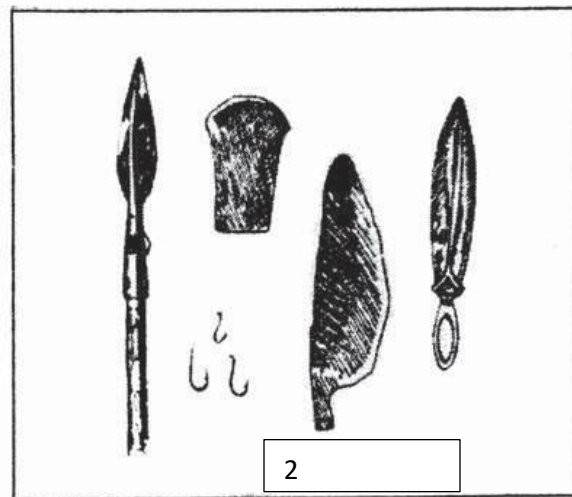


fig 6

- 1) Copper axe and instrument for casting
- 2) Copper weapons and implements
  - a) spear blades
  - b) the axe
  - c) the flute
  - d) saws
  - e) dagger

This new metallurgy almost revolutionized craft of carpentry, tools, utensils etc.

### Development of transportation

- a) Transportation by river

As these civilization were along the banks of river the main way of transportation was river. Canoes of tree trunks and rafts made of bamboo and reeds for transporting large quantities of goods. The invention of the sail came earlier and was the first indication of the use of non animal energy for locomotion. When the river transport extended to sea a new problem arose in the boat building and navigation . more for the strong winds stronger cloth sails and more robust were needed to accommodate them. Wood work to be needed more stronger and more flexible. Rivers follow specific paths so river ways are some what like roads but there was a possibility of losing one's way in the midst of vast sea. To determine direction and position there was a need to invent new ways. Navigation with the help of sun and star became quite popular. (13)

- b) Transportation by road

with the urbanization necessity of transportation of heavy goods required over short distance by land .in the plains tree trunks was used as rollers. In this time the invention of the wheel revolutionized transportation system. the most significant development in the bronze age was the use of wheeled carts for transporting goods and passengers one of the remarkable events.

Attaching the fixed wheel to the car such way that it rotates but did not detach from the car that was greatest innovation. In other words wheel and axle were the twin children of human intelligence. First animal drawn carts were used in Indus valley region. Still in India today axle shaft is tied to the cart with leather strap. (14)

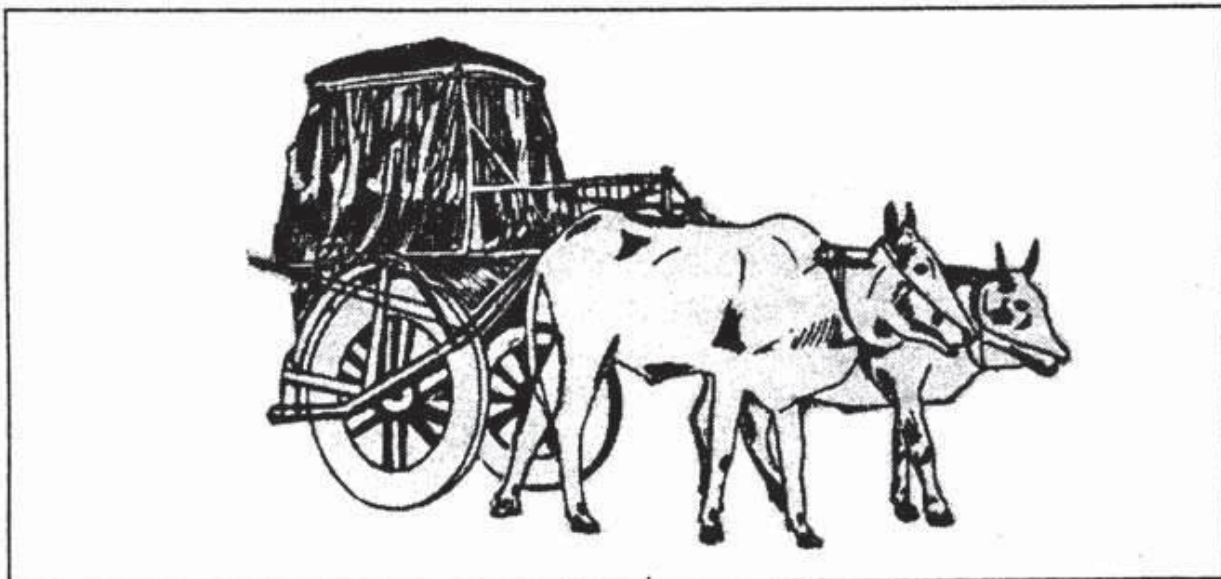




Fig 6 Shaft is tied to the cart with leather strap

## Indus valley civilization –A civilization of highest order application of science(scientific aspect of bronze era)

The town planning of the ancient cities of the Indus civilization really amazes us. Some of the residence in the cities were multi-storied and palatial. They were carefully built, made of burnt bricks and had improved facilities like bathroom and toilets. The cities were laid out in a streets. The roads were straight and at right angles to each other. There were excellent drainage system for rain water drainage and pits for collecting impure water. large well built barns were also seen .A notable feature of of the indus cities was the common bathroom measuring 23\*30\*8'. A multi roomed and multi storied house was seen surrounding an open courtyard with a rectangular reservoir. The walls of the reservoir was made of layers of water proof pitch in the middle. For cleaning the water in reservoir was drained through a well constructed drain and filled with water from another well near by. The advanced structure and lay out of the indus civilization proves that technical and technological knowledge of the people of these cities was

