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HISTORY OF SCIENCE IN INDIA : IN THE SEARCH OF A PARADIGM*

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In one of his recent surveys on science in ancient India, Chattopadhyaya has proposed certain paradigms. This article records our agreements and disagreements with some of his specific propositions. It is pointed out that some of the earlier works on the subject have been ignored and under-valued.

It is very necessary to evolve some sound paradigm to explain the history of Indian science, specially with an idea 'to understand the nexus between science, technology and society'. However, it is equally necessary for us to maintain a healthy regard for alternative approaches and acquisition of more facts. Even the best paradigm is necessarily a tentative one.

INTRODUCTION

Professor Debi Prasad Chattopadhyaya has compiled an excellent monograph[1] dealing with the 'beginning' of Indian Science during the Harappan and Vedic ages. Our article does *not* seek to review his entire book, the technical part of which has been drafted by some of his junior colleagues and thus could not be of uniform standard. Our principal aim is to deliberate on the issue of a set of paradigms which he has proposed in his book ; to endorse some of his observations, and to record major disagreements with some of his views. We regret that some of the earlier publications[2, 11] on the subject have been ignored or derated in his work.

'SCIENCE IN INDIA' (1969)

One of us (AKB) outlined a bird's eye view on Indian science in 1969, and proposed several components of a paradigm to rationalise the advancement of science in India from the ancient to the modern period.[2]

We proposed that the progress of science is not a mere catalogue of events ; it must be rationally analysed in terms of the socio-economic factors.

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* **Editor's Note** : The article was sent to Professor Debiprasad Chattopadhyay. He could not agree with the major comments of the authors, but asked us to get the opinion of an expert. The latter could not also agree with some of the views of the authors, but found their "hypothesis quite thought provoking" and worthy of publication. It will be of interest if some of the readers feel inclined to make positive comments.

India excelled in technical arts during the Harappan age and in speculative science during the Vedic age. Less emphasis on technical arts, and gradual onset of the rigid caste system inhibited the growth of Indian science to a considerable extent. Yet, sufficient concern for observation, experimentation and logical inference was demonstrated in the Vedic and post-Vedic literatures of Caraka and Suśruta. During the later ages, Varahāmihira, Āryabhata, etc. were not chauvinistic, and maintained intellectual concourse with the foreign astronomers.

We had copiously quoted Jean Filliozat, J. D. Bernal, H. T. Colebrooke, W. E. Clark, *etc.* to show that our claim for the excellence of Indian science upto the pre-Muslim period is fully justifiable, and *not* based upon any notion of chauvinism.

On the other hand, we had also quoted Al-Bīrūnī at length to show why there was a steep decadence of Indian science during medieval ages. The Hindus had become vainglorious. "They thought that there was no science like theirs..... Their ancestors were not as narrow-minded". Their society was caste-ridden, and they believed that the entire knowledge of mankind had been enunciated in the Vedas. Some of them believe this even to-day ! Al-Bīrūnī was honest enough to admit—and it should be noted specifically—that the other reason for the early decadence of Indian science was the barbarity of the early Muslim invaders who destroyed not only temples but also libraries.

In our book,[2] we tried to provide suitable answers to the questions such as why modern science could not flourish in India first, in spite of its earlier brilliant achievements, and to what extent religion was responsible for this phenomenon.

CHATTOPADHYAY'S CONTRIBUTION

In the words of Joseph Needham "Chattopadhyaya made his name in the world of learning with his book *Lokāyata*[3] (1959) in which he showed how much theoretical materialism there had been in ancient India, and how it had been systematically obscured and vilified by the theologians". Chattopadhyaya has extended his thesis ably, by explaining what is living and what is dead in Indian philosophy.[4] He has also made an incisive study on ideology and counter-ideology in the ancient Indian science.[5] We have endorsed his basic thesis of a dialectical struggle between reason and anti-reason in the Indian thought-world *with the rider* that this struggle existed in all civilizations, and exists even to-day down to the psychological plane of an individual.[6] Thus Brahmagupta calculated the diameter of the moon in order to explain its eclipsing the sun, and yet gave tacit approval to the *Rāhu* theory of eclipses. *Rasa-Ratna Samuccaya,* a 13th century *A.D.* text, strongly endorsed accurate and careful experimentation and yet propagated obscurant theories about the origin of minerals, and endorsed the view that free diffusion of knowledge was not desirable.[7]

IN THE QUEST OF A PARADIGM

Having expressed our agreement with and admiration for some of the views of Chattopadhyaya, it is necessary for us now to articulate the major areas of

disagreement. In his anxiety to establish a Marxist paradigm to understand and explain Indian science, Chattopadhyaya has not adopted a reasonable attitude in regard to alternative paradigms.

