

A STUDY OF CONTEMPORARY SCIENTIFIC METHODS IN CHRONOLOGY AND HISTORICAL INTERPRETATION

The noted historian E.H.Carr says that history is an unending dialogue between the Present and Past.¹ He further extends that what scientist talk of 'Law of Evolution', accordingly historians talk of 'Law of History' but the target research is same. Therefore, J.B.Bury says, history is science, no more; no less.² Responsible persons are heard remarking that there is no use of digging graves. But strangely enough we are unmindful of the treasures lying hidden in or on the surface of the earth- treasures of which any nation would be proud.³ All you can agree that forensic science exactly does the same thing to find out the reason of the death of the person. So the historian with the help of scientific methods developed in the laboratory by an interdisciplinary approach finds out the past and chronolise it. And then interpret it which becomes our culture. History is based on evidence and if there is no evidence, there cannot be a history as such.

How the history is constructed? All the sciences, economics, social sciences have their own history. Because history only leads to further development in a particular field of knowledge. That may be any invention or discovery of any kind which had some primary background and then it reached to its final version. Therefore, history cannot be separated from any science, technology or humanities.

The history is purely based on chronological sequences. History, as the terminology came after **Pre-history** and **Proto-history**.⁴ The period of history starts when the art of writing was developed and the human being could decipher as and when it was compiled at any place, any period and any region. The history of Ancient India can be traced from Palaeolithic Age to the age of Mauryas and further up till 10th century C.E. There is a qualitative change between the traditional writing of history and history as we know it today. The modern writing of history was influenced in its manner of handling the evidence by two factors. One was the intellectual influence of the scientific revolution, which resulted in an emphasis on a systematic uncovering of the past and on checking the authenticity of historical facts.⁵

If we talk of contemporary science and relation between history, then we have to relate that history with the help of science could define its chronology and accordingly could interpret the past and thus could be attributed as science no more; no less. Science has its own principles where one can test the results in a lab and then generalize the scientific principle. Both history and science are based on hypotheses which are later experimented and then established. Time and Space are the two senses of History along with five biological senses. One that is Time or Chronology is very significant on which we build our history on a sound footing.

Indian archaeology was launched on its science-based progress by Sir Mortimer Wheeler. His concern for stratigraphical digging, accurate recording, a wide collection of data, and the use of the sciences as ancillary aids to archaeological researches have helped later workers in the field. He situated archaeology and history within the parameters of chronology. However, we cannot forgive him for the death-blow he gave to epigraphy. Unless fresh blood is added, it will not recover from this blow.⁶ James Prinsep, a scholar whose remarkable achievements was the unlocking between 1834 and 1837, i.e. within the incredibly brief space of three years, the mystery of both the Kharoshti and the Brahmi scripts, the effect of which was instantly to remove the thick crust of oblivion which for many centuries had concealed the character and the language of the earliest Indian epigraphs.⁷ A.K.Ghosh said when historians believed mostly on traditional literature for truth of history that caution is necessary to guard that 'fancy does not fly ahead of facts'.⁸

The ancient period became the golden age. The antiquity of Indian civilization was pushed back by dating the Vedic literature to 4000 B.C.⁹ It is indeed anachronistic that the beginnings of Indian civilization are frequently traced to Vedic literature whereas a more advanced culture preceded it in the third millennium B.C.--the Harappa culture, or what is alternatively known as the Indus civilization. This **anachronism**¹⁰ is partly due to a hesitancy to use archaeological evidence.¹¹

Archaeology, since it is concerned with the discovery and interpretation of the material remains of the past, provides evidence on two significant areas of investigation. One is the study of technology, the answer to how cultures changed. The other is the evidence on the environment or the ecology.¹² Accordingly it took the help of the contemporary dating sciences and methods of systematic chronology developed in the modern times and tried to build the ancient history on sound footing.