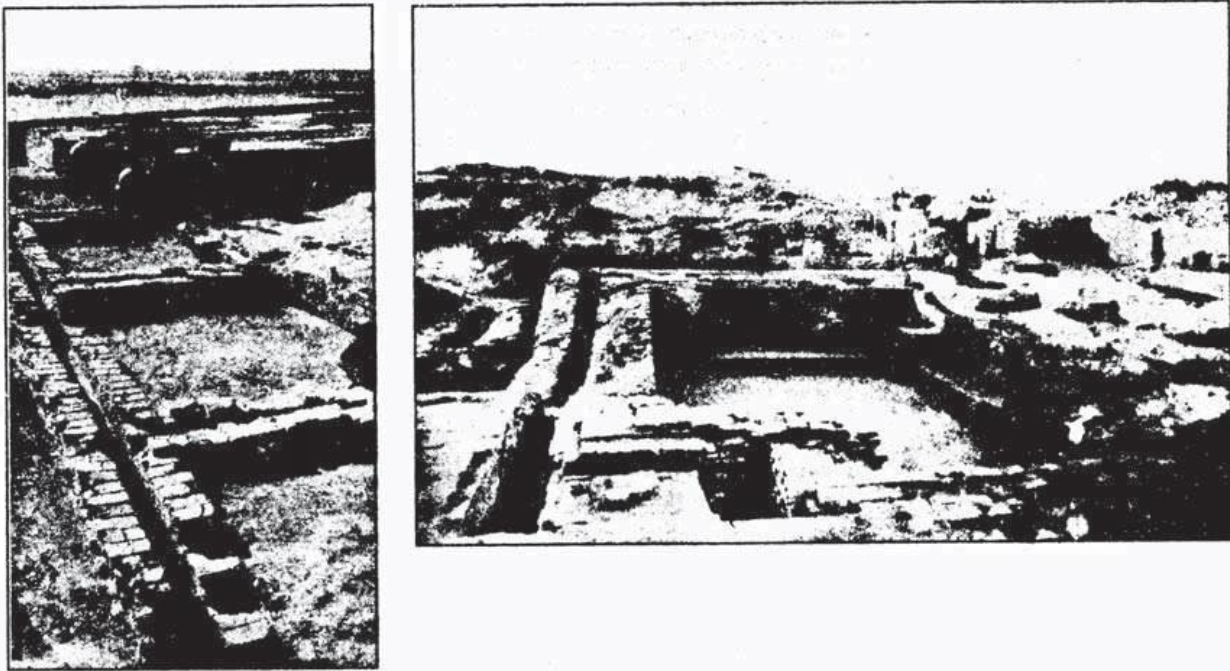


Fig 7

quite advanced. They specialized in construction method with the knowledge of geometry and proper use of land. Historians speculate that they needed a deep geometrical knowledge to make bricks of specific geometric shapes, lay them straight and angular in various size and shapes for building house and road. (15)

### Geometry

Various geometry theorems and axioms were described in detail in a book called “sulbha sutra”. Those sutras were used in vedic period to construct Yajurvedi of complex shape. This Yajurvedi also found in cities of indus valley. Sulbha geometry was creation of early indus valley civilization. We know from form famous theory of Pythagoras that ‘ square of the hypotenuse

of a right triangle is equal to the sum of the square of other two sides". We know it as discovery of the Greek philosopher Pythagoras. The 'Sulbasutra' has an alternative statement "the area of a rectangle formed by the hypotenuse is equal to the sum of the areas divided by its length and breadth". Also Sulbasutra deals with drawing geometrical figures combining and changing areas, measuring area and volume, turning a circle into a square of equilateral sides and many other such problems. (16) In Sulbasutra the value of the square root of 2 is given as 1.4142156. From these we can conclude that the inhabitants of Indus civilization posed fairly advanced

### Scientific analysis

Various bronze implements, vessels, seals, ornaments, toys etc. found in excavation in Mohenjodaro, Harappa and other places proved that Indus civilization had advanced to a high stage of scientific and technical skill. Various handicraft and archaeological investigations prove that they had trade links with Mesopotamia. The fertile soil along the banks of the Indus could be cultivated without deep tillage. That is why here instead of plows made of bronze, only tools for sowing seeds shallowly have been found. A notable feature of Indus civilization was that bronze was used only for making strong tools like knives, blades, saws and jewelry. It was almost never used in the manufacture of any weapons. The thin blade that was found that had no midvein was ineffective in combat. The turning of the wheel, the use of the levers to move stones, the raising or lowering of heavy objects with the help of the floors, to build temples, gave great impetus to the practice of mechanics. Mechanics played a dramatic role in enhancing human mobility. (17) The conclusion about the Indus civilization is based entirely on factual information. They include artifacts as tools and machinery, utensils and textiles, architectural and urban planning, urban water supply and drainage system etc. from these regions. If we could decipher the script on the seals found there we would know more about that era. The meaning of inscriptions and symbols on all these seals has not yet been deciphered. Therefore in the future, more information may be revealed which will shed new light on that civilization and culture.

### Conclusion

In short we have seen so far how changes in production methods gave birth to villages and towns. The development of cities created more demand and led to advances in science and technology. This advance again improved the method of production. The various machines invented during this period have not changed in the next 5000 years. Most of us use the same chairs, tables, live in houses of the same bricks, stone and mortar walls and roofs the same, we wear clothes of the same type of cottons, silk or wool, eat from the same type of utensils. Most of the crops that we consume as staple foods were known in those days as well. After a burst of initial technological progress, progress stagnated for a long time due to it was not diffused to common people and dominated by priest and monarchy over the technology.

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