We appreciate the laudable approach of 'understanding the nexus between science, technology *and society*' and the remarkable studies on the scientific *methods* in ancient India made by Acharya Prafulla Chandra Ray.[8] We also regret that Prafulla Chandra Ray's observations on scientific methods and obscurant ideas in ancient India have been expunged by Priyadaranjan Ray while updating the earlier work.[9] It is necessary that the expunged portions should be republished. But an editorial deletion need not be viewed as an 'ideological retreat' as Chattopadhyay puts it.[10]

It is also surprising that Chattopadhyay found the excellent publication on Indian Science[11] brought out by the Indian National Science Academy (INSA) as one typifying a 'false model of catalogue-making' just because it does not get into the question of scientific methods.[12]

THE MYTH OF ARYAN INVASION

Like majority of the scholars, Chattopadhyaya *believes* in the theory of Aryan invasion[13] in ancient India even though the corpses of Aryan soldiers, in his own words, 'are still eluding the archaeologists' spade'. Indeed, there is not a shred of evidence in favour of this myth. Yet, he concludes that 'one reason for the objection against the theory of Aryan invasion... seems to be frankly chauvinistic'. Naturally, he could not use any such inuendo against the foreign scholars and archaeologists who do not subscribe to the myth.

Chattopadhyaya quotes G. F. Dales,[14] but does not answer his challange for a single piece of evidence to prove the theory of Aryan migration into India from outside. He refrains from quoting many other scholars.[15]

Dyson concluded in 1982 that 'the invasion thesis becomes a paradigm of limited usefulness'.

Shaffer traced in 1984 the growth of the 'cultural myth' which does not fit in with the 'archaeological reality'. "The archaeological data do not support the existence of an Indo-Aryan or European invasion into South Asia at any time in the pre-or proto-historic periods. It is time to end the linguistic tyranny that has prescribed interpretative framework (of Aryan invasion)".[15] For the former army man, as Sir Mortimer Wheeler was, the Aryan invasion of the Indus towns was as simple as the Roman invasion of Britain. Even he had to state : "It is best to admit that no proto-Aryan material culture has yet been identified in India". (*Early India and Pakistan*, 1959, p. 126).

The eminent archaeologist H. D. Sankalia has admitted in writing to us (letter dated 10 October, 1986) that the theory of Aryan migration to India is yet to be proven :

> "The theories cannot be proven, unless definite knowledge regarding script, language, *etc.* can be had. ..... The old problems, first raised in 1930, have remained unsolved".

AN ALTERNATIVE PARAIDGM

The literary and archaeological data pertaining to the Ṛgvedic and Harappan civilization can be explained by an alternative paradigm contradicting the myth of the so-called Aryan migration to India. We subscribe to the view expressed by Macdonell, Muir and Swami Vivekananda that the Ṛgvedic civilization was indigenous. The Ṛgvedic and Harappan civilizations were part of a bigger complex as is evident from their overlap on the banks of Sarasvati river. The wars described in the *Ṛgveda* were definitely civil wars. The details of this paradigm, supported by many scholars and archaeologists from India and outside, have been outlined by us in a recent publication.[16] (also see post script) Dr. Asko Parpola, the famous Finnish scholar, has identified the seven fireplaces in the Harappan site of Kalibangan, situated on the bank of dried-up Sarasvati, as the Vedic *Dhisniyas*.

THE RGVEDIC CIVILIZATION UNDERVALUED

In his legitimate attempt to glorify the Harappan civilization, Chattopadhyaya has unnecessarily sought to underrate the scientific contributions of the Ṛgvedic civilization. He writes :

> "The concept of *ṛta*—containing the idea of the laws of nature—could never have occurred to the Ṛgvedic poets as ordained by any omnipotent Divine Creator for the simple reason that *the monotheistic theology was totally unknown to them*".[17]

This is indeed strange. How could Chattopadhyaya miss *Ṛgveda's* clear message on the unity of Godhead and monotheism (vide *Ṛgveda*, 1.89.10, 1.164.46., 3.55.1-22., 8.58.2., 10.82.3, *etc.*) ? It has been clearly stated in the *Ṛgveda* that *one ṛta* exist everywhere (4.40.5), and *one* Indra appears differently through illusion or *māyā* (6.47.18).

Chattopadhyaya summarily dismisses (ref. no. 1, pp. 378-79) S. R. Rao's suggestion that the Ṛgvedic people were literate *i.e.*, they did have knowledge of script. One may refer to *Ṛgveda* (10.71.4) in this regard, and to the fact that Gā-ya-trī was eulogised as *tryakṣare*, *i.e.*, her name consists of three alphabets.