Modern Scientific Dating Systems of History

Basically, there are two types of dating systems i.e. Relative Dating and Absolute Dating. In a Relative method some relations with absolute dating required to decide chronological estimation. Whereas absolute dating with help of scientific techniques does not keep any scope for ambiguity of the chronology of any historical artefacts.

There are some datable objects like coins, inscriptions, bones, wooden objects, cloth, paper etc. for absolute dating.¹³ For Pre-historic and Proto-historic cities, we have to depend on Relative dating methods like Stratigraphic sequence, typological Comparisons etc.¹⁴ Before the beginning of the so-called scientific history the prevailing idea of historical explanation was anthropomorphic form. Past events were explained on the model of the human form with growth, maturity, decay and death as the logical cycle of human affairs and institutions.¹⁵

Radio Carbon or C-14 Dating as a Contemporary Scientific Method

This method was pioneered by Willard Libby in 1949 and reached it to its completion in 1960 for which he was received the Noble Prize in Chemistry.¹⁶ The scientists of the world have taken 1950 as a Base Year and the approximation of plus or minus 100- 115 years for measurement of the life of the object or artifacts. Every living being inhales Carbon dioxide and after its death this process is stopped.¹⁷ But releasing Carbon process continues till its decay. Carbon- 14 is a radioactive heavy **isotope**¹⁸ of Carbon. It is present in the upper atmosphere of the earth. The C-

14 atoms combine with oxygen to form Carbon dioxide and get mixed in the earth's atmosphere. They enter into all living organisms like plants and animals.¹⁹

It is further assumed that all living animals derive body material from the plant kingdom, and also exhibit the same proportion of C-14 material. Therefore as soon as the organism dies no further radiocarbon is added. At that time the radioactive disintegration takes over in an uncompensated manner. The C-14 has a **half-life**²⁰ of about 5730 years, i.e. only half the C-14 will remain after the half-life period. In the disintegration process the Carbon-14 returns to nitrogen emitting a beta particle in the process. The quantity of the C-14 remaining is measured by counting the beta radiation emitted per minute per gram of material. Modern C-14 emits about 15 counts per minute per gram, whereas Carbon-14 which is 5700 years old emits about 7.5 counts per minute per gram.

Objects/artifacts for C-14 Chronology

Specimens of organic material which can yield good amount of carbon can be collected for C-14 dating. For example charcoal, wood, shell, paper, leaves, cloth, animal hair, bone, pollen, tooth, iron, prehistoric soot from the ceiling of the caves – practically any material containing some carbon – can be subjected to C-14 dating.²¹

Suggested Size of the Specimen

The size of the specimen sent for radiocarbon dating should be sufficient enough to give proper results. It has been found that a sample yielding five grams of pure carbon is generally sufficient. As quite a bit of sample is lost in the pre-pigmentation process one should try to collect as big sample as possible. Bones are generally affected by ground water carbonates and are therefore least reliable for dating. Charred bones are better preserved and are therefore relatively more reliable. Charcoal is best material specially if derived from short live plants.

Precautions to Collect Specimen Size

1. The specimen should be collected from an undisturbed layer which has never been touched earlier.
2. The site should have a fair soil cover and is free of lay water reservoirs like ring wells and soakage pits.
3. Avoid specimens near the roots of any plants or trees.
4. Collect the specimen with clean and dry stainless steel scalpels or squeezers or glass so that it should be free from organic material.²²
5. The specimen object should be carried in stainless steel, glass, polythene or aluminum to keep the specimen away from carbonations organic material.
6. The specimen should be sun dried and soil should be removed before it is sent to the laboratory. It should bear the tag of its details and later on data sheets must be prepared.

e.g. the buried soil in the plain of Gujarat are not contaminated with more recent or “dead” carbon do not make reliable specimens for radiocarbon dating. Laboratory experiments have shown that most active isotopic exchange is produced by atmospheric CO₂ in contact with damp calcium carbonate.²³

Difficulties in Dating Specimen

1. It requires large amount of specimen and may be difficult to get valuable museum specimens.
2. The radioactive decay is a random process, and is therefore, governed by the laws of statistical probability.²⁴
3. The initial ratio of C-14 to C-12 is very small and difficult to measure with precision.
4. The possibility of uneven distribution of radio carbon in organic matter.
5. If the specimen is analyzed after having been exposed to contamination by carbon compounds of an age younger than its own, radio carbon age is liable to be reduced.
6. The dangerous contamination by the growth of fungus and bacteria on the surface of the specimen which even when removed from the specimen may falsify its actual age.