Wheeler had suggested that the Harappan script was the original Brāhmī script. S. R. Rao has shown how the late Harappan alphabets, which might have been used by the Ṛgvedic people, link the early Harappan and the Brāhmī.

The Ṛgvedic and Harappan civilizations were definitely contemporary and overlapping to some extent. This hypothesis would explain many facts satisfactorily.

Chattopadhyaya makes another sweeping and breath-taking generalisation when he writes :

> "Only one among the many philosophical trends in India, namely Vedānta, was keen on denying logic and rationalism in order to make room for an abject faith in the scriptures."[18]

It is quite significant that Chattopadhyaya ignores the masterly treatises of Swami Vivekananda on the Vedānta,[19] which is based upon reason and experience and not on 'an abject faith in the scriptures'. The Nāsadiya Sūkta of the *Ṛgveda*

(10.129) clearly questions whether any intellect is in possession of all the knowledge about the created world. There are many such passages in the *Rgveda* and in the Vedāntic literature which encourage enquiry and search for the truth.

SCIENCE AND RELIGION NOT ANTITHETICAL

Swami Vivekananda has criticised the cult of antireason and the oft-uttered expression that the Vedas contain all knowledge.[20] He endorsed that scientific principle must be applied to religion which will take away its dross and make it more scientific.[21] While deliberating on the cult of antireason and the 'class contempt of Śankara', and endorsing Prafulla Chandra Ray's criticism of Śankara, Chattopadhyaya could have also quoted Swami Vivekananda's similar pronouncements on the subject, which we have discussed in fair detail.[22] This exercise would have led Chattopadhyaya to a more sympathetic position *vis-a-vis* the neo-Vedāntic tenets.

Chattopadhyaya does not accept B. N. Seal's contention of a wider framework of logic which encompasses and transcends the logic of modern science. We cannot accept the view that there is no logic or truth beyond modern science.

We have argued at great length that true spirituality subscribes to reason and is *not* antithetical to the mission of modern science.[23] The problem lies in the fact that the venue of demonstration for subjective truth (religion) is not the same as that for objective truths (physical sciences). Aldous Huxley wrote to us on 19 February 1961 ; "No subjective experience can be demonstrated. How do you demonstrate music ?" The seekers of the religious truth and the scientific truth have thus no option but to remain neutral, and, if possible, sympathetic to each other.

We have also highligted the fact that the above syncretistic view was upheld by the pioneer scientists in the 19th century India, such as J. C. Bose, Mahendralal Sircar and Father Eugene Lafont.[23] Subsequent reviewers[24, 25] have agreed with the logic of our earlier presentation. Our analysis about Sircar and Lafont's contributions to Indian science has been acknowledged and quoted even in the international circles.[26]

Thus, it is not necessary to uphold a cudgel against the *genuine* contributions made by the spiritual traditions. Quite appropriately, Joseph Needham ends his 'Foreword' to the otherwise excellent treatise of Chattopadhyaya,[1] with the following counsel of friendly warning, which we strongly endorse :

> "Finally I should like to say that I sympathise very much with the attempt to 'de-mystify' ancient science, and to destroy the arguments which primitive theology brought against it. But *we must beware of 'pouring out the baby with the bath-water'* (as we say in my country). Today ethics is needed more than ever, whatever one's attitude may be to developed religion..... Now people are desperately afraid of what modern science and industry are capable of, as in the recent case at Bhopal".[27]

Similar viewpoints as above had been earlier expressed by Swami Vivekananda, and we have explained in great detail[22] how Swamiji's thoughts evolved a synthetic

paradigm (for modern India) constituted of four 'S's : socialism, science, secularism and spirituality.

CONCLUDING REMARKS

We share Chattopadhyaya's concern for scientific methods and sociological analysis in connection with deliberations on Indian science. But one must not underestimate the importance of collecting, collating and cataloguing more facts about Indian science.[11] No paradigm is possible without a healthy regard for facts and more facts. Like scientific theories, all paradigms are tentative and subject to changes and drastic alterations, no matter whether these are Marxist or anti-Marxist.

We also share Chattopadhyaya's zeal for a scientific approach against the elements of antireason and obscurantism in the Indian thought-patterns. But then, Joseph Needham's warning, quoted by Chattopadhyaya, must also be heeded.

Since more facts about the Harappan and Ṛgvedic civilizations are likely to be discovered, there is no case for being dogmatic about one paradigm (*viz.* invasion of Aryans, for which *no* proof exists), and unsympathetic to the alternative propositions.

We have admitted that antireason, caste structure and fatalism have contributed, to some extent, to the early sunset of Indian science. But then we have also adduced additional reasons which have been accepted by the reviewers of our work.[2]

> "The author's lucid analysis of the socio-economic and political factors which led to the decline and stagnation of Indian science leads us to the inescapable conclusion that more than the element of fatalism in Indian tought, it was the 'military conquests, arson, loot and plunder of the Moghul and Maratha armies' that successfully exterminated whatever was left of Indian industry and technology .....The claim that there is an inherent conflict between science and Indian religions does not stand up under scientific scrutiny".[24]

We have identified that political instability, lack of ideological motivation and necessary political will to transform and modernise a society, and gross socio-economic inequality have largely contributed to the stagnation of scientific progress in many developing countries including India.[28] Professor Debiprasad Chattopadhyaya has made an excellent 'beginning' in his studies on ancient Indian science, and we hope that his views might come closer to ours, when he extends his studies to the medieval, premodern and modern periods. It is necessary for us to evolve an open-structured, flexible and universally acceptable paradigm while we are engaged in assessing the past, viewing the present, and planning the future of science in India.

POSTSCRIPT

After the submission of this paper for review in December 1987, one of us (AKB) elaborated the theme further in his talks before a National Seminar (Calcutta, July 1988) and in the National Institute of Science, Technology and Development (New Delhi, March 1990). The first presentation has now been published :

'Aryan Myth' *in* Historical Archaeology of India, edited by Amita Ray and Samir Mukherjee, Books and Books, New Delhi, 1990 pp. 29-47.

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8 Ray, Prafulla Chandra, *History of Hindu Chemistry*, Vol. I, 1902-03 and Vol. II 1909, The Bengal Chemical and Pharmaceutical Works Limited, Calcutta.

9 Ray Priyadaranjan (ed.), *History of Chemistry in Ancient and Medieval India*, Indian Chemical Society, Calcutta, 1956, on pp. 240-42 of this edition we do find a gist of Prafulla Chandra's sociological analysis.

10 Reference No. 1, pp. 22-24.

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12 Ref. no. 1, pp. 27, 52.

13 *Ibid*, pp. 360-371

14 Dales, G. F., The Mythical Massacre at Mohenjo-Daro, *Expedition, 6, 36-42, 1964* reprinted in Possehi, G. L. (ed), *Ancient Cities of the Indus*, New Delhi, 1979.

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16 Biswas, Arun Kumar, *A Pilgrimage to Khetri and Sarasvati Valley*, Sujan Publications, Calcutta, 1987, pp. 102-116.
Ṛgveda records (7.83.1 and 6-7) that the Ṛgvedic people were attacked by the kings of ten tribes who came *to the east* with *parasu*, big axes. Some of the enemies were their kith and kin *(ārya)* and invoked the blessings of Indra and Varuṇa (10.83.1, 10.102.3). Swami Vivekananda asked quite pertinently *(Complete Works*, Volume 5, p. 535) :

"In what Veda, in what Sukta, do you find that Aryans came into India from a foreign country ?"

F. E. Pargiter concluded in 1922 (*Ancient Indian* Traditions, Cosmo Publications, 1979 Edition, pp. 108, 264, 295-302) that the Ṛgvedic Aryans were not fresh immigrants, and belonged to the pre-Vedic *Aila* tribe who had moved southwards from the Himalayan region probably Kashmir.A branch of this tribe might have emigrated towards Central Asia. This model explains most of the facts related to Indo-European languages as noted by G. A. Grierson and A. R. Hoernle. Bridget and Raymond Allehin agree *(The Rise of Civilization in India and Pakistan.* New Delhi 1983 ; P. 302) that ;

"Our aim of relating linguistic and archaeologicalevidencesremains problematic, and *we must allow for several possible hypothesies, none of which at the present can be firmly established or rejected'.*

17. Ref. no. 1, p. 392.
18. *Ibid,* p. 47 ; also reference no. 4 Chapter 1
19. Vivekannada Swami, *The Complete, works* Mayavati Memorial Edition, 1963, Volumes 1 and 2. Lecturees related to Vedanta.
20. *Ibid., The Complete Works,* Volume 2, p. 336 Volume 4, pp,127-433
21. *Ibid.,* Volume 1, p. 367.
22. Biswas, Arun Kumar, *Swami Vivekananda and the Indian Quest for* Socialism,Firma KLM Pvt. Ltd. Calcutta, 1986, pp.41-42, 51, 156, 179.
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27. Ref. no. 1, pp. vii—viii.
28. Ref. no. 2, Last Chapter *Quo Vadis Indian Science* and our observations on modern Japan.