Though there are some drawbacks and technical difficulties, the radiocarbon method is a reliable, efficient and most useful method of dating the archaeological specimens.

Conclusion

History is considered under the discipline of Social Science but it requires the evidence what judge require in any of the criminal or civil case. The history although cannot be General Science, it can be reached with maximum possibility of science and hence it can bring objectivity. Therefore, it takes the help of auxiliary sciences like Physics, Chemistry, Archaeology, Anthropology and thus have its construction on sound footing. This is all because of contemporary progress happened in the science which facilitated History to be Absolute Dating with Radio Carbon method.

Notes and References

- [1] Carr E.H., What is History, Penguin Books, London, 1987, p.30.
- [2] Sreedharan E., A Textbook of Historiography, Orient Longman, New Delhi, 2006, p.211.
- [3] Sastri Hiranand, Archaeology and ancient Indian History, Gujarat Vernacular Society, Ahmadabad, 1944, p.3.
- [4] **Pre-history and Proto-History:-** Pre-history is the period of Stone Age during which period only the objects, weapons and material which used by human being belonged to stone, wood, bones etc. the art of writing was totally absent. The Proto-history is the period during which the stone, wooden and bone objects existed and art of writing was also existed. But this writing was just a pictorial writing which still has not been deciphered by human being. For instance Indus Valley Civilization has pictorial writing but till date it has not been deciphered. Therefore, this period is called as Proto-history.
- [5] Thapar Romila, The Past and Prejudice, National Book Trust, New Delhi, 1975, p.3.

- [6] Sanklia H.D. in Recent Advances in Indian Archaeology (edited) by S.B.Deo and K.Paddayya, Deccan College Post-Graduate and Research Institute, Poona, 1985, p.3.
- [7] Roy Sourindranath, The Story of Indian Archeology, 1784-1947, ASI, New Delhi, 1961, p.26.
- [8] Chatterjee Ratnabali in The Making of History, Tulika, New Delhi, 2001, pp.501-02.
- [9] Thapar Romila, op.cit. p.18.
- [10] **Anachronism:-** A chronological mistake; erroneous dating of an event, circumstances or object.
- [11] ibid. p.23.
- [12] ibid.
- [13] Samel, Ranade and Nabar, Elements of Archaeology, Museology and Library Science, Manan Prakashan, Mumbai, 2007 p.20.
- [14] ibid.
- [15] Puri B.N., Ancient Indian Historiography, Atma Ram & Sons, Delhi, 1994, p.6.
- [16] Deo S.B., Puratattva Vidya, Continental Prakashan, Pune, 1976, p.106.
- [17] Ibid.p.107.
- [18] **Isotope:-** In Physics isotope means any two or more forms of an element where the atoms have the same number of neutrons within their nuclei. As a consequence, atoms for the same isotope will have the same atomic number but a different mass number (atomic weight).
- [19] Ranade, Samel and Nabar, op.,cit., p.22.
- [20] **Half -life:-** In Physics half-life means the time required for half of the nuclei in a sample of a specific isotope to undergo radioactive decay.
- [21] Deo S.B., op.cit. p.107
- [22] ibid. p.108.
- [23] Hegde K.T.M., in Recent Advances in Indian Archaeology (edited) by S.B.Deo and K.Paddayya, Deccan College Post-Graduate and Research Institute, Poona, 1985, p.101.
- [24] Deo S.B., op.cit. p.109

